Influence of Water Fund to Sustainability of Community Managed Rural Water Supply Projects: Moshi District, Northern Tanzania

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Abstract: *Water financing is one of the major factors, which determine the sustainability of rural water supply projects in Sub-Saharan Africa including Tanzania. This study investigated how financing aspects affects sustainability of community managed rural water supply projects. The study was conducted in Moshi district Council in Kilimanjaro region, northern Tanzania whereby two different types of management models i.e. the Board of Trustees and the Water Users Associations were used for data collection during the study. Purposeful sampling was used to get a total of 157 community water users who were interviewed. Six groups of 10 key informants each participated in focus group discussions and 6 key informants were involved in in-depth interviews. These respondents represented a population of 141,386 people in the case study area. The transect walk was also used in the service area to learn about the service level, users satisfaction, quality of water infrastructure, status of water sources, availability of water service at the public toilets, household connections and public water points. The analysis of the findings provided the evidence that water fund collected is inadequate to cover operation and maintenance costs due to extremely low tariff levels, users preference of service level, weak water consumption control measures and power relations between upstream and down stream users. These results conclude that there is a relationship between water fund, sustainability and management of rural water projects. Thus, the ingredients, which can evolve the sustainability of community, managed projects are first the rethinking of rural water financing strategies and mechanisms and second, reviewing the effectiveness of community based management.The study has used institutional bricolage by employing reconsideration of participatory water governance and possibilities to draw attention to local, endemic, or informal institutional approaches that might be adapted to deal with water related concerns by shaping the knowledge, needs, interest and aspiration of rural communities.*

KEY WORDS: Sustainable development, water fund, community management and tariff design

INTRODUCTION

The most well-known definition of sustainability is from Brundtland Commission report (Brundtland, 1987) where it is defined as development that meets the needs of the present without compromising the ability of future generations to meet own needs. This definition is applicable to different disciplines including water supply delivery services. According to Farrell and Hart (1998), sustainability focuses on balancing social, economic development and ecological goals. Despite its importance however, water supply services in many of the rural areas in developing countries have not been sustainable and in turn bring in expected results in terms of accessibility and reliability. Nearly 700 million people lack access to improved water supplies and almost 2.5 billion people lack adequate sanitation even today (WHO/UNICEF, 2015).

Despite the investment efforts to sustain rural water services in Sub-Sahara African (SSA) countries, water supply services delivery and improvement has still been declining since 1945 to post independence era. To addresses this challenge, International Structural Adjustment Programs (SAPs), emerged with ideologies that led to evolution of the community participation models in African countries. Communities changed from being recipients and became owners and users (Maganga *et al*., 2002; URT, 2002; URT, 2008) with mandate to plan, manage and operate water supply services (Harvey & Reed, 2003). Tanzania like many other African countries, adopted the community management model that is commonly referred to as Community Owned Water Supply Organizations (COWSOs). These ideological changes however, did not go along with adequate empowerment programs, which could enable COWSOs to manage water supply projects effectively and sustainably.

To date many water supply projects that are own by communities, are faced with several challenges, which affect the sustainability of services delivery. Nkongo (2009) and Kanda *et al*. (2018) describe challenges affecting water services to include high non-revenue water, high operation and maintenance costs, low metering of connections, low revenue collection efficiency, governance challenges, and low quality of services.

These include inadequate financial investment and poor governance that result into insufficient operation and maintenance, poor cost recovery and thus poor accesses to water and sanitation services by majority of the people in rural areas. Carter (2010) has shown how financial costs which communities are expected to raise may be unaffordable especially due to

the fact that cash contributions by the households can only be available at the crop harvest time. This results into low community participation in water supply services or abandonment of water facilities and projects by the targeted communities as reported by Obeta and Nwankwo, (2015). Moriarty *et al*. (2013:329) argue that community management is at the beginning of an end meaning that community management has failed to achieve expected benefits of community management and it is no longer an informal voluntary work.

The literature therefore indicates that survival of sustainable service delivery depends on multi-dimensional aspects. These include social and cultural; the institutional and governance; the environmental; technical, economical and financial dimensions. Literature survey has indicated that effective management of water funds is a determinant factor for sustainable rural water supply services and that unsustainable funds management results into complex scenarios in water supply service delivery. This lead to failure to meet operation and maintenance cost such as inability to operate water pumping schemes due to insufficient funds, employment of unqualified staff and extension workers, unmotivated water project management staff, unaffordable water treatment services, inability to maintain the water supply facilities, inadequate protection and conservation of water sources as well as inability to expand and rehabilitate water supply projects beyond the design periods.

Numerous factors associated with effective water fund management as a determinant for sustainability of community managed rural water supply services and projects as have been reported by Ochelle (2012), as cited by Wanjiru Mwangi, (2014)have shown that key sustainability indicators include community resources contribution to meet operation and maintenance costs. According to Harvey and Reed, (2004) sustainable financing needs to consider Operation and Maintenance (O &M) and long-term rehabilitation needs. This is because lack of capital maintenance has contribution to infrastructure lasting for less time than its design lifetime or service levels in terms of quantity, quality or reliability starting to deteriorate. In order to counter this problem, Mwangi (2014) suggests that, projects design packages should include projection and consideration for O&M costs as well as recurrent regular incomes. This is also in line with the findings reported by Rural Water and Sanitation Network (2010) and Fonseca *et al*. (2013), that water point functionality is closely related to payment for capital maintenance to cover operational and capital maintenance expenditures. Koehler,

Thomson and Hope (2015) have provided a summary showing how Africa is suffering in terms of achieving sustainable water supply services due to barriers of user fees payments. This suggests also that it is the availability of resources required for operation and management within the capacity of the community, which can only make the water supply projects sustainable.

Effective water fund management is also related to water pricing (Burr & Fonseca, 2013; Rogers, 2002; Fonseca *et al*., (2013). The artificially low water prices adopted in many rural water supply projects have been found to be the reason behind the observed unsustainable water supply and usage. Burr and Fonseca (2013) report that water has a very high economic value and costs. According to the Commission for European Communities (CEC, 2000) water pricing needs to reflect different financial, opportunity, environmental or externalities costs. Employing issues that influence the performance of water pricing lies within a diversity of factors. Vucijak (2015) points out several principles guiding tariff setting basing on international and national agreement as principles of equity and equality, affordability, full cost recovery, conservation and natural resources and economic efficiency. Stockholm International Water Institute (SIWI) working paper 28 outlines the pricing instrument for sustainable development as a shared value in the society, institutional capacity and political willingness to charge appropriate water revenues suitable for covering O&M. The main challenge facing water pricing is different expectations between operators and water users towards water tariffs. While water users prefer high quality water at affordable and stable price, operators and suppliers would like water revenue to generate adequate income. The sustainability of water service will be achieved if there is enough water fund to improve efficiency of the supply, for improved public welfare for equitable economic development.

Effective water funds management has also been associated with proper water supply service record keeping. This is due to lack of timely maintenance and repairs, which results into high leakages, which in turn increase the proportion of the non-revenue, and unaccounted for water. Among the major factors, which can produce unaccounted for water, are leakage, wastage, fraud, illegal tapping, inaccurate meter readings, poor billing, and poor identification of payment centers. Addressing levels of faults as well as investigating related causes and eventually eradicating or reducing them can tack these challenges. Schouten and Moriarty (2004), argues that involving communities in identifying sources of wastage or leaks and promoting the benefits of conservation and the

rational use of water can reduce the problem of unaccounted for water. Effective and sustainable water supply services have also been linked with communities' post construction support services. According to Mugumya (2013), post construction support to communities adds up to water supply sustainability although it is not given adequate attention by local authorities and water supply agencies. According to Jansz, (2011) and Lockwood and Smit (2011) sustainability and scalability can only be achieved if communities receive appropriate levels of institutional support, which can enhance financing and effectively raise, operate and maintain the water supply projects.

This paper aims at exploring the underlying factors that affect effective management of water funds for sustainable water supply services. The overall objective of this paper is to report findings of a study on how effective water fund management determines sustainability of community managed rural water supply services. This research work was triggered by the assertion that there are no miracles, which can enable water services to be sustainable unless financial sustainability factors are addressed critically (Peltz, 2008; Daemane, 2005; National Water Policy, 2002).

Materials and Methods

General

This study was conducted in Moshi District (MD) located Latitude: -3° 21' 0.00" S Longitude: 37° 19' 59.99" E which has an elevation of 3188.98 ft above sea level. MD covers a land area of 1,713 km^2 on the southern slopes of the snow-capped Mount Kilimanjaro in northern Tanzania. The area has a high population density (273 people per km^2). According to National Bureau of Statistics 2012 census report, the total district population is 466,737 out of which 225,767 (48.4%) are males and 240,970 (51.6%) are females. MD is divided into 31 wards. The total population in the 9 case study wards was established to be 141,386 people. Figure 1 shows a map of the case study area in Kilimanjaro region.

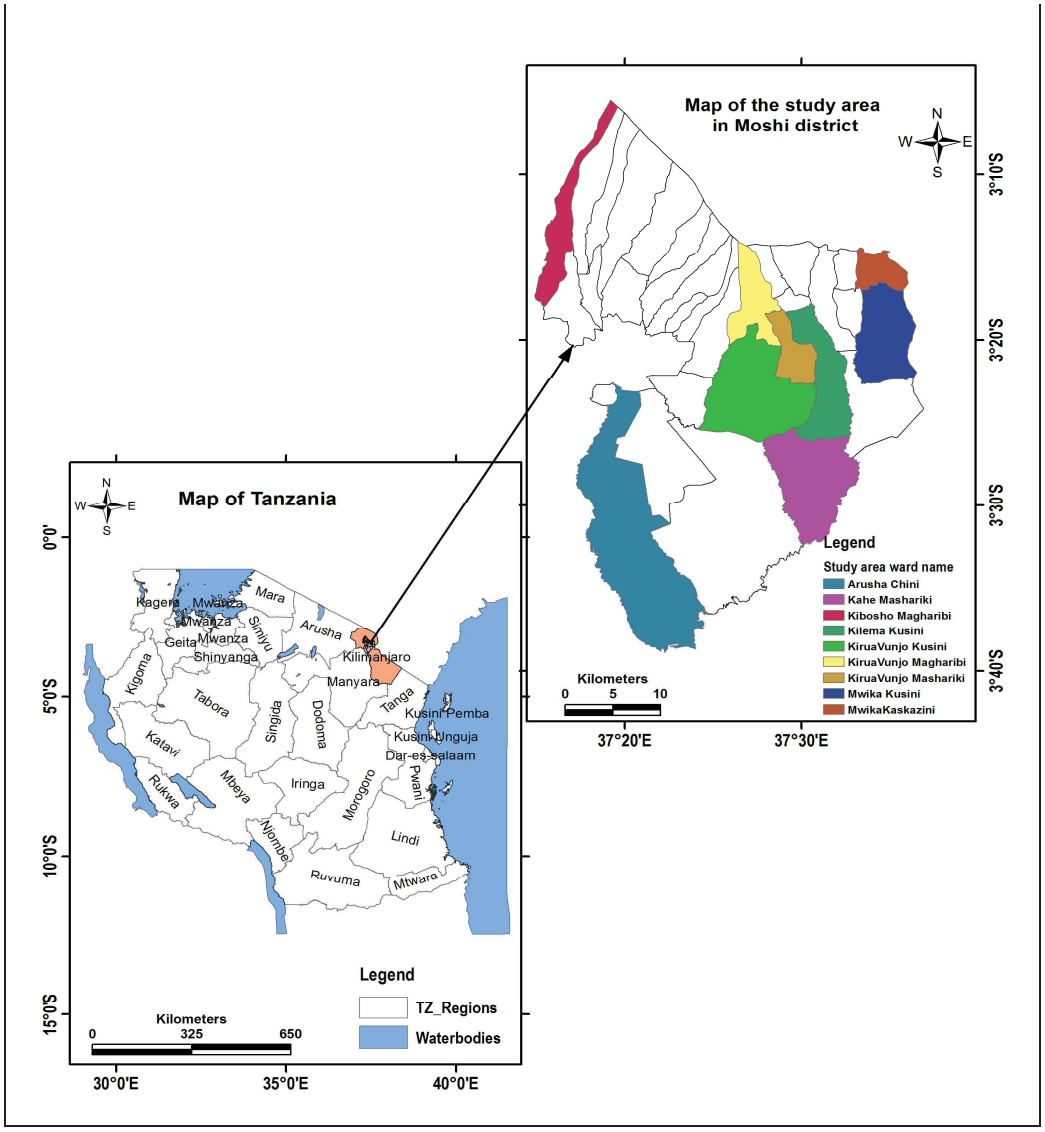

Figure 1: Location of the study area in Moshi District Council in Kilimanjaro Region

Almost three quarters of the population in the district are dependent on the resources provided by the mountain ecosystems. The soil in the case study area has a rich mineral content and substantive biological diversity. A combination of fertile volcanic soils and favorable climate has given rise to spectacular development in agriculture in the district (Misana, Sokoni and Mbonile, 2012). The district's land consists of three belts; the highland belt which has specialized in home gardens with coffee and bananas, the middle lands specialized in beans maize and sunflower cultivation, and the lowland farming and livestock raring zone

Research Design

This study adopted a descriptive case study design whereby a mixed approach of both qualitative and quantitative methods was applied with the aim of providing strengths that offset the weaknesses of each of these designs as recommended by Creswell and Clark, (2011). Survey tool used include random interviews with water users. A total of 157 community water users were interviewed on how financing determined sustainability of rural water supply services. Other methods used included focus group discussions (FGD) and desk research. Transect walks to observe water sources and infrastructure like water storage tanks, water distribution networks, household connections and public water points in the case study area were also undertaken.

Two main types of water management models namely: Board of Trustees (BoT) and Water User Association (WUA) were sampled for data collection from the study area. Kirua Kahe Water Gravity Scheme, Kirua Kahe Water Pumping Scheme and Lyamungo Umbwe schemes were selected to represent BoT schemes and Uchira, Kilema Kusini and Mwika Lekura were selected to represent WAU managed water supply schemes. The water entities cover multiple villages in the study area. Out of 31 administrative wards in the case study area, 9 wards were involved in the study. From each service area, two villages were selected one being a village performing well (in terms of water supply services provision) and the other village that was performing poorly. A total of 12 villages were involved in the study. The study employed purposeful sampling to get the sample size of ten percent of the respondents of the population of 141,386. In nine wards in the case study area, which was obtained, basing on sub villages and came up with 157 respondents.

Apart from 157 interviewed community water users, 50-water entity leaders were also interviewed on community management issues in water supply projects. Ten (10) representatives from development partners and Non-Governmental Organizations working in the water sector were also interviewed, and ten representatives from District Water and sanitation teams and 10 from regional Secretariats were involved in data collection. A total number of 75 key informants were involved in 3 different focus group discussions (FGDs) with the focus of collecting data being on the influence of water fund management for sustainable water supply service. The review of water entities' monthly reports submitted by all community organizations to Moshi District Council was undertaken to collect data and information on the financing issues and the way water funds are used to cover operation and maintenance costs.

Table 1: Description of respondents

Management Model	Community Water Organization	Villages	No. Of Respondents
Water Trusts	Kirua Kahe Pumping	Mikocheni A	18
		Soko	22
	Lyamungo Umbwe	Manushi Ndoo	8
		Manushi Kati	7
		Manushi Sinde	10
	Kirua Kahe Gravity	Kitotoloni	12
		Iwa	24
WaterUser Consumer	Mwika Lekura	Lole	9
		Kirueni	14
	Kilema Kusini	Kilema Pofo	15
		Marawe Kyura	10
	Uchira	Koresa	12
		Uchira	10
Total			**157**

Results and Discussion

Socio–Economic Characteristics

The socio-economic characteristics in the case study as gathered through interviews and FGDs indicated that income-generating activities for the residents include peasantry, which is carried out by 50% of the residents as well as peasantry and livestock keeping carried out by 29% of the residents. About 13% of the local people are engaged in entrepreneurship and only 6% are civil servants, while 1% depends entirely on livestock keeping (Figure 2). Majority of the water users thus, are agriculture-based workers who access financial resources largely during the harvests time. For the purpose of water user fee collection, water managers have to design payment modalities, which suit the different waterusers' resources accessibility. These findings are plausible with Ayashola *et al*. (2013) findings that willingness to pay for water services in Ilorin Nigeria are influenced by household size and income which was 5 percent significant. The economic theory state that the higher the population the higher the demand, the higher the income and the higher the willingness to pay for the improved services.

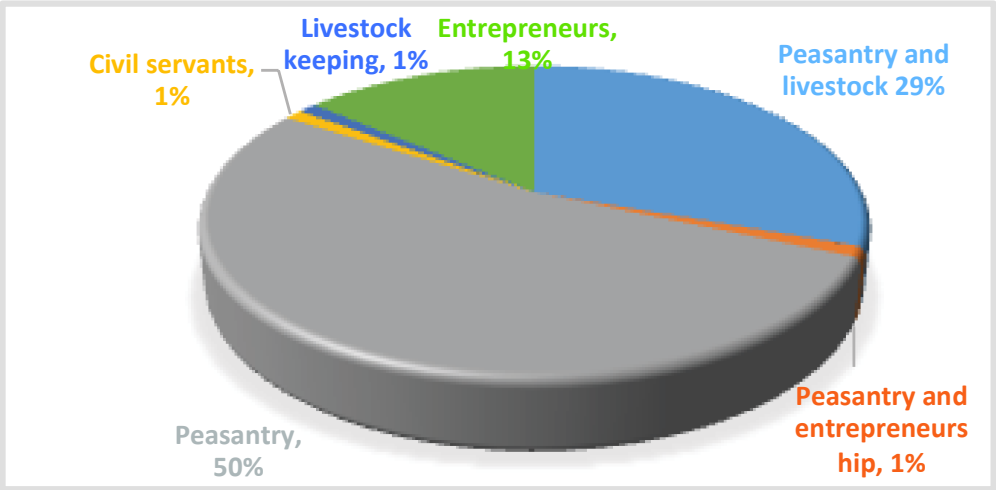

Figure 2: Income Generating Activities at the case Study Area

Water Supply Service delivery Profile in the case Study Area

Water supply service is accessed by a total of 152,689 beneficiaries spread over a total of 56 villages in the study area. Out of these 9,879 or equivalent to 6.5% have private in-house connections. According to the 2012 Census report, Kilimanjaro Region has the highest (78.1%) proportion of private households with access to piped water in Tanzania. In line with Moshi District Council Strategic Plan 2016/2017-2020/2021 developed in 2016, the Council has 12 registered BoT and WUA. The district's water supply covers 487,615 people with 1,020 fully functioning water points. The population coverage in the district is about 77%, which is slightly less than 78.1% for overall Kilimanjaro regional coverage. There are 30 hand pumps, 22 water gravity springs, 22 pumping schemes and 1,566 service water points including non-functional water points. The main sources of water in the rest of the district are springs, farrows, rivers, shallow wells and deep wells (boreholes).

Details presented in Table 1 indicate that the total monthly water collection funds in the study area were established to be Tsh1 61,000,000, which translates into about Tsh. 400 water fees/charges per person per month. Results of this study also indicated that economy of scale in water supply services in the area is a function of a number of water users connected to the system. As such the higher the number of users, the higher the collection of fees and thus the sustainability of the water supply services. This is the case for example in Lyamungo Umbwe, which had 66,439 beneficiaries in 24 villages and a collection of above

[1] One USD is approximately Tanzania Shilling (Tsh) 2,230

Tsh. 25 million per month. Similarly, Kilema Kusini collects Tsh. 7,500,000 from 3,225 users. The collection for Kirua Kahe (monthly collection of Tsh 10,000,000) could have been much higher had it not been for the low number of beneficiaries (55) with private home connections.

Table 2: Water supply profile and coverage in the case study area

Service Delivery and Characteristic	BoT		WUA			TOTAL
	Lyamungo Umbwe	Kirua Kahe	Uchira	Kilema Kusini	Mwika Lekura	
No. of villages served	24	15	2	3	12	56
Technology used	Gravity	Pumping	Gravity	Gravity	Gravity	-
Total beneficiaries	66,439	56,000	15,000	3,250	12,000	152,689
House connections	4885	55	1,189	750	3,000	9,879
Metered customers	5278	34,000	1262	809	0	41,349
Monthly yield (m3)	57,000	6693	15,290	23328	Unknown	-
Monthly collection (Tsh-000')	25,000	10,000	15,000	7,500	3,500	61,000
Tariff structure (Tsh/HH)	500	600	500	400	1500	-
Payment modality	Per Unit	Per Unit	Per Unit	Per Unit	Flat rate	-
Collection/service beneficiaries (Tsh/month)	376.29	178.57	1,000.00	2,307.69	291.67	-

Table 1 indicates the higher the number of beneficiaries, the less payment for the water supply services by an individual beneficiary, except for Kirua Kahe and Mwika Lekura whose payment mode was on flat rate monthly basis. Information summarized in Table 1 also underpin the notion that economies of scale is a function of other factors like total monthly yield and effective collection efficiency in addition to a number of beneficiaries, particularly those with private home connections. Low monthly collection for Mwika Lekura (Tsh 3,500,000) seems to have been contributed by mode of collection used (monthly flat rate) as compared to payment per unit mode in other water user entities. Study results also indicated that low collection in Mwika Lekura had been contributed by the fact that more than 80% of the users don't paid for water supply services.

Water Supply Service Level

As is the case with many water supply communities, in the study area, there are different classes of users such as residential, commercial, industrial, institutional, and Government organizations. This research work sought to establish service level as an entry point towards a study

on the relationship between financing and sustainability of water supply service delivery. Water supply service level can be understood as the quantity, quality, and pressure levels provided depend on the customer class or the topography characteristic of the service area. Findings of the study indicate that, 62% of the population had access to private water supply (household) connections, while 36% obtained water supply services from public water points. It was also established that 2% of the residents drew water from neighbors.

These findings suggest that 98% of the people in the study area have access to potable water supply. Interviews and discussions with the local residents indicated also that majority of the people preferred private home connection rather than public water services or from the neighboring households. It was also determined that upgrading by connection of the water users to private homes results into loss of customers for public water points. These in turn result into reduced remunerations and even unemployment for the public point water operators and at times closure of public water points.

Sustainability Indicators for Water Supply Services in the case study Area

Out of ten sustainability indicators presented during interviews and FGDs, respondents were asked to select five critical sustainability indicators. Out of the 157 respondents, 53% suggested that availability and management of collected water funds is one among the most important sustainability factors in water supply services. This was followed by availability of spare parts (19% of the respondents) and effective operation and maintenance of the water supply schemes (14%). Other important factors that contribute to sustainable delivery of services as established by this research include; effective community participation (5%), effective monitoring and evaluation (3%) as well as technical support to water user entities from district water offices (3%). Some respondents suggested that fair distribution of water supply services, functioning of WUC, strong links between community and support organizations as well as water sources protection and conservation are also important for the sustainability of community water supply service. Details of the views on sustainability factors for water supply services are presented in Figure 3.

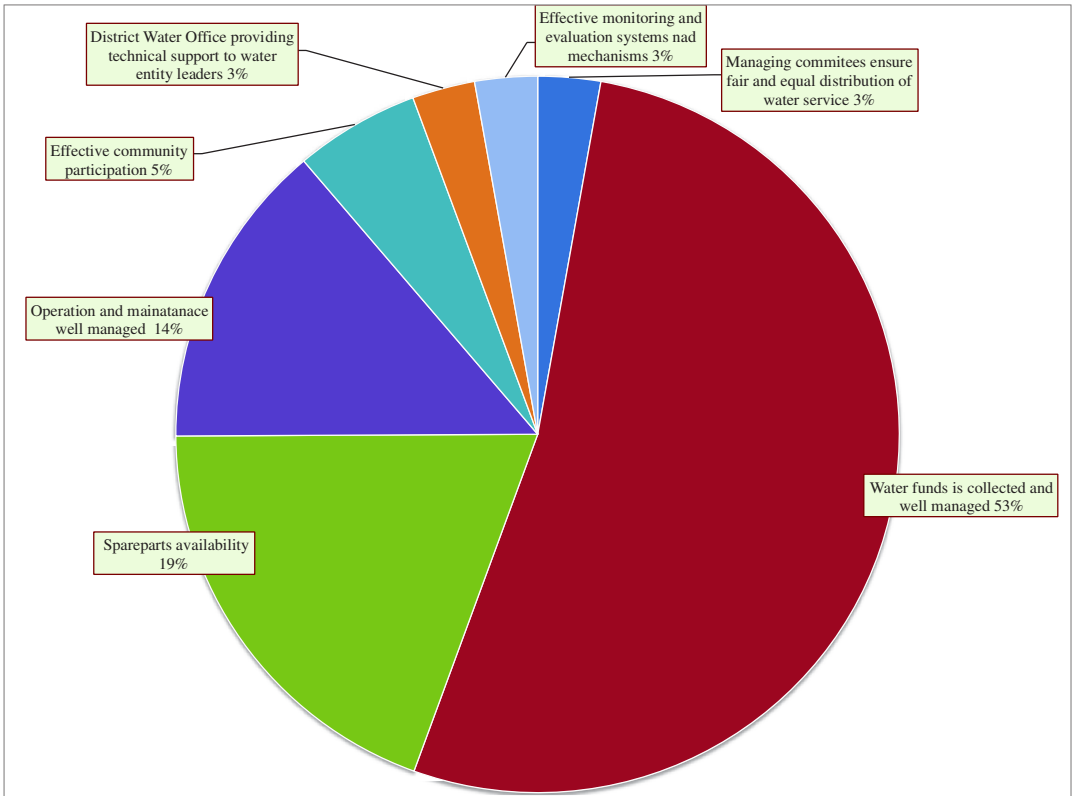

Figure 3: Key Sustainability Indicators for Water Supply Projects

This study established the tariff levels in public water points to be very low (from Tsh 8 to 10 per 20 liters for gravity schemes and Tsh. 30 per 20 liters for pumping schemes). For private home connections where the system was well metered the cost of one water unit was established to be Tsh 400 in Kilema Kusini Water User Association, Tsh 500 in two organizations, which are Lyamungo Umbwe Board of Trustees and in Uchira Water User Association, and Tsh 600 for Kirua Kahe Pumping scheme. One organization, Mwika Lekura, was charging Tsh 1,500 monthly flat rate in the upstream although in practice water beneficiaries did not pay at all. In Mwika Lekura following disconnection of all water meters, beneficiaries used water for horticulture, irrigation as well as for preparation of local brew. Mwika Lekura beneficiaries in the downstream agreed to pay Tsh 3,000 flat rate per month but they received unreliable services, which affected the collection. These tariffs could not generate adequate income for operation and maintenance costs of water supply services. Findings of this study indicates that there are no clear guidelines on water tariff setting and charges for commercial

water users or public entities like prisons and hospitals/dispensaries. As a result the Water User Entities managers complained that Government and institutions like prisons, schools, military offices and health facilities had a problem of delayed payment due to late disbursement of funds from the Central Government. Non-payment of water user fees by some institutions might also have been contributed by lack of meters and effective billing system for the public institutions.

The present study also reveals that areas which are hundred percent metered are very effective in terms of water fees collection efficiency. The study further reveals that almost all water entities (except for Mwika Lekura where none of the water users are metered), use the water metering system. Field investigations revealed that in Mwika Lekura, water meters were installed but they were uprooted by the residents and/or sold as scrap metals. Currently in Mwika Lekura the tariff level is at Tsh. 1,500 flat rate per month and the collection rate is the lowest (Tsh 3,500,000) compared to other entities as shown in Table 1. As a monthly collections efficiency was observed to be high in metered areas, further suggesting that collection and sustainable funding of the water entities was dependent on water use and control mechanisms.

In order to enhance collection efficiency through willingness to pay, Jensen and Chindarkarb (2017) found service quality improvement billing customers accurately, sending bills regularly and simplifying billing presentation, handling billing enquiries and communicating messages about water bill payments also on handling billing enquiries and prioritize daily water accessibility as very important ingredients to sustainable financing. On the other hand, according to Sanders and Fits (2011), by presenting tariff structures and operations, maintenance and major repair and depreciation costs in a transparent manner, communities can cooperate and contribute to sustainable service delivery. The present study shows that more than 80% of monthly collections go to operation rather than maintenance costs.

User Fee Collection Efficiency, Mechanism and Techniques

Revenue collection efficiency in the study area was observed to vary from highest (85%) Lyamungo Umbwe to 75% in both Kirua Kahe Pumping and gravity water trusts as well as in Uchira water Consumer Association. The lowest performer was Mwika Lekura which collectsonly 20% of the expected revenue as indicated in Figure 4.

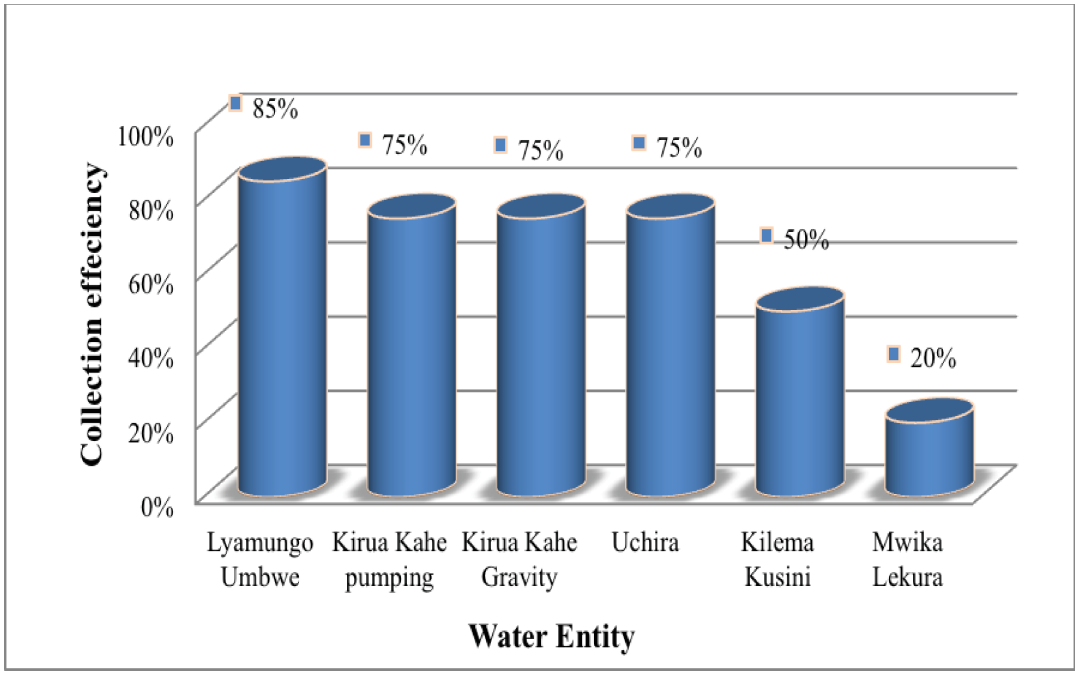

Figure 4: Water Entity Collection Efficiency

As highlighted earlier effective user fee collection system and mechanism is determined by a number of factors. These include efficient billing systems, efficient collection mechanisms and service satisfaction by the users and thus willingness to pay (Nanjowe, 2016). These factors also differ from one entity to another. This study, for example, revealed that it is only Lyamungo Umbwe Water Trust , which has established offices in nearly every village, and that water fee collection staff move around to monitor water use sales. Again Lyamungo Umbwe Water Trust has a timetable, which shows dates and time for which the collectors will be in the office for water users to pay. This is likely to have contributed to high collection for Lyamungo Umbwe Water Trust.

On the other hand, Uchira and Kilema Kusini have only one collection point. It was also noted that water point's caretakers are able to maintain the list of users, collect fees and impose controls on water use when necessary. Relatively high collection in Uchira might have been contributed by the fact that penalty and reconnection fee are simultaneously charged for delayed payment by customers. The study also revealed that collection effectiveness is characterized by institutional capacity to employ professional accountants. This is based on the fact

that in Uchira the entity accountant is a university graduate, the same as Lyamungo and Kirua Kahe Gravity and Pumping schemes. Enhancement of fee collection that is contributed by high skilled labour in community management.

Willingness to Pay

Willingness to pay is the declared maximum amount that an individual is willing to pay for water services. In this study 16% of the respondents indicated that community members pay water bills effectively at hundred percent. However, the majority (45% of the respondents) suggested that most users pay their bills at the level of 75 percent only while 18% of the respondent stated that users pay their bills for 50 percent. Data from the present study also show that 50% of the community members were satisfied with the water quality, whereas 19% considered water to be not adequately safe. 11 percent said water was safe but not clean and 20 percent said water was clean but not safe. Furthermore, only two out of six water entities, i.e. Lyamungo Umbwe and Uchira, were found to have water treatment facilities including chlorination. These results indicate divergence with regard to willingness to pay for the water services.

These results might suggest that dissatisfaction with the water quality could have influenced the willingness to pay for the services. The studies around the world also support the results like Behailu *et al*. (2012) who found that 1% of respondents showed their willingness to pay while 99% were not willingly to pay in Shebedino District in southern Ethiopia. The study by Ndetewio *et al*. (2013) reveal that about 79% of the farmer respondents were willing to pay an additional fee as compensation to the land owners near catchment forests in return for improved water quality and quantity but 21% of the respondent were not willing in lower Moshi, Pangani Basin in Tanzania. These variations indicate that there is a great influence between water service improvement in quantity and quality of water and users' willingness to pay for the service (Rananga and Gumbo, 2015b; Orgill *et al*., 2013; Moriarty *et al*., 2013). The comment is that there is a relationship between community perception on the significant improvement in water services and willingness to pay for O&M. Further, Jensen and Namrata (2017) study on why do people don't pay their bills found households pay their bills positively to reliable supply of water but not to hours of water supply, sufficiency, and quality. Also Rananga and Gumbo, (2015) who assessed the factors that influence willingness to pay for the service in South Africa, identified the factors to be service reliability, water quality and quantity, high water prices, service level

preference, poor water facility maintenances and incorrect meter readings. World Bank (2015), Schweitzer (2013), and Moriarty *et al*. (2013) have shown, community members need to understand the value of water and the associated costs so as to enhance WTP. In this study when the community members were asked whether or not they are willing to increase tariff levels in future for O&M for project sustainability when the community meeting convene, 80% indicated unwillingness for the increase in tariff. This finding is contrary to the fact that 50% of the members believe that currently collected funds are not enough to cover O&M costs. Unwillingness for tariff increase might reflect the fact that the community felt there was no transparency on financial statements related to budgets, operations, maintenance and administrative costs, confirming findings that the Water Board members did not provide adequate feedback to communities after meetings. In order to adress these challenges there is a need to pay more attention on political economy and political ecology changes in community management of rural water supply as a common resources (Briscoe, 2011).

Post Construction Support Services for Sustainable Services

The respondents in the Water User Association and Boards of Trustees pointed out the need to have skilled water staff to successfully manage water projects. On ground however, this research work established that water executive committee members responsible for managing WUAs are unskilled and thus unable to effectively manage water supply projects. This is in spite of the fact that many literatures have reported on unrealistic expectations that rural communities left on their own after a water project construction is completed could successfully manage water supply systems. According to Andres *et al.* (2017) and Komives *et al.* (2008) communities need strong beneficiary level institutions including capacity development for financial management for successful operation and management of water supply schemes. This is also supported by findings of this study which revealed that, as a result of exit training provided by the project consultants and financiers, entities like Lyamungo Umbwe, Kirua Kahe pumping schemes as well as Uchira and Kilema Kusini had better performance in a number of parameters including higher revenue collection. Mwika Lekura where exist training was not provided by the project consultants has less than 20% revenue collection. Findings on post construction support and sustainability in Ghana, Peru and Bolivia, Balikan and Wakeman (2009) also revealed that regular visits by District Water and Sanitation Teams is positively associated with functionality of water supply systems managed by

communities. Similar views have also been expressed in Jiménez and Pérez (2010) in a study on challenges for Water Governance in Rural Water Supply in Tanzania.

Conclusion and Recommendations

The study found very low levels of tariff structures accompanied by an average of 80 percent collection efficiency, inadequate skills and knowledge to manage projects, skilled personnel to manage financial aspect, average unwillingness to increase tariff levels though the communities acknowledge high operation costs and availability of revenue collection offices near water users, and rules and regulations to sanction delayed payments as factors that determine financial sustainability of community managed rural water projects. The most ideal tariff structure should seek to balance between the economic, technical, environmental and socio-cultural demands through strong integration and collaboration between communities and other sector stakeholders. In terms of post-construction services, community management normally requires additional external follow up technical support from the Local Government authorities, regional and national levels.

Perpetuation of benefit from community management contribution for rural water supply services demands that the water sector should come up with strategies of considering values and related costs of water supply management, administrative and operation and maintenance that will lead to effective tariff setting mechanism. The strategies may include clustering water entities for economies of scale, which will reduce operation costs. Rural water supply can no longer continue to deliver reliable water service without sustainable financing strategies like financial support from National water Fund. Community managed rural water supply projects can never be sustainable even with hundred percent collection efficiency, with the current tariff levels. It is unfair to expect community water entity to collect enough funds for rehabilitation, major repair and cover operation, maintenance, administrative and community support services. Otherwise it looks challenging to meet targets of water and sanitation for all by 2030 without sustainable rural water sector financing mechanisms in place.

In order to continue realizing current and future, water resources sustainability generation and acquisition of water fund management is a critical factor, which need sustainable financing strategies. Effective water fund management in Tanzania is derived in a complex institutional environment as water engineers and scientists are oriented

towards dealing with technical aspects of the projects and leave aside very fundamental economic, financial, socio-cultural. Institutional bricolage, which has been used in this study in particular, focuses on flexible, adaptive arrangements that canaddress changing needs while maintaining a sense of social grounding and cultural familiarity. These characteristics indicate that institutions are demonstrations of negotiated social practices, which can resolve water, fund management challenges and not only formalized visible entities.

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