

## ACCESSING WATER SERVICES IN DAR ES SALAAM: ARE WE COUNTING WHAT COUNTS?

### AUTHORS' COPY

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### ABSTRACT

A significant proportion of urban residents in developing countries has no access to public water supply and relies on unofficial, or even illegal, sources. They buy water from small scale water vendors or collect it from unimproved water sources. This paper draws on qualitative semi-structured interviews with public officials, private water providers and citizens to document details of citizens' strategies for accessing water in Dar es Salaam, Tanzania. From these data, we develop a descriptive and evaluative framework to capture the complex mix of sources, uses, and intermediaries in planned and unplanned settings and by affluent and poor citizens. We assess to what extent these strategies solve access problems like quantity, quality, affordability and reliability. We conclude that statistics such as the Millennium Development Goals do not count the access to drinking water that counts for citizens. We discern a bias towards formal state or privatised city-wide systems, dis-counting the mostly informal, small-scale and unofficial strategies to access water.

### *key words*

Access to water; informal water providers; Millennium Development Goals; Dar es Salaam

### INTRODUCTION

In many developing countries, citizens' access to reliable and safe water remains a challenge. Current trends show more pronounced deficiencies in sub-Saharan Africa. In 2010, only 61% of the population in sub-Saharan Africa had *access* to improved water sources (UNICEF/WHO, 2012). When issues of water *quality and quantity* are considered, the reality is more disheartening (Satterthwaite, 2003, 184). Using household surveys, finds disparities between access to water as stated by official statistics and the actual water supply situation from a user's point of view. The above raises issues of what is being counted (how access is defined) and how it is being counted (are data accurate). In this paper we focus on the former with a detailed study of citizens' access strategies in Dar es Salaam, Tanzania. We develop a descriptive and evaluative framework to capture the complex mix of sources, uses, and intermediaries in planned and unplanned settings and by affluent and poor citizens. We assess to what extent these strategies solve multiple access problems like quantity, quality, affordability and reliability, and add a few dimensions of access that emerge from our study. One-size-fits-all solutions are likely to fail in diverse contexts and conditions (locality, economy, politics, institutions, living conditions, family and persons). Qualitative approaches have the ability to uncover realities that

otherwise would be ‘little recognized’ or ‘passed unseen’ (Rasmus Heltberg, 2012). The qualitative approach employed in this study complements quantitative studies on how people cope with poor access to water.

Stakeholders in the water sector, particularly donors, governments and researchers, disagree on the appropriate definition of access to water. The most frequently used definitions are aimed at comparing water access within and between countries in order to quantify the global status and progress of international interventions like the Millennium Development Goals (MDGs). The MDG goal 7 aims to “halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation”. To monitor progress with this goal, the WHO/UNICEF Joint Monitoring Programme (JMP) defines access to safe drinking-water as the “proportion of population using an improved drinking-water source” (UNICEF/WHO, 2012). Critics contend that the JMP definition does not capture the complex nature of water particularly from the perspective of the users. For Kristof (2005), good access to water implies access to “a reliable source of water which supplies adequate quantity and adequate quality of water in a convenient way” (Kristof, 2005, 3). Others substitute access to water with ‘water use’ arguing that mere provision of water does not necessarily indicate actual use by the people (Kayaga et al. , 2009). Kudat et al. (1993) argue that households are more likely to demand certain attributes of water and not just water in itself. They observe that different attributes of water have different value depending on the intended use by the households. For instance, the quality of water may be very important for uses such as drinking and cooking as opposed to water for watering plants.

Yet other critics of the JMP/MDG definition argue with empirical data that using an *improved* drinking water-source does not necessarily mean access to *safe* drinking water (not contaminated) and falsify the assumption used by JMP (Gundry et al. , 2006). Similarly, O'Hara et al. (2008) report that the deterioration of water sources lead to access to unsafe water even from pipes. Not counting adequately access to water may also benefit local governments by hiding the problem. Aggregate statistics hide the condition of the most marginalized and low-income communities (Cheng, 2013). [Zawahri et al \(2011\)](#) argue that a universal definition of improved access and a focus purely on quantifying infrastructure provision underestimate problems such as affordability of services and quality ([Zawahri et al. , 2011](#)). From their research in the Middle East and North Africa, the authors observe that the diffusion of the MDG universal definition “has reinforced and magnified pre-existing incentives among domestic leaderships to hide their deficiencies” and “provided governments with perverse incentives, to prioritize reporting of aggregate coverage rates rather than investing in more adequate metrics to gauge quality, accessibility and affordability of services” ([Zawahri, Sowers, 2011, 1171](#)).

The government of Tanzania adopts the MDG definition and reports accordingly that “the proportion of people served by the 19 urban water authorities using drinking water from improved sources increased from 74% in 2005 to 84% in December 2009” (United Republic of Tanzania, 2010, 48). Another definition used is the percentage of population with access to improved sources of water within 400m/30 minutes (United Republic of Tanzania, 2013).

In Dar es Salaam, the official figures estimate that 51% of the population gets water directly from the official public water supplier (EWURA, 2012). However, Kjellén (2006) believes this figure to be one third, as most people purchase water from those with pipe connections or private boreholes, or fetch water from shallow open wells and buy bottled mineral drinking water. Affluent households may also construct their own well (Kjellén, 2006, Twaweza, 2008). The piped water service is extremely

unreliable and characterized by extensive rationing and low pressures (Kjellén, 2006, Kyessi, 2005). Even when connected, citizens have to develop strategies, such as storing while there is flow and/or reducing consumption, to cope with intermittent water supply. The poor are most affected by unreliable public water supply because they often live in informal settlements where piped water supply is absent by design.

## DESCRIBING STRATEGIES FOR ACCESSING WATER

Detailed studies into citizens' strategies for accessing water exist for other locations (Adeniji-Olukoi et al. , 2013, Hackenbroch and Hossain, 2012, Nyarko et al. , 2008, Pattanayak et al. , 2005, Virjee and Gaskin, 2010). Depending on the authors' theoretical focus, they describe just one or two aspects of access: affordability, cost recovery, consequences of poor access, water vendors and other intermediaries. Kristof's (2005) dimensions of reliability, convenience, adequate quantity and adequate quality are not detailed enough to evaluate access strategies (see Discussion below). Kjellén's PhD research on water supply in Dar es Salaam focusses on a project for privatisation of official water services, and presents rich descriptions of water access and distribution in this city (Kjellén, 2006). However, none of these studies describes comprehensively or systematically citizens' strategies for access. Drawing on these studies and our own fieldwork, we propose the following descriptive parameters for access to water (Table 1): source, use, intermediaries, user, strategy. This detailed description allows us to evaluate how problems of access (also labeled dimensions of access) are solved. We focus on enhancement strategies and do not include accommodation. Enhancement refers to strategies to increase the level and quality of water supply services by supplementing the available supply. Accommodation strategies adjust behaviour to accommodate the unreliable supply of water, such as consuming less water by using it twice or using pit latrines rather than flush toilets even when the latter are available (Kudat, Bell, 1993, 3).

<Table 1>

*Table 1 Parameters for access to water*

## RESEARCH DESIGN

The study employed a qualitative research strategy as this offers researchers a tool for understanding the entirety of an experience. The flexibility offered by a qualitative research approach (Yin, 2011) fits well the research objective of investigating day-to-day experiences of citizens' strategies for access to water. Within Dar es Salaam, the study was conducted in the Kinondoni and Temeke municipalities. Within these, we selected four 'streets' (the lowest administrative level), two in affluent areas (Masaki and Oyster Bay) and two in low income areas (Nyambwera and Mkunduge). Eventually, 22 citizens were interviewed, enough to reach saturation, a point where no more new stories and themes emerged (Guest et al. , 2006). These in-depth interviews were conducted between November 2012 and May 2013. They addressed individuals' personal experiences on accessing water: type of water sources, time of collection, and interactions with water providers. Getting respondents in low income areas was easy given that many were at home during working hours. It was a challenge to find respondents in affluent areas since many people were not at home during working hours. Access to residents was only possible with a formal research permit from the street government office and the recruitment of a local guide. In some cases, two visits to a single house were required – first to make an appointment, followed by the actual interview on the second visit. Furthermore, semi-structured interviews were conducted with Kinondoni and Temeke Municipal Water Engineers to ascertain their views on the

current state of access to water within their jurisdiction. Semi-structured interviews were also conducted with street leaders to document their perspectives regarding access to water. We interviewed NGO staff from WaterAid and the Belgian Technical Cooperation to understand their interactions with citizens in Mkunduge and Nyambwera. These organizations have assisted communities to improve access to water through community water projects. Views from officials allowed a comparison with the information collected from citizens. Snow-balling was used to locate water vendors in Mkunduge and Nyambwera streets; they were also interviewed. A review of published and unpublished documents from government, NGO and research institutions was also carried out, with emphasis on urban citizens' attitude toward access to water. This review helped to understand how organisations perceive and represent problems with water as well as the way they interact with citizens.

The data analysis process began in the field by summarizing the emerging themes observed during data collection as well as through informal discussions. Afterwards, audio recordings of the interviews were first transcribed into Swahili, the language used in the interviews. Swahili interview transcripts were then translated into English and imported into a computer aided qualitative data analysis software. Field reports, field notes and secondary literature were also imported. In order to maintain the anonymity of respondents, all transcripts were given numbers e.g. OY1 = first respondent in Oyster Bay. Thematic coding (Bryman, 2012) was used to analyse the data where meaningful segments of text from the transcripts were assigned a code, for example 'water prices' and 'water quality'.

## **CASE STUDY AREAS**

Dar es Salaam is one of the fast growing cities in the Africa with a population of 4.4 million people (NBS, 2013). A significant proportion of Dar es Salaam population has no adequate access to water supply. Likewise, a large proportion of Dar es Salaam population lives in unplanned settlements creating a challenge for them to access piped water. As a result, the majority of the population relies on public standpipes and informal providers as their main source of water.

Dar es Salaam Water and Sewerage Corporation (DAWASCO) is the official supplier of water and sewerage services in the city. DAWASCO has three major reservoirs, constructed in 1976, 1958 and 1947 respectively. Other sources include bore holes which were constructed in 1997. In total, DAWASCO produces 245 million litres of water as compared to the estimated demand of 533 million litres (URT, 2013). However, not every drop of the produced water reaches the users: the Ministry of Water estimates that 49% of the produced water is lost due to old infrastructure and illegal water connections (URT, 2013) but persistent rumour has it that the figure may be much higher, close to 80%. The ministry also estimates that 68% of Dar es Salaam residents get "clean water" (ibid). However, the DAWASCO performance report for 2010/2011 shows that it has a total of 109,633 domestic water connections which is estimated to serve 600,000 households in its service area (EWURA, 2012). The report also shows that DAWASCO only serves 18% of the total number of households within its service area (ibid).

Access to water in Dar es Salaam varies significantly across socio-economic and geographical boundaries. The variation is most pronounced between planned areas, where piped water is in theory available, and unplanned areas, where it is not, and between affluent and poor households. In areas where piped water is unavailable, communal projects have been implemented mainly by NGOs. We now describe the four streets where data collection took place.

### ***Masaki and Oyster Bay Streets***

These affluent streets are located along the Indian Ocean peninsula and were inhabited by whites during the colonial period. After independence in 1961, the area was transferred to high profile public officials and diplomats. The construction of multi-storey apartment buildings, office blocks and estates characterize recent developments in the area. As a result, population density is increasing, putting pressure on the old infrastructure including water distribution networks.

### ***Mkunduge and Nyambwera Streets***

These low to middle income areas are located in informal settlements and characterized by unplanned settlement and poor public service. There is a DAWASCO piped water network in Mkunduge but it does not supply water. Nyambwera has no DAWASCO piped water network but few citizens get DAWASCO water through household resellers from a neighbouring street. Major sources of water in Mkunduge include borehole water vendors, pushcart water vendors, public water kiosks, and mosques. Major sources of water in Nyambwera include public water taps supplied by a community water project, neighbours who own deep water wells, and mosques. In both streets, citizens also get water from shallow wells dug on the river banks and valleys.

## **RESULTS**

A full list of all strategies used by citizens to access water found is presented in table 2 and 4 below, using the parameters listed in table 1. Table 2 describes strategies with respect to sources of water, uses and intermediaries, while table 4 describes strategies with respect to intermediaries. Together the tables enable comparison among coping strategies reported by citizens. As indicated, this information was derived from interviews and observations and should not be interpreted as results of a quantitative household survey.

Below, we illustrate the information presented in the tables by selectively describing the most typical strategies for access to water when piped supply is unavailable or failing. We then focus on key intermediaries that mediate citizens' to access water at the 'street' or household level because this aspect of access strategies has been largely overlooked in the literature. We find that water mechanics and water vendors (informal providers) are the most important intermediaries in ensuring access to water for the majority of people. In the discussion and conclusion we take all observed strategies into account.

<Table 2>

*Table 2 Access strategies, citizen categories and dimensions of access*

## **TYPICAL CITIZENS' ACCESS STRATEGIES**

### **Drilling of private deep wells**

Many households connected to piped water also have private deep wells as an alternative source of water during scarcity. Many of these wells provide salty water. In Masaki and Oyster Bay, the wells



are mostly used for a single household, while in Nyambwera and Mkunduge the water is sold to neighbours.

### **Installing water pumps and reserve tanks**

This strategy is common for households who have piped water connections but experience low pressure. Water users cannot be sure when they will have water and whether it will flow long enough to fill their storage facilities. This means that the additional cost of piped water is high. One respondent felt that having a private well is cheaper than piped water from DAWASCO.

### **Buying water from vendors**

During DAWASCO breakdowns, access to water for most households is through vendors. Masaki and Oyster Bay are served by big motorized tanker trucks while the majority of residents in Mkunduge get water from water resellers who have a private well or piped water connection, from pushcart water vendors and water kiosks. Pushcart vendors get their water from a variety of sources: water kiosks, borehole vendors and from household resellers with piped water. Water vending using pushcarts is minimal in Nyambwera. Water tanker trucks are non-existent in the poorer areas.

Water kiosks were originally introduced by DAWASCO as a means to supply water to communities that do not have in-house water connection. The kiosks are run by private agents who in return pay rent to DAWASCO. However, we found that in reality many kiosks do not get water from DAWASCO. Instead, they get water from tanker trucks or illegal connections to DAWASCO pipes.

The price of water sold by vendors in Dar es Salaam varies depending on the sources of water, quality of water and availability. The highest price is for bottled water and ranges between 600Tsh to 1000Tsh<sup>1</sup> (USD\$0.38 to USD\$0.63) per litre depending on the brand. Next is tap water which is usually sold at the price of 250Tsh (USD\$0.16) per 20 litre bucket during normal situations. However, the price can rise substantially when water is scarce. For instance, the aftermath of DAWASCO's operation to arrest illegal water users in February 2013 (Kisanga, 2013) saw the prices going as high as 700Tsh (USD\$0.44) per bucket due to scarcity. During this time, water had to be collected from distant neighbourhoods.

Trucks serving affluent neighbourhoods set the minimum amount of water a person can buy to 1000 litres, with the price of water decreasing as the amount increases. For instance, the price for 1000 litres of water is 8000Tsh (USD\$5.0) compared to 60,000Tsh (USD\$37.5) for 10,000 litres. Table 3 below summarizes the price of water in the four study areas. Residents in Masaki showed concern for the quality of water particularly provided by water vendors; the taste of water, i.e. salty or non-salty, is usually the yardstick.

<Table 3>

*Table 3 Price of water in the selected case study areas*

### **Buying water from neighbours**

Some households buy water or get it for free from their neighbours. Various ways are used to transport water between neighbours. Some households get water by connecting plastic pipes while others carry buckets on their heads. Some respondents are not allowed to enter inside the fences and get water from

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<sup>1</sup> USD\$1 = 1600Tsh

taps outside the fence. Given the high capital requirement for making connections; those who can afford it sell water to their neighbours. This is the main source of water for Mkunduge residents especially for drinking.

### **Buying water from mosques**

The importance of mosques as water providers is well established in the low and middle income neighbourhoods of the city. Because Muslims are required to perform a ritual washing prior to prayers, almost every mosque is equipped with a deep water well to ensure reliable water supply. Usually, the wells are fitted with electrical pumps to draw water to tanks. Since electricity in Dar es Salaam is not reliable, most of the mosques have bought generators to run the pump during power rationing. Thus, water from the mosque is considered more reliable than other sources affected by power cuts and low voltage. Mosques sell water in order to generate income for maintenance and pay electricity bills. In Nyambwera, the price for water at the mosque is lower than when bought from the community water project or private vendors.

### **Buying packaged water**

In all four streets respondents reported the use of bottled water. In high income areas bottled water may also be used for bathing during periods of high water scarcity. In Nyambwera and Mkunduge, households with fridges and freezers sell chilled water from different sources to their neighbours in small plastic sachets averaging between 30ml and 50ml. The price ranges between 20Tsh (USD\$0.02) and 50Tsh (USD\$0.03) per sachet depending on the availability of electricity and the source of water. Iced sachets made by tap water are sold at a higher price than those made by salty water from wells.

### **Illegal connections and stealing**

Different forms of illegal water connection or stealing from the DAWASCO network were reported in Masaki and Mkunduge streets. In Mkunduge, people have illegally connected their houses to the DAWASCO water network in nearby areas, since the network exists in Mkunduge but is not functional. One water vendor in Mkunduge explained how he obtained water to sell from about two kilometres using a self-installed pump and pipe. Government authorities including DAWASCO know this type of stealing.

In February 2013, the Ministry of Water (MoW) in collaboration with Dar es Salaam Water and Sewerage Authority (DAWASA) and DAWASCO, carried out a crackdown of illegal water users in Kinondoni municipality (Kisanga, 2013). The crackdown was largely carried out in low and middle income areas. Police force with machine guns were involved to facilitate arrests and protect public officials against assault. On the first day of the crackdown, the MoW officials apprehended 25 illegal water users most of which were water vendors. That is, citizens were not arrested for selling water but for illegal connection to DAWASCO piped network. There were mixed feelings among citizens regarding the MoW's initiative to fight water crimes. While few supported the initiative claiming that it would improve citizens' access to water, a majority were more pessimistic. In Tandale for instance, citizens were more concerned about the acute water shortage as a direct consequence of the initiative to arrest illegal water users. Following the arrests, the price of water from vendors escalated from a regular price of 250Tsh (USD\$0.16) per bucket (20 litres) to about 700Tsh (USD\$0.44). Apparently most citizens felt that the crackdown only singled out illegal users in low and middle income areas hence denying access to water for the poor. In addition, some respondents questioned the sustainability of the initiative.

In Masaki, large water consumers like apartments get water from the 'water mafia'. The water mafia's first step is to sabotage the water supply system by cutting off the water supply in one way or another.

Next, they approach the targeted customers offering their service, ensuring them that they can provide reliable water supply for an agreed fee. Other services offered include reconnection of water and fixing long standing debts with the water authority. Discussion with residents from the high income areas revealed that the local government and high level leaders are aware of such practices but they are allegedly colluding with the mafia. Respondents indicated that they do not report the water mafia's practices to officials out of fear of being victimized.

<Table 4>

*Table 4 Access strategies, sources of water, uses and intermediaries*

## INTERMEDIARIES

### **DAWASCO Staff**

Citizens interact with DAWASCO staff officially when applying for new water connections, reporting breakdowns, and payment of water bills. Many of these processes require physical visits to DAWASCO offices. Likewise, DAWASCO water technicians are responsible for managing the water rationing timetable. On the other hand, citizens interact with DAWASCO staff informally, to acquire illegal water connections. In most cases, face-to-face and personal interactions are preferred to virtual communication. One resident in the high income areas explained how they interacted with DAWASCO staff. *"...In case of a problem, our father used to drive to DAWASCO offices, and if the problem required physical visit by water mechanics, then he would bring them in his car and drive them back upon finishing their work. Sometimes my mother gave them lunch. They liked my father, whenever he showed up at their offices, they would react without delay"* [OY2].

With regards to monitoring illegal use of water, DAWASCO staff is also responsible for arresting people who have installed water pumps. In some cases, illegal water users collude with DAWASCO staff to connect into the water mains or divert water to areas which do not have piped connections. In addition, there are claims that DAWASCO staff tip-off illegal water users about planned operations designed to apprehend them.

### **Politicians**

Besides fostering representation and participation of citizens, political parties are also considered to play a significant role in influencing access to water of many urban residents. This role is greatly felt within informal and peri-urban areas where piped water connection is lacking. Within these areas, access to water is often through community water projects which are managed by water committees (part of the local government) and overseen by the political leaders such as street chairpersons. In Dar es Salaam, the performance of community water projects in ensuring reliable access of water to citizens greatly depends on the performance of local political leaders (Bourque, 2010). Citizens have high expectations that political leaders will improve access to water within their jurisdictions.

### **Water vendors**

Water vendors play an important role in enabling citizens to access water. They operate water kiosks, and sell water from a shallow well, a borehole, a commercial water connection, or a household connection to the piped network (Kjellén and McGranahan, 2006, 2). That is, water vendors act as intermediaries between citizens and other forms of water providers such as DAWASCO or community water projects. In areas with a piped water network, the role of water vendors becomes more



significant during DAWASCO breakdowns and stiff rationing. During such periods, water becomes scarce and has to be collected from long distances usually by water vendors. Thus, water vendors relieve citizens from the trouble of walking long distances or spending long hours looking for water. Yet, they extract payments in exchange for the service they deliver to citizens.

### **Private water mechanics and plumbers**

Private water mechanics provide technical support to citizens regarding water supply system. They give advice on the type and quality of spare parts citizens have to buy, construct water wells and repair piped and non-piped water systems. Very often, private water mechanics fill the gap of DAWASCO water mechanics particularly during long delays and unsuccessful response. Many private mechanics and plumbers work informally without any registration. While many private mechanics can respond quickly, some citizens were concerned about their poor quality of service and dishonesty.

### **Water Drilling Companies**

Both public and private water drilling companies mediate citizens' access to water. Depending on the quality of water pump, the cost of drilling a water well varies from one area to another, ranging between 5million and 10millionTsh (USD\$3000 and USD\$6000). The majority of citizens prefer small drilling companies since they are regarded cheaper and less bureaucratic.

### **House owners**

For the many households who are renting living quarters, their house owners or land lords play a significant role in ensuring their access water. For areas with piped water connections, all the interactions with the utility company are carried out by the land lords, including bill payments and reporting of problems.

## **DISCUSSION: WHAT DO ACCESS STRATEGIES SOLVE FOR WHOM?**

One access strategy can solve more than one access problem. For instance, buying water from vendors caters for problems of quantity, quality and convenience, particularly if the vendor has collected water from a public piped system. Not every citizen is able to use all access strategies; therefore, not all citizens can solve all access problems to the same extent and with the same ease. Access strategies vary significantly between planned and unplanned areas and between affluent and poor households. Rich citizens in planned areas use long term strategies while poor citizens in unplanned areas use a variety of short term strategies in parallel and over time. Short term access strategies, when used for decades, become in a sense long term. For instance, while citizens may choose a different type and/or location of vendors, they are likely to continue buying water for the greater part of their lives.

Long term access strategies require more complex transactions with a number of intermediaries. They raise (non-monetary and monetary) entry costs and render accessibility prohibitive for the poor. In addition to official procedures and payments required when applying for piped water connection, citizens are also compelled to make unofficial transactions in order to speed up the process. Similarly, communal strategies have high start-up costs. Setting up a functional community water project takes a very long time, including complex processes of mobilizing citizens, government authorities, NGOs, and many other stakeholders. Over time, citizens lose hope and distrust towards the government grows, especially if they have to pay a contribution that subsequently disappears. These high transaction costs (time, money and other resources) to access official improved drinking-water sources encourage the proliferation of informal water providers and incentivise corruption within official providers.

On the one hand, citizens acknowledge the lack of capacity of public water providers to provide adequate services and resort to informal and private efforts. In such conditions, survival modalities become the norm and those in need of assistance communicate with closely related individuals and networks. Likewise, those with resources see the opportunity to benefit from the gap created by the public water providers. As a result, a variety of water vendors is created that partly explain why city-wide protests are largely inexistent. On the other hand, widespread knowledge of the lack of capacity of public water provides is an incentive for utility staff to not only become indifferent to reported problems but also to cash in money from water users. Similarly, politicians use this knowledge as a cheap political point-scoring capital during elections. Promises to end Dar es Salaam water woes have been getting higher coverage in the past two presidential elections without fruitful results (Daily News, 2010, The Guardian, 2005). Persistently unfulfilled promises and delayed official responses to water problems induce citizens to adopt long term access strategies such as drilling deep wells.

### **Solving water quantity and quality problems**

The findings reveal that most access strategies are geared towards increasing only the quantity of water. Except when bottled commercially, water in Dar es Salaam is unsafe for drinking. Incidence of diseases like typhoid and frequent outbreak of cholera were common among citizens in the last decade (Penrose et al. , 2010). In addition, Kassenga (2007) also found a high degree of contamination in the public piped water. Many citizens therefore prefer bottled water for drinking when they can afford it. The majority of interviewed citizens were very aware about the health risks connected to drinking tap water. However, they do not generally improve the microbial quality of water by boiling or using household water treatment technologies. In most cases, water from boreholes is perceived as safe to drink, while this is usually not the case, so citizens are likely to boil water from DAWASCO and not water from boreholes. However, many citizens do not desire water from boreholes for drinking because it is salty. In high income areas piped water is used for gardening and household tasks, while in low income areas irrigation is done using water from open wells and rivers.

### **Solving reliability and proximity problems**

Due to limited storage facilities, poor households feel the absence of water immediately. Moreover, given that most people get water from vendors in buckets or jerry cans, reliability of supply does not mean that water is available 24/7. Instead, citizens consider a source as reliable when water is available when they need it. For instance, although most borehole vendors sell water only during the day, they may own electricity generators that pump water during power outbreaks to ensure supply. Most citizens living in low and middle income areas asserted that water from mosques is more reliable than from a community project. While official statistics emphasise the proximity of water sources, e.g. a distance of 400m, this metric is irrelevant for citizens who get water from vendors. Long distances travelled by water vendors are only indirectly felt by citizens through increase in prices, especially when water is scarce.

### **Solving other problems**

In addition to the four types of problems identified by Kristof's (2005), we identified the time of collection as a major concern. Many citizens who are connected to piped water are forced to wake up at night to fill up reservoirs or do their washing as that is the only time when water is flowing. In Mkunduge, a citizen reported that they collectively wake up at night to help their water vendor reconnect her piped water network at one of DAWASCO's distribution valves.

## CONCLUSION

Access to water in Dar es Salaam is influenced by a variety of factors depending on households' demand for water and the source of water they can possibly afford. Being connected to a piped water system does not guarantee a reliable water supply, nor does it provide water of drinking quality. More often, citizens cannot access water without private efforts e.g. by installing water pumps or by colluding with water utility staff, or by tapping into informal networks of neighbours, water vendors and other intermediaries.

The findings show that access to water for the urban population in Dar es Salaam is influenced by factors beyond the water sector, such as systemic corruption, regular electricity breakdowns, weak accountability, and political capture of water policies and projects. Citizens' day-to-day efforts to access water are constrained by petty corruption and illegal practices. Both grand and petty corruption in the water sector significantly impact citizens' access to water negatively. Effects of petty corruption are directly felt in day-to-day life experiences of citizens: petty corruption is considered by many as the way of life. One newspaper opinion observes that people expect to be asked for a bribe as "...the briber has an impulse of giving before even being asked to do so..." (wa Nyoka, 2013). Although petty corruption enables some Dar es Salaam citizens to access water, it disables many others who cannot afford it, particularly the poor. Despite the efforts by the government to combat corruption in the public sector by establishing the Prevention and Combating of Corruption Bureau in 2007, its impacts have not been realized particularly at the grassroots level. Widespread petty corruption in the water sector has also been observed in earlier studies outside Tanzania (van Dijk, 2011, Zinnbauer and Dobson, 2008), in spite of the fact that petty corruption, especially the kind exercised by the water mafia, often receives a good coverage in newspapers (Devanathan, 2013, Diani, 2009, Eichenseher, 2008).

The study has found that the capacity of public services and NGOs to provide enough water is limited, and the quality of water provided leaves a lot to be desired. Informal and small scale private service providers fill the gap at least as far as quantity is concerned. Therefore, when assessing access to water for the purpose of policy making it needs to be recognised that "actual water deliveries may better reach end-users through commercialised and decentralised organisational forms" (Kjellén, 2006, 237). Conventional wisdom may suggest that a possible solution for better access for all citizens would be to recognize and regulate the multiple informal providers that occupy the blurred space between citizens and water officials. However, widespread corruption practices in the water sector are likely to undermine regularization efforts. Any regularization approach will probably raise the cost of water from private providers due to bribes demanded by regulators. Alternatively, neoliberal rationality would suggest privatization of the water sector to induce massive capital investment for the infrastructure and sustainability through cost-recovery. However, a failed government attempt in 2003 to privatize water supply in Dar es Salaam (Pigeon, 2012) suggests that such interventions are not always effective. Overall, widespread corruption and existence of water mafias are likely to halt any efforts to improve access to water in Dar es Salaam. Only alternative solutions that universally provide what matters most to citizens – accessing adequate, reliable and affordable water – may successfully challenge the existing syndicate of mafias and their networks that currently benefit from the problems of water sector.

We conclude that official statistics of access to water are only partially relevant for the actual situation regarding water access, because on the one hand they leave out some important problems of access,

and on the other hand they ignore the fact that informal private water selling activities in fact constitute the majority of access strategies. These findings are in line with (Obeng-Odoom, 2012, Satterthwaite, 2003) who argue that official statistics do not fully represent the reality on the ground. For instance, walking distance to a source may not mean anything if the source does not provide water. Similarly, because many citizens get water at their doorstep from vendors, they are not interested in distance to a source but rather in the price they pay to the vendor. Given that water vending is considered illegal (unless organised by DAWASCO or another recognised entity), the way access is counted in effect reinforces state/NGO monopolies.

Findings of this study are also noteworthy and opportune for the post-2015 agenda discussions (Satterthwaite and Mitlin, 2013, Stoler, 2012) particularly in ensuring targets and monitoring structures of the next global development framework takes into account what matters most to citizens. As noted in the introduction, the attention to date has been on reporting aggregate coverage rates than investing into realizing improvements on access to water as registered by citizens. In other words, the new interventions should aim at resolving day-to-day hardships experienced by water users. This requires adjustments in the approaches in the design and implementation of water interventions.

A further study with more focus on further understanding of day-to-day practices of some of the intermediaries who benefit from the current water problems is therefore suggested. It is possible that these intermediaries have higher incentive to sabotage any efforts to improve water supply in Dar es Salaam. More broadly, research is also needed to ascertain power relations among key players such as water mafia and their impact to the water supply in the city.

Problems of water in Dar es Salaam are complex and a ‘silver bullet’ solution is unrealistic. The current findings add substantially to our understanding of what matters most to citizens – accessing adequate, reliable and affordable water. Informal and private means to access water in Dar es Salaam will remain important for many households for the near future. Therefore the contribution of informal and private ways to access to water needs to be acknowledged and included in official studies and statistics on access to water. For (Kjellén, 2006, 236), “the efficiency of water systems may be substantially enhanced by supporting the agents actually working in the sector, rather than ignoring or obstructing their practices”. These efforts would be especially beneficial for poor households who are now at risk of consuming poor quality water at exorbitant prices.

## ACKNOWLEDGEMENTS

We gratefully acknowledge the financial support of the research program, Sensors, Empowerment and Accountability (SEMA) in Tanzania, funded by the Netherlands Organization for Scientific Research – Science for Global Development (NWO-Wotro).

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## Tables

*Table 1 Parameters for access to water*

| <i><b>parameter</b></i> | <i><b>description</b></i>                                   |
|-------------------------|-------------------------------------------------------------|
| source                  | where is the water taken from?                              |
| use                     | what is the water used for?                                 |
| intermediaries          | who helps to get the water to the user?                     |
| user                    | who is using the water (income, planning status)?           |
| strategy                | is the strategy long or short term; individual or communal? |
| problems of access      | what problem is solved by this strategy?                    |

Table 2 Access strategies, citizen categories and dimensions of access

|          |                                                       | Citizens |           |         |           |         |           | Categories of Strategies |           |             |               |            |            | Dimensions of Access |   |          |   |           |   |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
|----------|-------------------------------------------------------|----------|-----------|---------|-----------|---------|-----------|--------------------------|-----------|-------------|---------------|------------|------------|----------------------|---|----------|---|-----------|---|---------------|---|-------------------|---|-----------------|---|-------------|---|-----------------------|---|--------------|---|-------------|---|---|---|---|---|
|          |                                                       | Poor     |           | Middle  |           | Rich    |           |                          |           |             |               |            |            | Quality (microbial)  |   | Quantity |   | Proximity |   | Affordability |   | Perceived quality |   | Collection time |   | Convenience |   | Palatable (non salty) |   | Availability |   | Reliability |   |   |   |   |   |
| Strategy |                                                       | Planned  | Unplanned | Planned | Unplanned | Planned | Unplanned | Short term               | Long term | Enhancement | Accommodation | Individual | Collective |                      |   |          |   |           |   |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 1        | Drilling bore hole for private use                    |          |           | •       | •         | •       | •         |                          | •         | •           |               | •          |            | •                    | • | •        | • | •         | • | •             | • | •                 | • | •               | • | •           | • | •                     | • | •            | • | •           | • | • | • | • | • |
| 2        | Buying water from push cart vendors                   | •        | •         | •       | •         |         |           | •                        |           | •           |               | •          |            |                      | • | •        |   | •         | • | •             | • | •                 | • |                 |   |             |   |                       |   |              |   |             |   |   |   |   | • |
| 3        | Buying water from land lords                          | •        | •         | •       | •         |         |           | •                        |           | •           |               | •          |            |                      | • | •        | • | •         | • | •             |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 4        | Buying water from DAWASCO kiosks                      |          | •         |         | •         |         |           | •                        |           | •           |               | •          |            |                      | • | •        | • | •         | • | •             | • | •                 |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 5        | Buying water from community project stand pipe        |          | •         |         | •         |         |           | •                        |           | •           |               |            | •          |                      | • | •        | • | •         | • | •             | • | •                 | • |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 6        | Buying water from bore hole vendors                   | •        | •         | •       | •         |         |           | •                        |           | •           |               | •          |            |                      | • | •        | • | •         | • | •             | • | •                 | • |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 7        | Buying water from mosque                              | •        | •         | •       | •         |         |           | •                        |           | •           |               |            | •          |                      | • | •        | • | •         | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 8        | Buying water from tanker trucks (in buckets)          | •        | •         |         |           |         |           | •                        |           | •           |               |            | •          |                      | • | •        | • | •         | • |               |   | •                 |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 9        | Buying water from tanker trucks (whole sale)          |          |           | •       | •         | •       | •         | •                        |           | •           |               | •          |            |                      | • | •        | • | •         | • | •             | • | •                 | • |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 10       | Buying bottled water                                  |          |           |         |           | •       | •         |                          | •         | •           |               | •          |            |                      | • | •        |   |           | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 11       | Buying bottled water during emergencies               |          |           | •       | •         |         |           | •                        |           | •           |               | •          |            |                      | • | •        |   |           | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 12       | Installing electric water pump                        | •        |           | •       | •         | •       | •         |                          | •         | •           |               | •          |            |                      | • | •        | • |           | • | •             | • | •                 | • | •               | • | •           | • | •                     | • | •            | • | •           | • | • | • | • | • |
| 13       | House water connection from DAWASCO                   |          |           | •       | •         | •       | •         |                          | •         | •           |               | •          |            |                      | • | •        | • | •         | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 14       | House water connection from bore hole vendor          |          |           | •       | •         |         |           |                          | •         | •           |               | •          |            |                      | • | •        | • | •         | • | •             | • | •                 | • | •               | • | •           | • | •                     | • | •            | • | •           | • | • | • | • | • |
| 15       | House water connection from community project         | •        |           |         | •         |         |           |                          | •         | •           |               | •          |            |                      |   | •        | • | •         | • | •             | • | •                 | • | •               | • | •           | • | •                     | • | •            | • | •           | • | • | • | • |   |
| 16       | Taping broken water pipes                             | •        |           | •       | •         |         | •         | •                        |           | •           |               | •          |            |                      | • | •        |   | •         | • |               |   | •                 |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 17       | Digging and collecting water from shallow wells       |          | •         |         | •         |         |           | •                        |           | •           |               | •          |            |                      | • | •        | • |           | • | •             | • |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 18       | Collecting rain water                                 | •        | •         | •       | •         |         |           | •                        |           | •           |               | •          |            |                      | • |          | • |           |   |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 19       | Illegal connection to DAWASCO water network           | •        |           | •       | •         |         |           |                          | •         | •           |               | •          |            |                      | • | •        |   | •         | • |               | • |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 20       | Buying chilled sachet water                           | •        | •         | •       | •         |         |           | •                        |           | •           |               | •          |            |                      |   |          |   |           | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 21       | Construction of large storage facilities              |          |           | •       | •         | •       | •         |                          | •         | •           |               | •          |            |                      | • |          |   |           | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 22       | Buying water storage containers                       | •        | •         | •       | •         | •       | •         |                          |           | •           |               | •          |            |                      | • |          |   |           | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 23       | Boiling water                                         | •        | •         | •       | •         | •       | •         |                          | •         | •           |               | •          |            |                      | • |          |   |           | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 24       | Waking up at night                                    | •        |           | •       | •         | •       | •         |                          | •         | •           |               | •          |            |                      | • |          |   |           | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 25       | Collecting water from rivers/ponds                    | •        | •         |         | •         |         |           |                          |           | •           |               |            |            |                      |   |          |   |           | • | •             |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 26       | Multiple use of water (washing then flashing toilets) |          |           | •       | •         |         |           | •                        |           |             |               | •          | •          |                      | • |          | • |           |   |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 27       | Constructing pit latrines that do need flashing       |          |           | •       | •         | •       | •         |                          | •         |             |               | •          | •          |                      | • |          |   |           | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |
| 28       | Bathing with bucket                                   | •        | •         | •       | •         |         |           |                          | •         |             |               | •          |            |                      |   |          |   |           | • |               |   |                   |   |                 |   |             |   |                       |   |              |   |             |   |   |   |   |   |

*Table 3 Price of water in the selected case study areas*

| Area             |           | Official Piped water            |                                    | Water vending                  |                                    |                  |                        |                            |                            |                              |
|------------------|-----------|---------------------------------|------------------------------------|--------------------------------|------------------------------------|------------------|------------------------|----------------------------|----------------------------|------------------------------|
|                  |           | House connection<br>(Tsh/litre) | Public stand pipes<br>(Tsh/litres) | Stand pipes<br>(Tsh/20 litres) | Pushcart vendors<br>(Tsh/20litres) |                  | Tankers<br>(Tsh/litre) | Mosques<br>(Tsh/20 litres) | Sachet water<br>(Tsh/50ml) | Bottled water<br>(Tsh/litre) |
|                  |           |                                 |                                    |                                | Piped water                        | Water from wells |                        |                            |                            |                              |
| Affluent streets | Oysterbay | 1.077                           | -                                  | -                              | -                                  | -                | 6-8                    | -                          | -                          | 600-1000                     |
|                  | Masaki    | 1.077                           | -                                  | -                              | -                                  | -                | 6-8                    | -                          | -                          | 600-1000                     |
| Poor streets     | Mkudunge  | -                               | -                                  | 50 - 500                       | 250 – 700                          | 50 – 200         | 15                     | 50                         | 20-50                      | 600-1000                     |
|                  | Nyambwera | -                               | -                                  | 50 - 200                       | 250 - 300                          | 25 - 100         | -                      | 50                         | 20-50                      | 600-1000                     |

Table 4 Access strategies, sources of water, uses and intermediaries

|          |                                                       | Sources of Water    |           |            |             |          | Uses of water |             |         |              |          |         |           | Intermediaries |        |           |       |              |                   |                  |                      |            |                 |              |      |
|----------|-------------------------------------------------------|---------------------|-----------|------------|-------------|----------|---------------|-------------|---------|--------------|----------|---------|-----------|----------------|--------|-----------|-------|--------------|-------------------|------------------|----------------------|------------|-----------------|--------------|------|
| Strategy |                                                       | DAWASCO piped water | Bore hole | Open wells | Rivers/pond | Rainfall | Bottled water | Car washing | Cooking | Dish washing | Drinking | Laundry | Gardening | DAWASCO staff  | Mosque | Mechanics | Mafia | Kiosk agents | Push cart vendors | Bore hole vendor | Water tanker vendors | Land lords | Water Committee | Pump sellers | NGOs |
| 1        | Drilling bore hole for private use                    |                     | ●         |            |             |          |               | ●           | ●       | ●            | ●        | ●       |           |                |        | ●         |       |              |                   |                  |                      |            |                 | ●            |      |
| 2        | Buying water from push cart vendors                   | ●                   | ●         |            |             |          |               |             | ●       | ●            | ●        | ●       |           |                | ●      |           |       | ●            | ●                 | ●                |                      |            |                 |              |      |
| 3        | Buying water from land lords                          | ●                   | ●         |            |             |          |               |             | ●       | ●            | ●        | ●       |           |                |        |           |       |              |                   |                  |                      | ●          |                 |              |      |
| 4        | Buying water from DAWASCO kiosks                      | ●                   |           |            |             |          |               |             | ●       | ●            | ●        | ●       | ●         | ●              |        |           |       | ●            | ●                 |                  |                      |            |                 |              |      |
| 5        | Buying water from community project stand pipe        |                     | ●         |            |             |          |               |             | ●       | ●            | ●        | ●       |           |                |        |           |       |              |                   |                  |                      |            | ●               |              |      |
| 6        | Buying water from bore hole vendors                   |                     | ●         |            |             |          |               |             | ●       | ●            | ●        | ●       |           |                |        |           |       |              | ●                 | ●                |                      |            |                 |              |      |
| 7        | Buying water from mosque                              |                     | ●         |            |             |          |               |             | ●       | ●            | ●        | ●       |           |                | ●      |           |       |              |                   |                  |                      |            |                 |              |      |
| 8        | Buying water from tanker trucks (in buckets)          | ●                   |           |            |             |          |               |             | ●       | ●            | ●        | ●       |           |                |        |           |       |              |                   |                  | ●                    |            |                 |              |      |
| 9        | Buying water from tanker trucks (whole sale)          | ●                   | ●         | ●          |             |          |               |             | ●       | ●            | ●        | ●       | ●         |                | ●      | ●         |       | ●            |                   |                  |                      |            |                 |              |      |
| 10       | Buying bottled water                                  |                     |           |            |             |          | ●             |             |         |              | ●        |         |           |                |        |           |       |              |                   |                  |                      |            |                 |              |      |
| 11       | Buying bottled water during emergencies               |                     |           |            |             |          | ●             |             |         |              | ●        |         |           |                |        |           |       |              |                   |                  |                      |            |                 |              |      |
| 12       | Installing electric water pump                        | ●                   | ●         |            |             |          |               | ●           | ●       | ●            | ●        | ●       | ●         | ●              |        | ●         |       |              |                   |                  |                      |            |                 | ●            |      |
| 13       | House water connection from DAWASCO                   | ●                   |           |            |             |          |               | ●           | ●       | ●            | ●        | ●       | ●         | ●              |        | ●         | ●     |              |                   |                  |                      |            |                 |              |      |
| 14       | House water connection from bore hole vendor          |                     | ●         |            |             |          |               |             | ●       | ●            | ●        | ●       |           |                |        | ●         |       | ●            | ●                 |                  | ●                    |            | ●               |              |      |
| 15       | House water connection from community project         |                     | ●         |            |             |          |               |             | ●       | ●            | ●        | ●       |           |                |        | ●         |       |              |                   |                  |                      | ●          | ●               | ●            |      |
| 16       | Taping broken water pipes                             | ●                   |           |            |             |          |               |             | ●       | ●            | ●        | ●       |           |                |        |           |       |              |                   |                  |                      |            |                 |              |      |
| 17       | Digging and collecting water from shallow wells       |                     |           | ●          |             |          |               |             | ●       | ●            |          | ●       | ●         |                |        |           |       |              |                   |                  |                      |            |                 |              |      |
| 18       | Collecting rain water                                 |                     |           |            |             | ●        |               |             | ●       | ●            | ●        | ●       |           |                |        |           |       |              |                   |                  |                      |            |                 |              |      |
| 19       | Illegal connection to DAWASCO network                 | ●                   |           |            |             |          |               |             | ●       | ●            | ●        | ●       | ●         | ●              |        | ●         | ●     | ●            | ●                 |                  |                      |            |                 | ●            |      |
| 20       | Buying chilled sachet water                           | ●                   | ●         | ●          |             | ●        |               |             |         |              | ●        |         |           |                |        |           |       |              |                   |                  |                      | ●          |                 |              |      |
| 21       | Construction of large storage facilities              | ●                   | ●         | ●          |             |          |               |             |         |              |          |         |           | ●              |        |           |       |              |                   |                  |                      |            |                 |              |      |
| 22       | Buying water storage containers                       | ●                   | ●         | ●          |             | ●        |               | ●           | ●       | ●            | ●        | ●       |           |                |        | ●         |       |              |                   |                  |                      |            |                 |              |      |
| 23       | Boiling water                                         | ●                   |           |            |             |          |               |             |         |              | ●        |         |           |                |        |           |       |              |                   |                  |                      |            |                 |              |      |
| 24       | Waking up at night                                    | ●                   |           |            |             |          |               |             | ●       | ●            | ●        | ●       | ●         | ●              |        |           |       |              |                   |                  |                      | ●          |                 |              |      |
| 25       | Collecting water from rivers/ponds                    |                     |           |            | ●           |          |               | ●           |         |              |          | ●       | ●         |                |        |           |       |              |                   |                  |                      |            |                 |              |      |
| 26       | Multiple use of water (washing then flashing toilets) | ●                   | ●         | ●          |             | ●        |               |             |         |              |          |         | ●         |                |        |           |       |              |                   |                  |                      |            |                 |              |      |
| 27       | Constructing pit latrines that do need flashing       | ●                   | ●         |            |             |          |               |             |         |              |          |         |           |                |        |           |       |              |                   |                  |                      |            |                 |              |      |
| 28       | Bathing with bucket                                   | ●                   | ●         | ●          |             | ●        |               |             |         |              |          |         |           |                |        |           |       |              |                   |                  |                      |            |                 |              |      |