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Urban water governance failure and local strategies for overcoming water shortages in Dar es Salaam, Tanzania

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Abstract

In Tanzania's largest city, Dar es Salaam, water supply does not meet the needs of the community. In response, people adopt multiple strategies to secure adequate water for their daily requirements. This paper investigates urban water provision and governance in Dar es Salaam, and has two aims: to investigate the causes of urban water failure; and to examine the full range of strategies employed by the local community to overcome water shortages. We critique the socio-economic implications of both water shortages themselves and the methods used to overcome them. The paper draws on a household survey and key informant interviews in Temeke, one of the city's three Municipalities. We find that failing urban infrastructure and rapid urbanisation place additional pressure on water supply, but argue that the primary cause of water shortages is water governance failure.

Key Words: urban water; water governance; governance failure; water management; privatisation; East Africa

In early March 2012 the World Health Organization and UNICEF announced that the Millennium Development Goal of halving the proportion of people without access to safe drinking water had been reached, five years early (WHO, 2012). A joint media release reported that: 'Between 1990 and 2010, over two billion people gained access to improved drinking water sources, such as piped supplies and protected wells'. This increase means that 89% of the world's population (1% above the MDG target), or 6.1 billion people, now use improved drinking water sources (WHO, 2012). The announcement marked real and symbolic progress towards global efforts to reach identified water development goals. However, it came with several cautions. Among them, global figures mask massive regional disparities. In particular, reaching this global goal overlooks significant challenges that remain in sub-Saharan Africa. Here, only 61% of people are reported to have access to improved water sources, and 40% of people globally who lack access to improved drinking water sources live in sub-Saharan Africa (WHO, 2012). In Tanzania, access to improved drinking water is reported to have declined since 1990 for urban, rural and national populations (WHO/UNICEF, 2012).

In this context, this paper investigates urban water provision and governance in Tanzania's largest city, Dar es Salaam. In Dar es Salaam water supply does not fulfill daily requirements for the majority of residents. As such, people seek alternate methods for obtaining adequate water to meet daily needs, making use of a combination of providers and technologies. The paper has two aims: to investigate the causes of water shortages in Temeke Municipality – one of the city's three Municipalities; and to examine the full range of local strategies employed to overcome water shortages. We consider the socio-economic implications of both water shortages themselves and strategies being used to overcome them.

Urban water provision and governance is the subject of extensive scholarly attention, with cities of the global south providing a sharp focus (e.g. Bakker, 2007; Swyngedouw, 1997). Several scholars working in the field identify governance as the primary cause for urban water failure. In investigating the case of Temeke Municipality, we draw on the notion of 'governance failure' (Bakker, 2010). Here, urban water provision is managed not simply by 'public' or 'private' interests, but by a complex mix of state, corporate and community mechanisms. We follow Bakker's call to 'pay closer attention to urban informality and direct our attention to the broader range of community and corporate organizations involved in the provision of water supply' (2010, page 25).

The paper draws on field research involving primary and secondary, spatial and socio-economic data relating to water provision and governance in Temeke Municipality. Field research was undertaken between June 2007 and April 2008. Spatial data includes water supply networks, distribution of water wells and coverage of water projects in the

municipality. Socio-economic data includes relationships between water supply, wealth and wellbeing of residents. Field techniques included structured questionnaire-based interviews of 250 households, randomly sampled from four wards (of 23 wards in the Municipality). The four wards (also randomly selected) were Mbagala kuu, Miburani, Vijibweni, and Yombo Vituka. Semi-structured interviews were conducted with public and private water institutions. Focus group discussions were held in each ward, involving members of district, ward and street officials, individuals and representatives of groups involved in water supply systems. Field observations provided a picture of water sources and systems, household and community uses of water, leakages, and water projects, and provided insights into opportunities and constraints for water users at the household and community levels, as well as the state of the environment in Temeke.

The following sections provide a brief review of key issues emerging from the literature around urban water provision and governance, focusing on cities in the global south. Next we discuss the context of water provision and governance in Tanzania, including the shift towards privatisation, and the specific context of Temeke Municipality. The next two sections present analysis of the field data, focusing first on causes of water shortages, and second on strategies being employed to overcome them.

Urban water provision and governance

Development institutions widely recognise the challenges of urban infrastructure in the developing world. In 1987 the World Commission on Environment and Development reported to the United Nations General Assembly that 'in the space of one decade, the developing world will have to increase by 65 per cent its capacity to produce and manage its urban infrastructure, and shelter – merely to maintain present conditions' (United Nations, 1987). In 1997 the Secretary-General stated that the result to date was mixed at best (United Nations, 1997). In the context of urban water, several institutions and reports – including the 2006 Human Development Report, the 2006 World Water Development Report, and the United Nations Millennium Development Goals – recognise the enormous challenge of water provision. Yet these reports find that water scarcity is frequently the result of failed policies, and not infrastructure or inherent environmental conditions. As such, they draw attention to questions of water governance.

Urban water governance in cities of the global south has attracted a large body of research over the past two decades (e.g. Bakker, 2007; Bayliss and Fine, 2008; Budds, 2009; Kooy and Bakker, 2008; Loftus, 2009; Swyngedouw, 1997; 2005). Some of this work focuses on governance as the source of water shortages (Bakker, 2010; Mustafa

and Reeder, 2009). Bakker (2010, page 8) defines governance as 'a practice of coordination and decision making between different actors, which is invariably inflected with political culture and power'; 'a process of decision-making that is structured by institutions (laws, rules, norms, and customs) and shaped by ideological preferences' (page 44). She suggests that 'governance failure' occurs 'when there is a mismatch in decision-making between citizenship and associated political rights, on the one hand, and institutional and cultural practices on the other' (page 45). Bakker's view explicitly includes formal institutions, cultural norms and practices, and individual agency and ideology. Other authors emphasise the significance of interactions between formality and informality (e.g. McFarlane, 2012). In this paper we take 'governance failure' to include formal and informal institutions, actors and practices, and draw on the concept to investigate causes of water shortages in Dar es Salaam.

Privatisation, and the role of the private sector, has gained particular attention in recent literature (e.g. Bakker, 2003; 2010; Budds and McGranahan, 2003; Mustafa and Reeder, 2009; Swyngedouw, 2005), due in large part to the prevalence and specific shape of neoliberal reforms in the global south. In many cases, privatisation is either strongly encouraged or a condition of donor funding. Yet it has repeatedly failed to deliver expected outcomes. Mustafa and Reeder (2009) for example, discuss the failure of water supply privatisation in Belize City, arguing that expectations of improved quality and quantity, and customer service, did not materialize, and water supply became unaffordable for most Belizeans.

In recent years scholars and public institutions have identified a shift away from simple privatisation towards 'new mixes of public-private partnerships or tri-sector partnership (involving civil society too)' (Loftus, 2009, page 957), as well as recognition of the importance of community participation (Bayliss and Fine, 2008; Loftus, 2009). Bakker (2010) problematises the very notion of a public/private dualism, arguing that particularly for cities of the global south, simple categories of public and private don't work. She urges that scholars 'expand our focus beyond formal water supply networks, develop an understanding of the roles that both public and private actors play in governance of urban water supply for the poor, and pay closer attention to the practices of urban water use in developing countries (particularly those of the "urban unconnected")' (2010, page 6).

Debates on water governance focus on both the role of the private sector in water provision, and how to achieve water security for those experiencing scarcity (Loftus, 2009). As such, work on the political ecology of water is concerned with both access to water and democratic politics. Research undertaken in Dar es Salaam is consistent with this dual focus. For example, Bayliss (2008), Kjellén (2006) and Mujwahuji (2002) track

the considerable change in policy and governance arrangements that has led to the current conditions of water provision and governance (which we discuss below). Others report on the wide range of strategies adopted by communities to obtain water (Kjellén, 2006; Smiley, 2013), including specific methods such as water vending (Kjellén, 2000), and organisation of neighbourhood associations to fill gaps in infrastructure services left by centralised institutions (Kyessi, 2005).

Households make use of a range of water sources, which vary over time (Kjellén, 2006). As a result, sources and access are difficult to capture in quantitative surveys. Formal methods for identifying or measuring access exist, including the Human Development Report 2005, Household Budget Survey 2002, and national population censuses (Kjellén, 2006). But in some cases – such as the census – only one source of water, from a limited range of options, may be recorded for each household (Bayliss, 2008; Kjellén, 2006), which does not reflect the complex range of sources actually used. In this paper we seek to address this gap by investigating the full suite of strategies people employ to overcome water shortages, and some of the associated socio-economic implications.

Tanzanian water governance

Tanzanian water governance has undergone several phases of restructuring since the colonial era. Systematic water supply development began in the 1930s, when the colonial government started using public funds to develop water supplies, focusing on urban centres. Following construction, water users took responsibility for management and paid for water use (Maganga et al, 2002). In both urban and rural areas, water provision and management was governed through cost-sharing systems, in which costs of construction, maintenance and use were shared between the state, local authorities, and individual users (Kjellén, 2006; Maganga et al, 2002). Under the cost-sharing system, discrepancies in provision arose, as some local authorities were unable to collect adequate funds to pay for operation or maintenance of water supply.

Following independence from Britain in 1961, the new socialist government, under first President Julius Nyerere, invested heavily in basic social services including education, health, water and sanitation. Supported through central government investment programmes and substantial donor support, these initiatives contributed to significant improvements in life expectancy, infant mortality, education enrolments and literacy (Bayliss, 2008; Wangwe, 2005). The Nyerere government's 'free water for all' policy was put in place in 1969. From this time, rural residents were no longer required to pay for water used for domestic purposes and livestock (Maganga et al, 2002; Mujwahuzi, 2002; Semboja and Wangwe, 1995). In urban areas residents who sourced water from domestic connections or metered public kiosks continued to pay for water, but it was

later determined that only those with domestic connection in house or yard would pay (Maganga et al, 2002; Mushi, 2004). This policy, in which the state takes responsibility for water provision, has been criticised by some as fomenting an attitude of 'no commitment' from residents (Mujwahuzi, 2002).

Construction of water infrastructure proceeded apace during the 1970s, but costs of construction, operation and maintenance soon became too great a burden for the government (Mujwahuzi, 2002). The 1970s saw economic crisis related to a series of reinforcing events including changes in terms of trade, severe drought, and an increased oil price (Bayliss, 2008). In this context, the free water policy performed poorly, and heralded another change in approach to water supply. Central government returned to a cost-sharing system in the mid-1980s, establishing Village Water Committees and Funds. It was hoped that through this approach village communities would participate in initiation, planning, construction, operation and maintenance of projects (Mujwahuzi, 2002). However, the new cost-sharing approach did not overcome the problem of 'no commitment', and a poor sense of ownership of facilities, operation and maintenance prevailed.

A National Water Policy was adopted in 1991 (Mujwahuzi, 2002), which shifted the approach once more. Two key changes included a move from cost-sharing to full cost recovery for maintenance and operation in urban areas (Maganga et al, 2002; Mujwahuzi, 2002), and a new emphasis on private sector involvement (Mujwahuzi, 2002). In 1997 the Dar es Salaam Urban Water and Sewerage Authority (DAWASA) was established as owner of water supply and sewerage infrastructure, bringing together water supply and sewerage for the first time. DAWASA was to 'operate commercially' and somewhat independently from the Minister for Water (URT, 1997), and further legislative changes in 1999 allowed for its privatisation (Kjellén, 2006).

Concurrently, and to address the financial crisis, Tanzania signed its first Structural Adjustment Programme with the IMF in 1986. By the mid-1990s all services, including water, were up for privatisation, effectively reversing the socialist policies of the Nyerere government (Bayliss, 2008). Under pressure from multilateral financial institutions, the IMF and World Bank, in 2000 Tanzania conceded to privatisation of public water services (Mushi, 2004). Privatisation of DAWASA was a condition of Tanzania receiving Heavily Indebted Poor Countries debt relief (Kjellén, 2006).

The Tanzanian government began the process of privatising the water utility with the hope of obtaining new technologies, improving operation and maintenance efficiencies, and accessing funding for rehabilitation and improvement (Kjellén, 2006). Bayliss

(2008, page 167) argues however, that 'Faith in the private sector stems more from the failure of the state to deliver rather than the intrinsic merits of private provision per se'. After a lengthy bidding and negotiation process a lease contract was signed in February 2003 with Biwater Gauff (Tanzania) Ltd (a British-German corporate consortium), forming local operating company City Water (City Water, 2003). City Water took over water and sewerage operations on 1st August 2003 (Kjellén, 2006), at which time 'the local press expressed relief, as the signing of the lease contract would set the sorely needed investment program into motion', and 'most residents of Dar es Salaam were relieved and hopeful that the company would be able to solve the city's water dilemma' (Kjellén, 2006, page 199). However, City Water faced challenges of dilapidated infrastructure, operating systems and procedures, the pressures of a rapidly growing urban population, and corruption. The contract was terminated within 18 months, and Dar es Salaam Urban Water and Sewerage Corporation (DAWASCO) took over operations. Today, DAWASA delegates responsibility for operation of the piped water system to DAWASCO. DAWASA has responsibility for water and sanitation projects for the urban poor who are not covered by DAWASCO piped water, and these projects are implemented by NGOs appointed by DAWASA. This series of major restructures, and the associated instability, provides an important context to contemporary water provision and governance.

Privatisation did not solve the water supply challenges of the city. In low income areas the majority of households still have no direct access to piped water, relying instead on buying water from vendors or neighbours, sometimes at greatly inflated prices (Kjellén, 2006). Contemporary water shortages in the city have been attributed to poor governance and lack of community participation (Mujwahuzi, 2002; Water Aid, 2003). Agenda 21 (Chapter 18.9) recognises the importance of local community participation in design, implementation and evaluation of projects, and stresses the importance of economic efficiency and social appropriateness. Full public participation should include women, young people, indigenous peoples and local communities in all stages of management, decision-making and policy-making. Supply and sanitation in Tanzania has to date focused on ensuring adequate investment in infrastructure, operation and maintenance (Maganga et al, 2002), at the expense of an inclusive system of governance. In the next section we consider the specific conditions of water provision in Temeke Municipality, before moving on to examine the causes of water shortages.

Water provision and governance in Temeke Municipality

Dar es Salaam currently sources its water from three surface water treatment plants: Upper and Lower Ruvu plants on Ruvu River, and Mtoni plant on Kizinga River. Piped water from these sources secures about 50% of demand, with ground water providing the remainder. More than 36 deep boreholes were recorded in 2002 as being connected

directly, without treatment, to the main water supply system (Mato, 2002). Dill (2010) describes unregulated spread of boreholes throughout the city. Despite the importance of ground water in the city, water quality and extraction are not well monitored, which has led to major outbreaks of water related diseases, especially in the rainy season, and growing uncertainty about long-term water supply.

The city's water supply and sanitation infrastructure was built from the 1930s, and extended beyond the city centre during the 1950s. It is currently in a very poor state of repair. Infrastructure has historically been unequally distributed, with the majority sourcing water from communal supplies. Only a minority of city residents rely exclusively on piped water; most combine water from different sources, at varying costs, which we discuss below. Many also engage in developing new small scale, low cost sources (Kjellén, 2006).

Temeke is one of three Municipalities in Dar es Salaam, and includes large unplanned and unserviced areas. The majority of households are not connected to piped water. According to NGOs WaterAid and Tearfund (2003), in 2003 at least 120,000 households of an estimated 200,000 were unconnected to the centralised water system. Across the city, Smiley (2013) finds that actual water provision is significantly lower than reported household water connections. Temeke also includes large areas under cultivation. Over half the land area of the municipality is used for growing cash- and food-crops (an estimated 58,278 ha, or 52% of the land area in 2004 [URT, 2004]). Water and sanitation demands therefore encompass mixed urban and agricultural needs. The population of the Municipality is growing rapidly, placing further stress on decaying infrastructure and failing governance systems. Access to safe drinking water and sanitation are arguably the greatest of Temeke's challenges.

Most Temeke residents obtain water through a complex suite of strategies, reflecting the combination of formal and informal practices found elsewhere (McFarlane 2012). Control, management and cost vary from source to source. DAWASA is responsible for developing and rehabilitating the piped water supply system. Billing, tariff collection, operation and routine maintenance is the task of DAWASCO. Maintenance is challenging due to the state of disrepair of the infrastructure. In many places pipes are cut in order to obtain water free of charge. Illegal taps are not accounted for in the billing process, and contribute to further leakages. According to DAWASCO Chief Executive Engineer Alex Kaaya, less than 50% of water pumped to the city reaches consumers due to leakages and illegal diversions (Guardian, 2005). Although precise quantities are impossible to know, approximately half of the water lost is thought to be through illegal use, the other half leaked from mains and distribution systems (Howard Humphreys, 1995; Kjellén, 2006).

The most common alternate water sources are bore-wells and tanks. Bore-wells are usually developed by DAWASA, NGOs and Community Based Organisations (CBOs), and are sometimes privately owned. Following construction, management is usually by CBOs and local residents, or by individuals. CBOs maintain records of water supply, including frequency of water availability and quantities, and in some areas money obtained from selling water is shared. Water vendors are common in areas with insecure public water supply and households with some purchasing power. In lower income areas householders gather their own water. Free public water supplies are rare, and include local wells or springs and swamps, but these sources are often seasonal, management informal, and water quality poor.

Water prices range from 20-200 Tanzanian Shillings (Tsh) per 20 litre bucket, depending on a range of factors including location, supply source, season and DAWASA breakdowns. DAWASA piped water is the most expensive source. With prolonged power cuts affecting pumping, water prices can rise up to 400 Tsh per bucket. In this context the urban poor remain the most marginalised members of society.

Causes of water shortages in Temeke

Water supply in Temeke does not meet community needs, particularly those of low-income households. More than 60% of households surveyed state they do not have access to enough water to satisfy daily requirements. The reasons are complex. Household surveys and key informant interviews reveal multiple factors leading to water shortages in the Municipality, including poor infrastructure, lack of proper governance, poor billing methods, population growth, power supply problems, and lack of local community participation.

Structural issues, such as infrastructure and rapid urban population growth, without corresponding investment in infrastructure and governance, place additional pressure on water supply and a failing governance system. However, we argue that governance failure, broadly conceptualised as involving formal and informal institutions and practices (Bakker, 2010; McFarlane, 2012), is the primary cause of water shortages experienced by Temeke residents. As identified elsewhere (e.g. Bayliss, 2008), a key element of governance failure is limited community involvement in planning and decision-making. This section presents further evidence to support this argument, and demonstrates that lack of local community participation in water governance continues in Temeke.

Infrastructure and urbanisation

As described above, Dar es Salaam's water infrastructure is failing. The supply and distribution system is inadequate to fulfil the city's needs, and is poorly maintained. Significant leaks are caused by two main factors: plastic distribution pipes laid above ground are easily cracked and broken through everyday city traffic; and distribution pipes are intentionally cut to create new (illegal) diversions. Like many African countries, Tanzania is experiencing rapid urbanisation¹, leading to growth of unplanned settlements without access to basic services (Bayliss, 2008). Only 25% of the city's residents have access to water managed and distributed by DAWASA; the remaining 75% are reported to live in unplanned and unserved areas (UN-HABITAT, 2009). In this context people make alternate arrangements to meet basic needs. Many fetch water from long distances, or pay high prices for water that may be poor quality (as found elsewhere; e.g. Dreibelbis et al, 2012; Hemson, 2007; Smiley, 2013). For example, shallow ground-water sources may be polluted by pit latrines – the main sanitary system across the unplanned areas of the city. Obtaining water from alternate sources is time-consuming, and can provide water that is unsafe for drinking. Urban population growth is not matched by investment in infrastructure and governance capacity. We argue that these structural factors of infrastructure and urbanisation are not the causes of water shortages; rather, they are symptoms of, and create additional pressure on, existing water provision and governance arrangements.

Governance failure: privatisation and local participation

The Tanzanian government recognises the challenge presented by urban water provision, and emphasises the need to improve management of supply based on sound policy and a strengthened institutional approach (URT, 2002). Through the National Water Policy and the Water Development Strategy (both 2002), the Tanzanian government developed a number of goals and plans to supply its citizens with water. The National Water Policy aims to develop 'a comprehensive framework for promoting optimal, sustainable and equitable development and use of water resources for the benefit of the present and future generations' (URT, 2002, pages 6-7). Yet policies and plans are not effectively implemented. In this section we draw on fieldwork findings to discuss key characteristics of governance failure in Temeke, which include: privatisation and the failed cost recovery system; NGO and Municipal water projects and lack of effective community participation; and barriers to local participation.

Water privatisation in Tanzania was a condition of debt relief, and thus of development and rehabilitation loans from the World Bank (de Waal, 2003). Water supply was privatised on the premise that it would be best managed under the free market. Yet privatisation has not overcome the problem of water shortage (see also Dill, 2010).

Rather, private sector participation has diminished the rights of the poor to own and manage water resources; it is therefore the poor who carry the costs of privatisation.

The 2002 National Water Policy established a tariff-setting mechanism to ensure water users pay full cost recovery for water. The implementation of this mechanism provides an illustration of the failure of the newly privatised water sector to address the city's water shortages. The tariff has two parts: the operator tariff, to cover operational costs; and the DAWASA tariff, which contributes to the authority's operating costs and servicing of debt (Kjellén, 2006). Inadequate billing arrangements have resulted in low revenues incapable of meeting basic operational and maintenance requirements. Most pipes are worn out, leading to leakages, which in turn contribute to the challenges of water supply. Most surveyed households connected to DAWASA water complained about the flat rate billing, which ignores irregular and inadequate supply. Water does not flow every day, is reported to vary among households, and can flow exceedingly slowly. In addition to being unreliable, piped water is expensive. The cost of piped water is usually 100-200 Tsh per bucket. In comparison, water from bore-wells costs around 30-50 Tsh. Many families have no choice but to seek water from other sources. Some other sources are provided by the Municipality and NGOs. However, research findings show that project implementation is poor, and community participation is low.

Temeke Municipal Council contributes to provision of water to urban populations through a variety of projects. Namely, it investigates the location of water sources (surface water, springs, deep and shallow wells) and determines the quality and quantity of water; designs water schemes; prepares plans and implements water projects; operates and maintains projects before they are handed over to communities; and advocates and implements water policy. At the time of this research, the Council had drilled more than 130 boreholes, operated by hand-pump, diesel or petrol pumps, or by electric power. After construction, projects are handed over to water committees elected by water users in each ward, including Jumuiya ya Watumia Maji Kilakala (JUWAMAKI) in Yombo Vituka, and Mbagala Kuu Water Users Association. Dill (2010, page 613) notes that for proponents of CBOs, 'because community-based service provision by definition involves bringing "beneficiaries" into the delivery process, services will be more efficient, equitable, accountable, sustainable and responsive to the needs and interests of heterogeneous communities'. However, this research found that in some instances community members lack information about projects, indicating low levels of participation. Almost half (46%) of respondents stated that they are unaware of municipal strategies to combat water shortages. The remaining 54% who are aware of municipal projects were predominantly local leaders, their relatives and neighbours, and leaders of CBOs.

Local and international NGOs play an important role in addressing water shortages. NGOs working in the study area include the Water and Environmental Sanitation Project Maintenance Organisation (WEPMO), which has worked in Mbagala kuu to drill a well and install a pump to supply the main tank. After construction the project was given to the CBO for operation. In Kilakala, CARE International works with CBOs including JUWAMAKI. Community participation is a condition of project funding from the World Bank and other international donors. As such, most NGOs claim to involve local communities in water supply projects. However, the research found that community members frequently have inadequate information about projects and the NGOs leading them. Many NGOs and government institutions take an 'implementation-centred' rather than 'plan-centred' approach to participation. Plans are made by DAWASA and relevant NGOs; few local leaders are involved at the planning stage. Rather, they are usually consulted at a later stage of the project, as implementation nears. At this time project officials visit the ward and project site and begin to meet with local leaders and then the community. It is at these meetings that they introduce plans for the project. At this late stage local knowledge and needs are not easily taken into account. Often the only feasible outcome for the community is to agree with the project as planned, which can prove a significant source of conflict. This is partially responsible for the lack of sustainability of projects.

For example, in Miburani ward the 'visima vya Mdundiko' (hand-pump operated 'dance' bore-wells) were constructed during the 1990s. The government conducted the drilling and construction work, and the bore-wells were given to the community after completion. Local government and the community were given the responsibility of operating and maintaining the wells. However, the community had not been involved in planning, community ideas were not included, and there was a lack of ownership. The wells did not survive for long; none were functioning at the time of this research. This example highlights the significance of participation for fostering a sense of ownership and responsibility, an idea well established in discourse and practice of international development (Dill, 2010).

Problems arising through poor planning and ineffective community involvement, were reported to include: unclear maintenance procedures; poor quality taps and other equipment; low-volume tanks, given the number of people to be served; and in some places communities are required to contribute to the cost of water projects, creating problems for low income earning households. In Mbagala kuu a pump installed by WEPMO became unusable in less than one year as a result of poor quality taps unsuitable for the large number of people using the facility. Participants stated that the NGO claimed the capacity of the tank was 20,000L; the community questioned the storage capacity but their concerns were reportedly ignored. Had the community been

involved from the early stages of development, their concerns about the ability of the facility to serve a community of that size could have been addressed.

When functioning well, NGOs can improve citizens' access to water, and bring practical skills and knowledge to local problems, thereby contributing to local capacity building. However, the performance of NGOs in the study area is limited by very low coverage and ineffective participatory techniques. Local communities must be involved from the early stages of planning, in order to improve the performance and sustainability of projects, and reduce conflicts over resources.

Effective participation requires access to education. For approximately 45% of the sample population Primary education is the highest level achieved (113 of 250 respondents). The 2002 National Water Policy sought active and effective participation of men and women in water supply programs in rural and urban areas (URT, 2002). Among those with only Primary education, women account for over 80%. Of the female respondents none reported having advanced secondary education or above. In contrast, half of the male respondents attained education levels at or above secondary level; 33% were graduates with certificate or degree qualifications. Early marriage appears to be a factor relating to women not continuing their education. Participation of women in water provision and governance projects is particularly important, as they are most frequently responsible for domestic management and water collection. Other barriers to participation include project plans frequently written in English, when the language used by most local people is Swahili. Further, information is regularly distributed via the internet, yet many people do not have computer skills, nor access to computers or the internet. These logistical barriers must be addressed .

Local strategies for securing water

As discussed above, the majority of Temeke residents are not connected to piped water. However, even those who are connected experience inadequate and unreliable water supply: 98% reported not receiving water every day, and 56% reported receiving water only 1-4 times per month. As such, the vast majority of households employ a range of strategies to meet daily water needs. Methods vary within the Municipality, notably according to income: higher income earners are able to pay for water that is safe for drinking and cooking, and is obtained from relatively reliable and convenient sources. Lower income earners rely on more tenuous, inconvenient sources, which frequently involve exposure to social, cultural or economic risk or disadvantage. This difference contributes to a feedback in which the poor remain the most marginalised members of society.

The main strategies used by Temeke residents to secure water can be grouped into three categories: buying water; collecting and storing water; and securing water through non-financial means. Individual methods include: obtaining water from vending kiosks, tanks and bore-wells; walking long distances; buying from water trucks; buying many storage vessels; harvesting rainwater; obtaining water from local wells, springs and swamps; domestic water budgeting; and making illegal connections. Each strategy involves socio-cultural and economic implications, which we explore below. Most strategies involve a mix of government, corporate, non-government, and community sources, reflecting Bakker's (2010) contention that the public/private dualism is untenable, especially in cities of the global south, and particularly for the 'urban unconnected'. In order to better understand the complexities of water provision and governance it is necessary to investigate the specific strategies employed by communities. In the remainder of this section we discuss strategies used by Temeke residents to secure water, and some of their implications.

Buying water

Over one third (35%) of respondents obtain water from vending kiosks, storage tanks and bore-wells, and pay for water from these sources. Prices per bucket vary from place to place, between owners, and between seasons. About 40% of wells in the survey area are privately owned, and 60% owned by CBOs and NGOs. Water pumped to storage tanks is dependent on electricity. With frequent power cuts in the city, tank water does not flow at all times, and communities are required to resort to other sources and/or wait for power to return. Under these conditions water rationing cannot be avoided. High demand and long queues frequently lead to conflict at kiosks, tanks and wells.

In the study area, women and young girls and boys frequently walk long distances to fetch water; in some cases up to 3km to other streets or wards. This observation differs somewhat from other studies that find that fetching water is undertaken predominantly or exclusively by women and girls (Kjellén, 2006; Mujwahuzi, 2002; WHO/UNICEF, 2012). Collecting water in this way takes time and prevents children from attending school and women from undertaking other work or economic activities, which in turn contributes to low incomes (see also Dreibelbis, et al 2012; Hemson, 2007). At times water flows from DAWASA taps very slowly, leading to long queues and more time consumed by the task of gathering water. The situation becomes tenser when water flow stops for several days, forcing people to travel even greater distances to alternate sources.

In an effort to beat long queues some start their trip before dawn. However, walking at night poses safety risks for women and children. Carrying heavy buckets of water long

distances contributes to health problems (Geere et al, 2010), and walking in urban areas amongst car, bicycle and pedestrian traffic makes carrying water on the head very challenging. Some residents reported concerns about the moral implications associated with collecting water. A wide range of people is present at queues, and the talk does not necessarily take into consideration the presence of young and old people. Insults and bad behaviour are exchanged between water fetchers, and the younger generation is exposed to, and is reported to copy, this poor behaviour.

Higher income households frequently have connections to piped water. But in times of water shortage they may buy water from trucks. Most households in this position hire water-vending cars to bring water directly to their homes. These families have large storage tanks or vessels that can store large quantities of water. At 10,000 Tsh per 1000L, this method is not available to the poor; the outlay cost is too great and poorer households are unlikely to have adequate storage vessels for such large volumes of water.

Collecting and storing water

Due to the irregularity of water flow, households are forced to buy many water storage vessels to store enough water for future needs. Water is gathered on days when water flows, and used on deprivation days. Storage vessels are of various types, and prices vary depending on material and capacity. Small jerricans (5L) are reported to cost 800 Tsh; a 20L bucket or jerrican costs 2500 Tsh; plastic tanks range from 50 to 20,000L, and cost from 50,000-2 million Tsh. More than 50% of poor households use buckets and jerricans as their sole water storage facilities. Higher income households, who can afford modern facilities with large storage capacities are able to secure adequate water for relatively long periods of time.

Rainwater harvesting is practiced to some degree by all households surveyed, and provides a reliable water source for the majority of households (80%) during the rainy season. This prevalence comes despite the fact that there are few initiatives to bring modern technologies to rainwater harvesting. Poor storage and collection facilities and technologies are common, and there is great discrepancy between rich and poor in the amount of water harvested. This relates to two factors: access to storage vessels, and having a roof from which water can be collected. Higher income households are more likely to be able to achieve both. Most low income earners in Temeke live in rented rooms, and some houses comprise ten households or more. In these cases, many households rely upon a single roof, and collecting adequate rainwater for all is very difficult. Technologies and equipment used for collecting rainwater are often of low

quality. In many cases, gutters are secured to only some sections of roofs, meaning that not all rainwater falling on roofs is collected.

In the study area, rainwater is considered the best alternative water source to DAWASA piped water, because it can be used for drinking without boiling. However, air pollution caused by growing industry and vehicle use and increasing urbanisation has a negative impact on the quality of rainwater harvested (see also Lye, 2009). Attention should be given to improving rainwater harvesting techniques, as this is a low-cost and relatively reliable seasonal water source that can greatly reduce the costs and problems of urban domestic water supply. The 2002 National Water Policy recognises the importance of rainwater, and aims to promote and encourage the use of rainwater harvesting technologies, enhance research on rainwater harvesting, and create awareness and training. Field observations indicate that these goals have not yet been effectively implemented in Temeke.

Securing water through non-financial means

Some respondents – particularly poor families – collect water from local wells, swamps and streams. This water can be obtained freely, but is generally not suitable for drinking or cooking purposes. Rather, it is usually used for washing, and in some cases for cooking. With water scarcity from DAWASA sources, and prolonged pipe-water breakdown, 8% of surveyed households indicated that they occasionally use this water for drinking. These households claim that it is salty and has a bad taste. The growing number of unplanned settlements in the city contributes to groundwater pollution from pit latrines and solid and liquid waste, making groundwater an increasingly risky water source. A swamp in Mbagala kuu is used primarily for irrigation, but some respondents reported using it for domestic purposes during acute pipe-water shortages. Free water is available only from these relatively unsafe sources (and rainwater harvesting), and in this way the poor are exposed to further risks.

Collecting water from these sources also takes time. At one local well in Mbagala kuu ward children spend a considerable length of time waiting for water, which collects slowly in the well. These children come from (self-identifying) poor families, and collect water from this source because it is free. As discussed above, time spent walking and waiting for water prevents children from attending classes, creating a feedback in which some children from poor families do not attend class, thereby receiving a lower level of education than other children their age, and potentially missing economic opportunities later in life (cf. Dreibelbis, et al 2012; Hemson, 2007).

Some households cope with water shortages by limiting their water use; 20% of those surveyed said that they use little water in order to survive. In some cases non-essential activities are neglected; washing clothes and bodies are the most commonly avoided uses of water during shortages. More than 90% of households with more than five members use this strategy, raising hygiene concerns. Mujwahuzi (2002) finds that low water use contributes to higher incidence of skin disease and diarrhoea. Going without washing bodies or clothes can have negative effects for school children. Schools insist on cleanliness of clothes and body, and failure to comply with this requirement can affect a student psychologically by encouraging them to keep a distance from teachers and student leaders, distracting them from their lessons, and limiting their ability to grasp topics being taught in class (see also Hemson, 2007). Consequently, academic performance can be negatively affected.

A final method of securing water through non-financial means is through illegal connections. Field observations indicate that cutting DAWASA and other water pipes to create new, illegal connections is a common practice. This strategy contributes significantly to leaks from the system, and can reduce water pressure and supply to those legally connected. It also leads to conflicts among residents; in this study, conflict was observed most in Miburani and Mbagala kuu wards. In an effort to reduce the risk of pipes being cut, people connected to DAWASA and other tanks sometimes monitor their pipes.

Conclusion

For residents of Dar es Salaam's Temeke Municipality, formal water provision does not meet daily needs. Reasons for water shortages in the city are complex. Infrastructure continues to be a problem, and urbanisation places additional pressures on a failing distribution and management system. But we argue that the prime cause of water shortages, here as elsewhere, is governance failure, broadly understood to involve a range of formal and informal institutions, processes and practices. Tanzania has seen significant restructuring of water governance since the colonial era. Following the economic crisis of the 1970s, and the signing of the first Structural Adjustment Programme in 1986, donor funding has been predicated on privatisation. Despite the promises and expectations, water privatisation has failed to overcome urban water challenges.

A key characteristic of urban water governance failure in Temeke Municipality is lack of effective community participation in water development projects. While community participation is a condition of much donor funding, this research has found that it is frequently focused on the implementation stage of water projects, rather than on

planning. Water governance must involve local community members in all stages, not only from the late stage of implementation or project completion. Effective participation should go some way to addressing local needs, and lead to greater sense of ownership and responsibility for maintenance and operation of water projects.

In response to water shortage, people develop multiple strategies to obtain adequate water, which often involve collecting water from tenuous and inconvenient sources. Strategies have social and economic implications, some of which further entrench the pattern in which the poor remain the most marginalised members of society. This is due to health risks associated with unsafe water or inadequate supply, exposure to other health and safety risks associated with collecting water, and education and employment opportunities lost in order to gather water. All of these implications have long-term consequences for individuals, families and communities. Women and children in particular are affected by education and employment implications, as they are most frequently responsible for collecting water. This fact is widely recognised by development agencies, but warrants further scholarly attention. In particular, greater attention to the work of children in gathering water is needed (Dreibelbis, et al 2012; Hemson, 2007). In this study, we found that women, girls and boys are involved in gathering water, whereas much other research suggests this work is undertaken predominantly or solely by women and girls. Further ethnographic research into water collection techniques, and especially the experiences of women and children, will contribute to a better understanding of the challenges communities and individuals face, and point to possible strategies for improving access and conditions for water gatherers.

The infrastructural challenges of water provision in Dar es Salaam are tremendous. Approximately half of all water delivered to the city is leaked from the system; illegal connections are thought to comprise half of total loss, and 'unaccounted for' loss the other half. Water loss from the system remains a major confounding challenge around the world, for cities of the global south and north. For the majority of households that do not have access to piped water, or for whom piped water cannot fulfill daily needs, simpler technologies should provide a focus of attention. Most notably, local capacity for rainwater harvesting should be improved. Rainwater collection has the potential to overcome many of the problems associated with other sources: this study found that the quality of rainwater is considered to be very good; collection can be local, therefore reducing the time and risks associated with gathering water; rainfall is seasonally reliable, providing a sustainable water source for part of the year; and it is potentially accessible for low income households. In order to make best use of the potential of rainwater, a concerted effort should be made to improve the quality and coverage of guttering and other rainwater harvesting technologies, especially in areas where multiple families live under one roof. Secondly, there must be improved access to adequate storage vessels to enable collection and storage of good quantities of water.

Finally, investment in water quality testing, and public information about rainwater collection, may reduce chemical contamination of harvested rainwater and associated health risks (Lye, 2009).

Global reports and figures on improvements in water provision, such as the Millennium Development Goals, obscure vast regional disparities. In many parts of sub-Saharan Africa people continue to face the challenge of securing adequate clean, safe water to meet their daily needs. Although infrastructure and urbanisation are significant factors contributing water shortages, we find that governance failure is the key cause. In order to improve the conditions under which people collect and secure water in the city, close attention should be paid to the specific conditions and strategies employed in particular places. Field research using ethnographic methods provides a good means for doing so. In turn such work may highlight possibilities for greater participation in democratic processes.

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¹ Between the 1998 and 2002 censuses, the population of Dar es Salaam grew from 1,360,850 to 2,497,940 (URT, 2002). By 2012 the population of the city reached 4,364,541 (NBS & OCGS 2013). Temeke Municipality was estimated in 1997 to have a population of 567,000; in the 2002 census 771,500. The 2012 census records the Municipal population as 1,368,881 (NBST 2012).