

DOMESTIC WATER SHORTAGE AND HOUSEHOLD COPING MECHANISMS IN THE CITY OF DAR ES SALAAM, TANZANIA

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ABSTRACT

This paper assesses households' mechanisms to cope with water shortages in Dar es Salaam City. Using 2009 data collected through questionnaires, interviews, observation, and focus group discussion administered to 105 households including 43 (41%) males and 62 (59%) females it has been revealed that water shortage in the city is grounded in deterioration of water infrastructures, poor governance at the local level, population increase and urbanization, poor revenue collection and illegal water connection. As a result, household members have to find out alternatives to access the water. Common mechanisms to cope with the situation include drilling of boreholes and wells, rainwater harvesting, buying water from street water vendors, changes in water consumption patterns, buying of many storage facilities and walking long distance in searching for water. However, such mechanisms vary from one area to another. Moreover, while some strategies have long term measurable demographic consequences, others are not. These drawbacks suggest the need for more efforts to be directed towards creation of awareness to community on rainwater harvesting; construction of large reservoirs which will be used to store large volume of water that will help during water deprivation days. Further, DAWASCO and local community should protect water infrastructures against those who practice illegal connections.

Keywords: Water shortage and household coping mechanism

1.0 INTRODUCTION

Water is essential for human existence for the reason that it provides an interesting range of user possibilities and functions such as water for domestic purposes, industry, agriculture, protection of natural and residential environment, constructions and recreation (Hueting, 1974; Dalhuisen & Nijkamp, 2004). While the world is enjoying its socio-economic utilities, water is becoming increasingly scarce as large parts of the world

periodically, seasonally, or permanently experience inadequate water of the quality and quantity required (Barrow, 1995; Seckler *et al*, 1999). It is argued that unless countries embark on massive water development projects, 1.8 billion people will live in regions or countries with absolute water scarcity by 2025, hence making them unable to maintain their current level of per capita food production, meet burgeoning urban demands, and even at high levels of irrigation efficiency (Seckler *et al*, 1999; Allan, 1998). With the existing climate change scenario, almost half of the world's population will be living in areas of high water stress by 2030, including between 75 million and 250 million people in Africa (International Decade for Action (IDA), 2012). For example, the World Health Organization points out that nearly a billion, 884 million people do not have access to clean and safe water, 37% of them live in Sub-Saharan Africa (WHO, 2010).

Problems of water shortage are experienced in cities in particular, as many local governments fail to provide their people with this basic need. The problem is much bigger in developing countries than in the developed world due to inadequate income, rapid growth of the urban population, unplanned urban growth which leads to stressing existing services as well as infrastructure which are increasingly in breakdown or decay (Barrow, 1995). Records show that 27% of urban dwellers in developing world do not have access to piped water at home (IDA, 2012). According to Deen (2011) rapid urban population is one of the governing features mega cities in Asia, Latin America and Africa, causing breakdown in services such as water supplies and sanitation facilities. About 62% of the sub-Saharan Africa urban population and 43% of the urban population of South Central of Asia lives in slum conditions, lacking basic services like drinking water and sanitation (IDA, 2012). For example, the Central Public Health Engineering Organization (CPHEEO) (2000) argues that although 88% of Indian urban population has access to a potable water supply, the supply is highly erratic and unreliable due to the fact

that transmission and distribution networks are old, poorly maintained, and generally of a poor quality. This results in typically high physical losses of water ranging from 25 to over 50 per cent (ibid). The fact is that, a good share of water is lost from the water-supply network, and supply failures often occur because public water utilities, which are often poorly managed, are at the end of their financial tether (GDI, 1998). Furthermore, many residents especially of urban slums are not connected to the water-supply network and are therefore forced to pay prices to water vendors that are far higher than the subsidized drinking-water tariffs (ibid).

Understanding water supply in urban areas households can be served by numerous indicators including sources of water, labour involved and treatment of the water. The sources of water, may include piped water within the dwellings, yard or plot, public tape, tube well, borehole, protected well, and spring water (WHO and UNICEF, 2004; National Bureau of Statistics (NBS) [Tanzania] and ICF Macro, 2011). Usually, lack of ready access to water sources tends to limit quantity of suitable drinking water available to the households. Furthermore, accessibility of water supply is linked to labour involved or readiness of people to seek for improved drinking water. Regarding treatment of water as an indicator for accessibility to improved water, literature indicates that home water treatment can assist in improving the quality of drinking water. In fact, waterborne diseases such as diarrhoea and dysentery are prevalent in Tanzania (NBS [Tanzania] and ICF Macro, 2011).

Tanzania, a typical developing country is grappling with huge problem of water supply to its citizens living in urban areas. Although increasing access to water is one of the Millenium Development Goals that Tanzania along with other nations worldwide has adopted (United Nations General Assembly, 2002; NBS [Tanzania] and ICF Macro, 2011), urban water supply in her

cities is still a persistent problem (Wangwe, Semboja and Tibandebage (eds), 2003). This paper uses data collected in 2009 through questionnaires, interviews and observation and focus group discussion administered to 105 households [including 43 (41%) males and 62 (59%) females] of Kinondoni municipality which assessed households' mechanisms to cope with water shortages in the City of Dar es Salaam. Dar es Salaam is the main industrial and commercial centre of Tanzania with relatively high population growth rates (URT, 2004). According to current Population and Housing Census carried out in 2012 the city's population is 4,364,541 with annual growth rate of 5.6% (URT, 2013). The city is heavily confronted with a series of water supply problems as many residents are not connected with piped water (Water Aid, 2008). This has forced the residents to adopt different mechanism to make water available for domestic uses. Following this section, the paper presents facts and figures of water supply in the city, sources of water shortage, households coping mechanisms, synthesis and conclusions.

2.0 FACTS AND FIGURES ABOUT WATER SUPPLY SERVICES IN THE CITY OF DAR ES SALAAM

The agency responsible for water services provision in the City of Dar es Salaam is Dar es Salaam Water and Sewerage Authority (DAWASA). DAWASA is a government agency created from the merger of the parastatal National Urban Water Authority (NUWA) and the former Dar es Salaam Sewerage and Sanitation Division (DSSD) (WUP Project 5, April 2000). NUWA was created in 1981, during the days of the socialist government of Tanzania when most public services (health, education etc.) were provided for free. Its role was to develop and operate water supply systems in the country's 19 main urban centres. The national government provided the subsidies that paid for construction costs and most of the operation and maintenance (O&M) costs. NUWA, which continually operated at a loss and a drain on government resources, clearly failed to meet its objectives. Water and

sanitation soon became one of Tanzania's major problems (Water Aid, 2003). However, since in 2005 Dar es Salaam Water and Sewerage Corporation (DAWASCO) has been responsible for water provision in the city on behalf of DAWASA. DAWASCO is a public parastatal company owned and financed by the Tanzanian state with a board appointed by the ministry, and is tasked to increase the systems' coverage, reliability and revenue (Pigeon, 2012).

The City's main water source is the Ruvu River from which some 262 million litres are extracted daily. A supplementary six million litres are extracted each day from the Kizinga River. The water is then treated – at the Upper and Lower Ruvu Water Treatment Plants, and the Mtoni Water Treatment Plant just south of the city. Water from the Ruvu is pumped through two main transmission lines that extend some 70 kilometers to the city's holding reservoirs. Transmission losses en-route are high and estimated to be 114 million litres per day (Mld), of which 61Mld are losses incurred due to infrastructure decay (Theodory, 2009).

The Upper Ruvu transmission line has a capacity of 80Mld. However, the steel pipes are badly corroded where they have been laid across swampy areas. In addition, the line is heavily tapped to supply villages and settlements in route, a small proportion of which are legal connections. The Lower Ruvu transmission line has a design capacity of 182Mld and is made from prestressed concrete pipes. In recent years the line has suffered two major bursts at river crossings caused by flooding due to the 1998 El Nino rains. This line is heavily tapped to supply the town of Bagamoyo, certain villages and irrigation agriculture.



Figure 1: Location of Lower River, Upper River, and Mtoni River Treatment Plants

This line is heavily tapped to supply the town of Bagamoyo, certain villages and irrigation agriculture. It is estimated that 35Mld of water is lost along the transmission lines due to unauthorized use including irrigation and agriculture. Moreover, 18 Mld is drawn off to supply an estimated 150,000 people who reside in villages and settlements along the transmission lines (Water Aid & Tearfund, 2003). They further estimated that around 154Mld is delivered to Dar es Salaam of which 48Mld is lost in

distribution within the city due to leaks. A further 6Mld is lost due to unauthorized use. The actual amount available for DAWASCO consumers is estimated to be 100Mld of which 53Mld is supplied through private connections, 17Mld is supplied to kiosks and 30Mld is illegally consumed. Also, the study revealed that only 23 per cent of DAWASCO's water production is billed and that only 16 per cent is paid for (Water Aid & Tearfund, 2003). However, according to the World Bank advisers suggest that only around 8 per cent of all water produced is being billed (World Bank, 2000).

Studies show that there is a large gap between demand and supply of water in the city of Dar es Salaam. It is estimated that the city's demand for water is between 350 to 400 MLd of which 60% is for domestic use, 10% is for commercial purpose, 10% is for industrial activities and 20% is institutional use. However, DAWASCO produces 300 million litres of water per day for the city against a demand of 400 million litres. The government has already announced plans to expand the Lower and Upper Ruvu treatment plants on the Ruvu River north of the City. If the proposed plan is implemented it is anticipated the production will increase to 710 million litres per day by 2013 (Water Aid & Tearfund, 2003; Theodory, 2009).

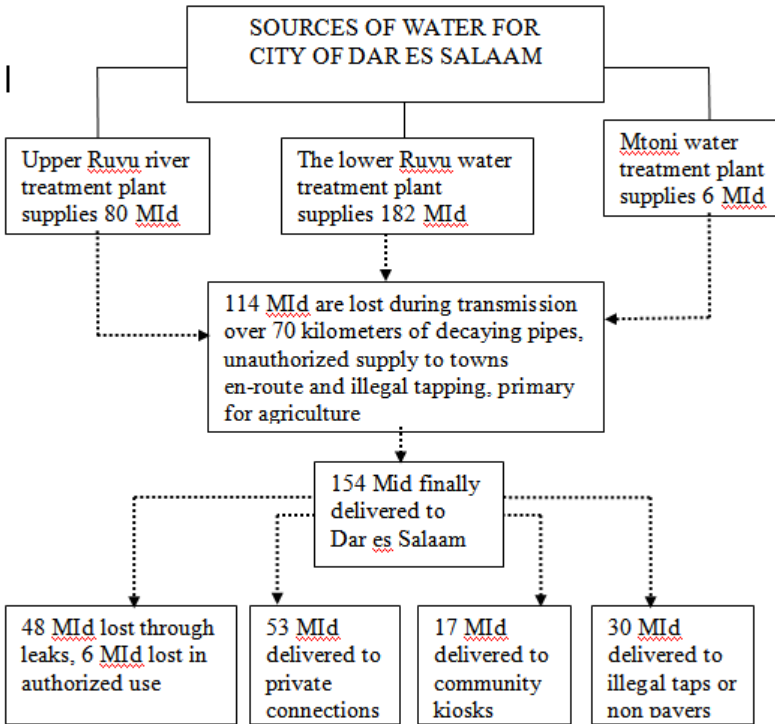


Figure 2: The Water Loss Chain of Dar es Salaam

Source: Water Aid and Tearfund, 2003

3.0 Causes of Water Shortages in Dar es Salaam City

The study started by seeking information about respondents’ perception regarding whether water supply in the city was an issue or not. They were given three options to choose (i) Yes, (ii) No and (iii) I don’t know. All 105 (100%) respondents agreed water supply was problematic. To prove the credibility of their answers they were asked to mention the causes of water shortage in the city. The causes mentioned included deteriorating water infrastructure as mentioned by 63 (60%) respondents; poor

governance as mentioned by 53 (50.5%) respondents; poor revenue collections as mentioned by 37 (35.2%) respondents; illegal water connection as mentioned by 31 (29.2%) respondents; and population increase as mentioned by 26 (24.8%) respondents. Table 1 presents the results.

Table 1: Sources of Water Shortage in Dar es Salaam

S/N ^o	Sources of Water Shortage in DSM	Frequency	Percentage
1.	Deteriorating water infrastructure	63	60.0
2.	Population increase and urbanization	26	24.8
3.	Poor governance	53	50.5
4.	Illegal water connections	31	29.2
5.	Poor revenue collections	37	35.2

Source: Field Data (2009)

3.1 Deteriorating Water Infrastructures

The study observed water infrastructures extremely old, poorly functioning and inadequate to the extent that it cannot cope with the prevailing water demand within the study area. As indicated in Table 1 above, 60% of the households involved in the study claimed that poor and old infrastructures was the leading factor for water shortages in the study area. This finding corresponds to that of Kjellén (2006) who discloses that the infrastructure for water supply in Dar es Salaam that was largely installed in the 1950s and 1960s now not only suffers from under-maintenance and old age, but also the challenge of supplying water to population vastly larger than it was originally set up to serve. During the survey most of infrastructures along the roads were uncovered and a much of water was leaking from the pipes. Plastic water pipes were seen above the ground and most of them broken by traffic movements, it was observed during the study that water which leaks out of the network was evaporating and

lost from human use. . Conversely, some of the respondents were not satisfied with the pressure of water supplied in their household taps. They said low pressure of flowage water was mostly contributed by available dilapidated water infrastructures around the study area.

3.2 Poor Governance

Although water supply and management is a cross-sectoral issue, in Tanzania, the Ministry of Water and Irrigation is responsible for water supply and management, it also provides technical assistance to regional and district levels. Ownership and operation of water systems by government institutions have been blamed for poor water delivery systems mainly linked to lack of investment capabilities and incentives for maintaining efficiency and accountability in water resource use and management. The 2002 National Water Policy aims at developing a comprehensive framework for promoting optimal sustainable and equitable development and use of water resource for the benefit of all Tanzanians (URT, 2002). On the ground things are different. Water problems are increasing regardless of the promising policy goals. This is seen as poor implementation of the policies triggered by poor governance from the ministerial stage downwards (Rugemalila, 2009).

Findings indicate that about 50.5% of the respondents were not comfortable with the practices of government and its institutions such as DAWASCO in the whole process of supplying water to the residents. During the survey DAWASCO's officers claimed for many of its customers for not paying their water bills, while the state has the power to force citizens to pay bills by taking them to court. This observation is almost in line with that of (Water Aid, 2008) which indicated that there was little or no evidence that DAWASCO or the government more generally was particularly concerned with public accountability. Concern with water consumer's interests never appeared to be a major factor

motivating government actors, despite domestic water supply being major concern for Dar es Salaam residents. Nothing prevented the government from putting up its own funds to address the water supply crisis in the country's largest city, particularly when it began to reap the benefits of debt relief.

3.3 Population Increase and Urbanization

Recently, the City of Dar es Salaam has been experiencing higher population growth rate (URT, 2002; 2013). It is argued that the City is one among fastest growing cities in Sub Saharan Africa. When tracing back, the population trend of the Dar es Salaam has been growing from time to time; from 3,500 in 1867 to 128,742 in 1957, to 272,821 in 1967, and to 843,000 in 1978, to 1,360,850 in 1988 and to 2,487,288 in 2002 and 4,364,541 inhabitants in the 2012 Population and Housing Census (URT,2002, 2004, 2013). According to the 2002 Population and Housing Census, population increase in the city has been mainly contributed by the rural-urban migration, natural increase, more significantly by transient population and reclassification of boundaries (URT, 2004). This is emphasized by UNFPA (2007) which observed that in most of developing countries the major causes of urban population growth in large cities is due to natural increase, rural-urban migration and reclassification. As urbanization advances, the contribution of natural increase inevitably becomes greater (UNFPA, 2007). That increase in population does not go together with improvement of available water infrastructure.

Rapid population growth in Dar es Salaam so challenging because it compromises with the social services needed, including water supply. Water supply services in different parts of the city do not fulfill the population demand. Additionally, even the available water sources such as boreholes and local wells do not comply with international water standard as agreed by World Health Organization (WHO), water from those sources are not safe with the concentration of salts hence cannot be used by human being.

The findings show that 24.8% of the respondents said population increase was one of the factors that accelerate water shortages in their locality because increase of population does not accommodate water rationing system. As UNFPA (2007) asserts, high population growth imposes additional pressure. Population growth usually increase demand for water in all sectors of the economy such as agriculture, industry and domestic. The institutional capacity to supply water in the prevailing condition of population influx is the challenge the government is facing.

3.4 Poor Revenue Collection

Shortage of water in the city was associated with poor revenue collections, as mentioned by 35.2% of the respondents. It was argued that poor water supplies, means billing system are not appropriate, this discourage payment. DAWASCO failed to address the poor billing systems in order to curb water theft as well as to accrue its rightful revenue. This has caused slightly drop in the bill collection records as result operation and maintenance costs cannot be done properly. This tendency of poor collection of revenue has failed DAWASCO to maintain and service pipe leakages and to replace the worn out infrastructure. If there were a good collection of revenue coming from bills the problem of water loss due to deteriorated water infrastructure would have been solved. This finding is in line with that of Chinyele (2008) who observed too low revenue collected by DAWASCO to enable it to run commercially in a competitive environment. Besides, DAWASCO has not devised any definite strategies to minimize running costs such as savings on the renovation of offices and the financing of seminars, workshops and meetings. Saving from such expenditures and others not mentioned here could have contributed to extending the water network. According to Wangwe, Semboja, and Tibandebage (eds) (2003) urban water supply in Tanzania is poor due to ineffective fee collection and low tarrifs as compared to operating costs. Conversely, the findings uncover DAWASCO's system to collect

bills from its customers was very inefficient, bills were set estimated, in some cases water supplied to customers was not metered as the result estimates of water consumption confuse the customers. It was further revealed during Focus Group Discussion (FGD) that bills collected sometimes end up into individual's pockets.

3.5 Illegal Water Connection

Illegal water connection affects the capability of DAWASCO to provide services to the formally connected households as required. Throughout the study, it was observed that there was a lot of water loss through illegal connections. DAWASCO loses more than 154,000 cubic liters of water per day due to illegal diversions and leakage (The Guardian, 2007-09-07). It was noted during the study area that illegal water connection contributes much on water loss in the city. This finding corresponds with that of (Chinyele, 2008) who observed high proportion of water lost through illegal connection along the transmission line. Illegal water connections have been involving some of DAWASCO staff. According to Chinyele (2008) since 2005 more than 70 of its workers have been dismissed after being implicated in illegal connections. Thus, unscrupulous workers are a major problem that hinders revenue collection. They collaborate with city residents to illegally connect them with water.

Regardless of the above factors which create this scarcity on domestic water supply, DAWASCO has started to witness an increase in water levels in some places in the city. This achievement is due to the various strategies adopted by the authority such as initiating campaign to track down people who were illegally connected to its main water system. However, DAWASCO has prosecuted all culprits involved in all kinds of infrastructure vandalism as the way forward to deter others with similar motives.

4.0 Existing Coping Strategies Used by Households to Get Water

The study found that water shortages in the city of Dar es Salaam had forced the community to seek for alternative ways of having clean and safe water. In other words, inadequacy in the quality and quantity of water for each of its intended purposes creates different coping responses. In his study on community mechanisms to combat water shortages in Temeke, Municipality, Dar es Salaam, Rugemalila (2009) observed that the coping mechanisms differ from low income earners to high income earners and thus the pinch of the shortages is quite different among these dichotomies. The major coping mechanisms included; use of water from wells and boreholes as mentioned by 71 (67.6%) respondents; rainwater harvesting as mentioned by 66 (62.9%) respondent;, changes in water consumption pattern as mentioned by 42(40%) respondents and purchasing water from vendors and neighbours connected to DAWASCO tap as mentioned by 27 (25.7%) respondents. All these mechanisms enabled households to cope with water shortages situation. The summary of the mechanisms is presented in Table 2.

Table 2: Coping Strategies to Shortage of Water by Households in DSM

S/N ^o	Coping Strategies to shortage of water in DSM	Frequency	Percentage
1.	Use of Water from Wells and Boreholes	71	67.6
2.	Rainwater Harvesting	66	62.9
3.	Purchasing Water from Vendors and Neighbours Connected to DAWASCO Tap	42	40
4.	Changes in Water Consumption Pattern	27	25.7

Source: Field Data (2009)

4.1 Use of Water from Wells and Boreholes

Water shortage has caused the residents in the study area opt for water from local wells and boreholes. Most households use water from wells and boreholes to supplement DAWASCO's piped water which is inadequate. The water drawn from the wells and boreholes are for laundry and bathing and very rarely for cooking purposes due to the fact that it is less clean and safe to drink. This study observed that households generally categorize water into two; water for their personal consumption (more safe) and water for other uses (less safe). Regardless of poor quality of water from boreholes and shallow wells, some of residents use that water for domestic consumption. This finding concurs with that of Mwakalila (2007) who documented that many parts of Kinondoni and Ilala municipality have no piped water supply especially those areas (wards and streets) located far from the city centre. Residents in those areas rely much on boreholes, shallow wells that are mainly used during water deprivation days and during DAWASCO taps breakdown.

Equally important, the study showed that well-off people have embarked on construction of boreholes and wells around their homes as a strategy to address the problem of water shortage and reduce water related costs. However, water from these sources is not safe for human health. Findings indicate that constructed boreholes and wells especially in informal settlements refute coexistence of onsite sanitation and use of ground water for domestic purpose, thus, calling for need of an adequate lateral separation between the pit latrine and the wells to reduce chances of faecal contamination of ground water. Many people in different parts of the city, especially, in informal settlement areas have been affected by water related diseases such as cholera, typhoid and diarrhoea because of using contaminated water from boreholes and wells. The findings by the Ministry of Water in 2002 noted that some people in urban centres of Tanzania get their water from underground sources by digging wells or drilling boreholes,

however, people access ground water in shallow wells that are possibly contaminated (URT, 2002). These people are also at increased risk of dying from waterborne diseases. The observation is comparable to that of Rugemalila (2009) who observed that many households in Temeke municipality get water from Kiosks and wells. Residents pay charges, and the price per bucket differs from place to place and from season to season. Most wells are owned by individuals, Community Based Organizations (CBOs) and Non Governmental Organizations (NGOs).

4.2 Rainwater Harvesting

The most significant mechanism used by households to get water is through rainfall harvesting. Rainwater harvesting is collected from rooftops through drains or gutters into storage containers like drums and surface tanks, and other storage facilities. During rainfall seasons households in the study streets harvest water and store in different storage containers. This finding corresponds to that of Chinyele (2008) who asserts that most residents at Kimara Ward particularly Mavurunza, Kilungule and Kingogo localities to depend on rain water for a variety of uses during rainfall season. Rainwater harvesting plays great role in water supply provisioning in the study area despite the fact that there are fewer initiatives to bring in modern technologies in rainwater harvesting. Poor technology plays a great role in functioning of rainwater supply in the study area. Nevertheless, the great challenge facing the households is inadequate storage facilities. This finding is in line with that of Mujwahuzi (1993) in his study done in Dar es Salaam City disclosed that rainwater collection is practiced by city's residents but due to inadequate storage facilities not much water is stored.

4.3 Purchasing Water from Vendors and Neighbours Connected to DAWASCO Tap

Since DAWASCO does not provide water to all citizens, small-scale independent water providers provide water to residents in the City of Dar es Salaam. The private commercial sectors play a major role in water distribution. According to Humphrey (1995) water vendors supply water to about 50% of households in the City of Dar es Salaam. It was observed in the study area that households bought water from street water vendors and from neighbours connected to DAWASCO taps. Water vendors use handcarts and truck tankers to distribute water to households. Street water vendors that use handcarts were buying water from truck tankers services and from private built reservoirs. These street water vendors sell 20 litres containers at 300 that price goes up during dry seasons and during DAWASCO taps breakdown. Such finding is similar to that of Messer (2001) who noted that when the water authorities do not provide water which meets the demands of the population, the locals look for alternative means of getting water. Individuals or collective organizations seek for alternative ways of obtaining water. Residents opt to buy water from water vendors who keep water in 5000 to 10000 litres reservoir on their plots. However, other residents obtain water from water vendors that use handcarts who are common providers of water in many parts of the city.

4.4 Changes in Water Consumption Pattern

Since water supply cannot suffice the needs of the residents in the city and as the water is provided on user fee basis, households have come up with strict water budgeting strategy. This strategy is mostly applied to safe and clean water uses. Clean and safe water is mainly used for necessary household consumption such as drinking and cooking. Some of the uses which are not important such as washing clothes and mopping are skipped. The findings indicate that 34% of the respondents use little water especially on vital domestic uses such as drinking and cooking. Other domestic

activities which need water such as washing clothes, mopping and bathing are avoided during acute water shortages. This finding concurs with that of Rugemalila (2009) who observed residents at Mbagala Ward using clean and safe water for essential domestic uses especially for cooking and drinking only. Other domestic activities which need water were depending on water from boreholes and wells.

5.0 Conclusions and the Way Forward

Basing on the findings, it is evident that domestic water supply service in the city of Dar es Salaam is problematic since it does not meet the required community needs. The problem is associated with deterioration of infrastructure system, lack of good governance, rapid population increase, poor revenue collection and illegal connection. People waste a lot of time looking for water. Such time could have been used on other socio-economic activities. Sometimes residents have to walk long distance up to 3 kms searching for water. The situation is worse during break down of DAWASCO taps and during dry season. Residents in the study area especially women had to spend much time in searching for water. Women are the most affected group as they can be attacked by bandits or rapists on their way to and from water sources. In most cases, when you see a man or a boy fetching some water, that water is for sell (business) and not for their homes. The rich families could pay more money to those boys and they can bring water for them.

It has also been learnt that the residents in the city use water from wells and boreholes, rainwater, changes in water consumption pattern and purchasing water from vendors and neighbours connected to DAWASCO tap as coping mechanisms. But, are these mechanisms sustainable? Basing on the findings, one could see the problem of water shortage in the city as a management problem. It has been learned that a lot of water is lost in the way to the city. This is a manageable issue.

Tanzania is a custodian of decentralization process. Local participation is very important to rectify the situation. We understand that pipes of water that pass through villages and urban streets. These can easily be protected by the local community and local government authorities. This could minimize problem of illegal water tapping. In line with this those involved in illegal water tapping should be punished by law.

Likewise, it has been found that water shortage in Dar es Salaam is due to ineffective bill collection, low tariffs and that revenue is lower than operating costs. The city government should find ways to improve the fee collection. This may include providing people with education on the importance of paying their bills to DAWASCO whenever required to do so. This can be done through radios, television and other public address systems.

Additionally, there is evidence that water shortage in Dar es Salaam is associated with increase in population that does not go together with improvement of available water infrastructure. This is partly an indication of lack of effective urban planning measures. It is argued that 40 to 80 per cent of the urban population in Tanzania resides in unplanned settlements, which also lack essential municipal services (Lerise, 2004). There is also an argument that during 1960s almost all residents in Dar es Salaam were served with piped water supply. But, in 1992, only 26% had water supply on their plots. This means that many residents are forced to search for alternative sources of water which is not safe for drinking. It is fact that the majority (90%) of the residents use pit latrines as the main sanitary system and most of these underground sources of water are polluted. That is why the residents in the city are frequently subjected to number of waterborne diseases such as cholera, dysentery and typhoid (Lerise *et al*, 2004). The government should improve the available water infrastructures and increase others so that our cities may become pleasant and health living places. If the

government is overburdened, then alternatives should be thought such as involving other development partners through public private partnerships.

Findings show that residents use rainwater as an alternative during water shortage among the poor families. But this source is affected by seasonality of rain, pollution and lack of modern storage facilities. Further, residents collect the water and use it. They do not have proper water storages that could enable them to keep it longer. The government has to initiate programmes which will focus on awareness creation among the local community on the benefits and necessity of water harvesting, and efficient and effective ways of harvesting the rainwater. Local community should be trained on how to practice advanced methods of harvesting rainwater.

In a nutshell, water scarcity is still a challenging issue in the city of Dar es Salaam as a number of residents are inadequately served with it. The demand for water for human consumption in the city is growing very fast. Lack of access to water has greater impact on the poor affecting their livelihoods and health. This can largely be avoided with better government strategies to enable the residents living in the city deal with the problem. Education on proper water sources conservation, water pipes conservation legislations and sanctions to those involved in illegal tapping of water, and creation of awareness of the city dwellers on how and why water should be conserved can serve the purpose.

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