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Abstract

Three informal settlements in the city of Kisumu (Kenya) are compared in terms of water provision and livelihood. In two of the areas (Wandiego and Katuoro), a major water intervention has taken place, whereby in the one (Wandiego) the community has taken things completely in their own hands (culminating in their own, officially registered water company), while in the other (Katuoro) the community and KIWASCO (Kisumu's major water provider) have joined hands (the delegated management model). In the third area (Bandani) nothing of the sort has happened. Survey results show that, despite all kinds of challenges and problems, the interventions in Wandiego and Katuoro did have a substantial positive impact on several livelihood aspects of the households – measured as well as perceived by the respondents – leading to the conclusion that both types of interventions deserve to be replicated elsewhere.

Introduction

“Water is fundamental to all forms of life and must be protected as a common resource, public good and human right” (Nyangena 2008: 119). It is a key asset for socio-economic growth and development at all levels, ranging from the national level to the individual. Access to water (and sanitation¹) is a key factor in improving health, economic productivity and social well-being of the human populace as both social and economic activities rely heavily on the quantity and quality of water (UNESCO 2009: 80). Access to water is therefore an essential component of any effort to alleviate poverty (*Ibid.*). Yet, in achieving this target, “sub-Saharan Africa remains the area of greatest concern” (WHO/UNICEF 2006: 3). Over the period 1990-2011, the number of people in this region *without* access to improved water sources did *not* decrease; on the contrary, it *increased* with 24% (WHO/UNICEF 2010). Moreover, the number of *urban* dwellers unserved with safe drinking water even more than doubled (112%; *Ibid.*). Figures for Kenya show the same tendency, particularly in the urban areas, where the number of people lacking access to improved water sources grew more than fivefold during that period (*Ibid.*).²

This gloomy picture regarding access to water (and sanitation) in the urban areas of Sub-Saharan Africa has two major causes. The first one concerns the rapid growth of the urban population. In Sub-Saharan Africa, as well as in Kenya, the urban population more than doubled during the 1990-2011 period (*Ibid.*). The growth of the urban population is especially high in the urban slum areas. “This rapid and poorly managed

¹ As much as this paper concerns water, sanitation cannot be detached from water issues.

² These figures are derived from the tables on p. 23 (Kenya) and p. 35 (Sub-Saharan Africa) of WHO/UNICEF (2013). Figures regarding access to sanitation facilities show the same tendencies: the number of people in *urban* areas in Sub-Saharan Africa lacking access to improved sanitation facilities increased with 129% and in Kenya with 134% between 1990 and 2011 (*Ibid.*).

growth of urban areas, especially in peri-urban slums, has overwhelmed most municipal water services” (UNESCO 2012: 177), which constitutes the second major cause: the inefficiencies of water utilities, especially those that serve the urban areas. Many systems are characterised by high water losses, insufficient revenues to cover operating costs, dilapidated and poor functioning infrastructure, lack of investments, low billing and collection efficiency, chronic water shortages, failure to meet the existing demand, low coverage especially for the urban poor, and corruption, among others (see e.g. World Bank 2004). Facing the enormous challenges in relation to a well-functioning water and sanitation sector, governments in developing countries have increasingly entered into public-private partnerships to improve the situation.³ Nowadays, there are various examples of cities in developing countries where the water and sanitation situation has indeed improved as a result of such partnerships.

However, in many (if not all) cases, one major challenge appears to remain: the low-income areas – or ‘informal settlements’, where the majority of the urban population lives – are not covered (see e.g. Budds & McGranahan 2003; Bayliss 2003; Davis 2005; RTI 2005; Prasad 2006). This is due partly to purely commercial considerations – low profitability, hence too great a financial risk (Budds & McGranahan 2003) – and partly to local circumstances in terms of physical infrastructure of such neighbourhoods and of local politics. All over the world, attempts have been done to (locally) improve this situation, either by the local water provider or by the local community itself (see e.g. Kariuki & Schwartz 2005). This paper deals with three such low-income areas, all in the city of Kisumu, Kenya. In two of these, a major water intervention has been implemented – one by the local provider and the other by the local community – while in the third area no intervention whatsoever has taken place.

Water and livelihoods

Among the challenges facing sub-Saharan Africa, provision of safe water supply – as well as adequate sanitation – is of the highest priority. Even where there is water, the quality is often poor, leading to exposure to water-borne diseases. The Human Development Report 2006 stresses that the crisis in water and sanitation is above all a crisis for the poor. It further states that almost two in three people lacking access to clean water survive on less than US\$2 a day, with one in three living on less than US\$1 a day (UNDP 2006). Moreover, “the poorest people not only get access to less water, and to less clean water, but they also pay some of the world’s highest prices” (*Ibid*: 7). The latter applies particularly to the urban poor, mainly because they are often forced to buy water from private water vendors (see e.g. Kjellén & McGranahan 2006).

According to UN-Habitat (2007), the urban poor get their water by queuing for hours to collect water from standpipes or illegal connections. Others buy their water from vendors who can charge up to twenty times more for water than the price paid by their wealthier neighbours. As such, not only do the poor suffer financially; they also suffer poor health from using unsafe water and poor sanitation facilities. It is estimated that “at

³ These partnerships can take various forms. For a brief overview, see Owuor & Foeken (2012b: 116-117).

any one time, close to half the population in Africa, Asia and Latin America suffer from one or more of the main diseases associated with inadequate water and sanitation” (*Ibid*: 6). A survey conducted in Nairobi’s informal settlements revealed that the prevalence of diarrhoea among children is 32%, while the infant and child mortality is 35%. The prevalence of diarrhoea was found to be double the rate for Nairobi and the national average (APHRC 2002).

Improved access to safe and affordable water, especially to the urban poor, is likely to have an impact on their livelihood, directly or indirectly, in at least three ways (UN-Habitat 2006: 28-29). First, it has a positive impact on health (and, as a consequence, nutrition), which increases time and energy to invest in productive activities. Second, closer proximity of water sources and increased quantity available reduces the time necessary to fetch water. And third, improvements are especially relevant for women, who are traditionally responsible for looking after ill relatives, and for fetching water for the whole household. In other words, improved access to safe and affordable water at the household and individual level is likely (1) to reduce the time spent on fetching or queuing for water, water-borne diseases,⁴ child morbidity, expenditure on water, and water-related conflicts; (2) to increase the girl-child’s school attendance - because girls are sometimes forced to be late or miss school to help their mothers fetch water; and (3) to improve household’s health conditions.

Studies done in Kenya confirmed these general observations. For instance, households in the highlands of Western Kenya with improved access to water reported time savings, improved health, cleaner clothes, as well as increased production of tea seedlings, milk and vegetables (Were *et al.* 2006). In Kibera – a large informal settlement in Nairobi – women’s income-generating activities were negatively affected when they had to spend more hours on fetching water, while some activities had to be curtailed when water was scarce or unaffordable (Crow & Odaba 2010). In another study among slum dwellers in Nairobi (Kimani *et al.* 2007), it was found that water was provided mainly by private vendors. The prevalence of water-borne diseases appeared to be very high, while hygiene was compromised during water shortage periods. These people were found to be more vulnerable to morbidity and mortality as a consequence of poor access to water and sanitation services.

In terms of economic production at the level of the business and/or household, at least two more benefits can be mentioned. First, depending on the nature and size of the business, micro and small enterprises may benefit. This was for instance shown by a comparative study in two small towns in Uganda (Davis *et al.* 2001). And second, urban farming, which is a very common and important livelihood activity for many of the urban poor, becomes much less dependent on the often unreliable rain. A study in Nakuru town (Kenya) showed that mean crop harvests from urban plots were substantially higher when irrigation was practiced (Foeken 2006: 60). Moreover, the time, energy and resources spent on some of the activities linked to poor access to water can be used on such and other productive economic activities, especially for women (UN-Habitat 2008).

⁴ The most common water-borne diseases in Kenya include malaria, typhoid, cholera, diarrhoea, dysentery, bilharzia and worms (Kenya 2006b).

However, women and the poor, including other vulnerable and disadvantaged groups, are often excluded from decision-making; yet, they are the most affected by lack of water and sanitation services (UN-Habitat 2008). Poor urban dwellers, like everyone else, are entitled to reliable, affordable, well-managed and sustainable water supply and related services (UN-Habitat 2007). On a more positive note, UN-Habitat's 2006 *Global Report on Water and Sanitation in the World's Cities – Local Action for Global Goals* notes that "inadequate water supply is not mainly due to a lack of government funds. Indeed, in many cities and smaller urban centres, it is possible to improve provision of water in low-income settlements while charging their inhabitants less than they currently pay for inadequate provision" (*Ibid*: 6).

Kenya's water reforms of 2002

Like other countries in sub-Saharan Africa, Kenya's socio-economic development goals are highly dependent on the availability of water in good quantity and quality. The government's long-term objective is to ensure that all Kenyans have access to clean potable water and that water is available for key economic activities (MWI 2005; Kenya 2006b). The water sector reforms implemented in Kenya under the Water Act 2002 of the Laws of Kenya are designed to contribute to the realization of this long-term objective (see Kenya 2002). Under the Act, autonomous water and sanitation (or sewerage) companies – so-called WASCOs – are given the responsibility to provide water and sanitation services within urban areas. In other words, they are the direct Water Service Providers. The lead partners in this venture are normally the local authorities. The WASCOs operate within the jurisdiction and oversight of the Water Services Boards, instrumental in their registration, incorporation and monitoring. The Act requires that a Water Services Board enters into a contract with a Water Service Provider (WASCO) through a Service Provision Agreement. However, the Water Services Boards remain the legal owners of the water and sewerage assets in their areas of jurisdiction (WASREB 2008: 2).

The WASCOs are expected to be managed on commercial principles, including signing performance contracts, cost recovery, and sustainability within a context of efficiency, operational and financial autonomy, accountability and strategic – but minor – investments. Yet, the key word is not 'privatisation' but 'commercialisation'⁵: water is considered by the Kenyan government as both a social *and* an economic good, to be available for all Kenyans and at a price reflecting its market value (cost recovery). Put differently, water services have to be managed "in accordance with sound business principles" (Section 57(5)(d) of the Water Act – Kenya 2002). As Wambua (2004: 7) argues, "through commercialisation, the Water Act 2002 requires local authorities to form autonomous water and sewerage companies with independent Boards of Directors to provide water services and re-invest (ring-fence) water revenues in service delivery improvement".

⁵ Prof. George Khroda (University of Nairobi), personal communication, 18 June 2007. Prof. Khroda was Permanent Secretary at the Ministry of Water and was in charge of the reforms that led to the Water Act 2002.

The government also recognises that the poor cannot afford to pay such prices, a problem that has to be solved by subsidised rates. Sections 11(1) and 11(2) of the Act laid the foundation for the *National Water Resources Management Strategy (NWRMS – 2006-2008)* (Kenya 2006a).⁶ The overall goal of the Strategy is “to eradicate poverty through the provision of potable water for human consumption and water for productive use” (*Ibid.*: 4). In short, the WASCOs are supposed to improve access to water and sanitation services for poverty reduction and sustainable development. In fact, the core mandate of the WASCOs is to provide effective, efficient, adequate and safe water to all customers.

Water provision in Kisumu

The WASCO of Kisumu is Kisumu Water and Sewerage Company (KIWASCO). The company was set up in 2001, prior to the Water Act 2002, and became operational in July 2003 as a limited company after the transformation of the Water and Sewerage Department of the Kisumu Municipal Council. Compared to several other WASCOs in the country, the Company’s record so far has not been very impressive. In 2008, the company produced about 18,000 m³ of water per day, but the demand was estimated to be about 45,000 m³ per day. The result has been a severe water shortage. Moreover, Kisumu has one of the highest levels of unaccounted-for water – i.e. water that is provided but not paid for – in Kenya. When KIWASCO started its operations, the unaccounted-for water level was 75%. This was reduced to about 62% in 2008. This (still) high level can be attributed to, amongst others, non-functional (static) meters, illegal connections, as well as burst pipes and leakages.⁷

A large proportion of the municipality’s population is concentrated in the low-income settlements, most of which are not connected to the KIWASCO water supply network. That means that only one-third of the total population is served by KIWASCO. Several studies have been carried out that show the seriousness of the water and sanitation problems in Kisumu. For instance, UN-Habitat (2005) found that water sources in Kisumu’s slum areas were unimproved and that the prevalence of water-borne diseases in these settlements was high. Another study (Citizens Report Card 2007) revealed that only 7% of the households in Kisumu’s low-income areas were connected to KIWASCO’s water supply network. Moreover, compared to Nairobi and Mombasa, households in Kisumu more often faced water shortages, spent more time on fetching water (with a negative impact on the women’s wage-earning potential, their time to take part in community activities and their overall physical condition) and also spent a higher proportion of their income on water. Wagah *et al.* (2010) found a strong statistical relationship between household income and daily per capita water use in Kisumu, being 2.5 times higher in high-income areas than in low-income areas.

Finally, two studies focused on the functioning of KIWASCO and the challenges facing improvement of the local water supply, one in Kisumu as a whole (Ong’or &

⁶ The NWRMS (2006-2008) is also based on three other policy papers: (a) *Sessional Paper No 1 of 1999 on National Policy on Water Resources Management and Development*; (b) the *Economic Recovery for Wealth and Employment Creation Strategy (2003-2007)*; and (c) the *Poverty Reduction Strategy Paper* (see Kenya 2006a: 3).

⁷ Interview with the KIWASCO Financial Manager, 13 October 2008.

Long-Cang 2007) and the other in the large informal settlement of Manyatta (see Map 1) (Otieno 2006). Both studies stressed the need for local initiatives by CBOs, NGOs and self-help groups in combination with community involvement in all stages of water and sanitation programmes as documented in the Water Act 2002.

Study areas and methods

The major aim of this paper is to assess the impact of water supply interventions in the low-income neighbourhoods of Kisumu on the livelihoods of the population in these areas. With a population of about 439,000 people (MCI 2012), Kisumu is the third-largest city of Kenya. It is located in the western part of the country on the shore of Lake Victoria. The incidence of poverty in Kisumu is very high: by the mid-2000s, 62% of the city's population was living below the urban poverty line, compared to 53% nationally (CBS 2005).⁸ The bulk of the population lives in informal settlements that are located in a broad fringe around the central business district (CBD) and the high- and middle-income areas (Map 1). Three study areas were selected in this fringe, namely Wandiege, Katuoro and Bandani.

Wandiege

Wandiege is part of the large informal settlement Manyatta "B" on the eastern side of the city, with a 1999 population of about 21,000 inhabitants (UN-Habitat 2005). Because Wandiege's water and sanitation situation was very bad indeed, the community took the initiative to develop its own water supply system (with assistance of some donors): the Wandiege Community Water Supply Project. By 2006, the project was completed and constituted of a borehole with a depth of 110 metres, a pumping station, a tower with two storage tanks of 10,000 litres each (Photo 1), a small office at the bottom of the tower, a pipeline system of about 5 km, seven water kiosks, and 60 individual connections to homes.⁹ The following year, the project became its own, independent WASCO.¹⁰ It is managed by a Board of Directors consisting of ten (un-salaried) members who are duly elected by the "paid-up and registered members" of the project (i.e. the shareholders).

The original water kiosks are operated and managed by the Company and are together with the private connections the main source of income. The kiosks are run by young people from the neighbourhood who are employed by the Company. One of these is also the pump operator. Three other people are employed by the Company: a revenue clerk, a line patroller and a security officer. The privately-run water kiosks are

⁸ The urban poverty line is US\$ 1.50 (Ksh. 87.10 at the time) per person per day.

⁹ By May 2012, another 3 km of pipeline had been laid, 24 water kiosks constructed (18 of which run by private persons), 148 metered connections established and a chlorine doser for water treatment installed. All these connections together serve a population of 10,000-15,000 residents. Moreover, a link with the KIWASCO pipe system and a second storage tank of 75,000 litres (filled with water from the KIWASCO supply system) were constructed. For a full overview of the Project, see Owuor & Foeken (2012a, 2012b).

¹⁰ Wandiege Water and Sanitation Company Ltd, after signing a Service Provision Agreement with Lake Victoria South Water Services Board. As such, it obtained the same legal status as its 'big brother' KIWASCO.

Map 1: Kisumu City, showing the three research areas



supposed to achieve one of the project's objectives of alleviating poverty in the community through income-generating activities. These kiosks are basically a water point and a 'structure' where people come to buy water. Some of them have a storage tank for water used when there is no running water from the pipe. According to the Chairman of the Board,¹¹ both the *connection* and the *consumption* charges are "very affordable" and "the lowest" in the area. Both tariffs are based on the project's primary principle of affordability and poverty alleviation. At the time of the fieldwork, the cost for a 20 litres jerry can of water was only one Kenyan shilling.¹²

¹¹ Interview, 14 October 2008.

¹² In May 2011, due to increasing costs, this tariff was raised to two shillings. Compared to 'normal' prices, this is still relatively low.



Photo 1 The Wandiege pumping station-cum-water kiosk (right) and the two 10,000 litres storage tanks [photo: Dick Foeken, 2012]

Katuoro

Katuoro is the local name for the KIWASCO pipeline area in the southwestern part of the (much larger) informal settlement Nyalenda “B” (or Pandpieri), with a 1999 population of about 25,000 (UN-Habitat 2005). It is one of the six areas in Nyalenda where KIWASCO has constructed a water supply infrastructure, branching off from the main pipe line along the road that separates Nyalenda from the high-income neighbourhood Milimani. Each pipeline – and including its connections – is managed by a Master Operator from the neighbourhood who is employed by KIWASCO: the so-called delegated management model (DMM).¹³ The Master Operator’s responsibilities are fourfold: increase the number of customers, reduce the level of unaccounted-for water, bill all the water that is delivered, and collect the revenues (from both water kiosks and individually connected households).¹⁴

As in Wandiege, the Katuoro Water Supply Project originated from within the community in the beginning of the 2000s. Although a KIWASCO infrastructure did exist in

¹³ “Under the DMM, KIWASCO selects contractors, called ‘master operators’ (MOs), through a publicly-advertised and competitive process, and offers them a bulk supply tariff. In turn, the MOs bill customers, collect revenue and are responsible for minor maintenance, such as the repair of small leaks.” See MCI (2012: 29); also Castro & Morel (2008).

¹⁴ For a thorough description of the intervention, see Castro & Morel (2008).

the area, it was in a very bad state due to for instance many illegal connections ('spaghettization'), frequent leakages, contamination of water (causing incidences of water-borne diseases), a very high level of unaccounted-for water and cartels among kiosk owners (hence, water was expensive).¹⁵ Many people also relied for their water on the Wiegwa River and on shallow wells, both with very unsafe water; and if purchased, the cost for water could easily go up to 20-40 Ksh. per jerry can).¹⁶ Unlike Wandiege, the community could not take things fully in its own hands, so it turned to KIWASCO to see what could be done. KIWASCO, after advice from a consultancy firm, decided to start a pilot project in Katuoro (DMM) for a period of six months: KIWASCO was responsible for the infrastructure, while the community had to realise at least 120 connections (a target that was actually surpassed). The project started in 2001 and was completed in 2005. In accordance with the stipulations in the Water Act 2002, the price for water was kept low; for instance, at the kiosks, a jerry can of 20 litres cost two shillings (at the time of the fieldwork).¹⁷

Despite the good intentions laid down in the contract between KIWASCO and the Katuoro Water Project, a lot of complaints could be heard from the side of the Katuoro project at the time of the fieldwork: "KIWASCO sometimes shuts down the line without giving notice", "KIWASCO does not take responsibility for bursts and leaks", "KIWASCO is keeping water scarce", "sometimes the water is brown [but] KIWASCO ignores the problem", "illegal connections are not handled by KIWASCO", "KIWASCO adds cubic metres to the bill". The most sensitive complaint was that KIWASCO was also connecting new households to the network, thus acting as a competitor of the community. These complaints were shared by all six Master Operators in Nyalenda and meetings between them and KIWASCO were described as "tough". A remark made by the KIWASCO Manager for the Milimani-Nyalenda zone¹⁸ – "DMM operation is controlled by KIWASCO" – seemed to be very true indeed.

Bandani

Bandani is located in the north of Kisumu and had a 1999 population of around 14,000 people (UN-Habitat 2005). According to UN-Habitat (2005: 32), "[T]he inadequacy of physical infrastructure and basic social services in this area is comparatively worse than in other slum areas". As for water, this "is the major problem in Bandani ... especially in the inner core areas" (*ibid.*: 34). Like Wandiege *before* the intervention, Bandani's access-to-water situation at the time of the survey was very bad indeed: except for a small 'corner' near the main road where KIWASCO had put up some water kiosks, there was no piped water at all. The people's main water sources consisted of a few springs, shallow wells and other types of surface water. During dry periods, these sources easily dry up or have little water, causing long queues. Alternatively, people had to walk long distances to springs still having water, with the risk to have to share this with

¹⁵ Commercial Manager of KIWASCO, interview, 10 November 2009.

¹⁶ Treasurer of the Katuoro Water Supply Project, interview, 20 November 2009.

¹⁷ For KIWASCO, the DMM was also a way to comply with the requirements laid down in the *National Water Resources Management Strategy* (Kenya 2006a) to improve access to water and sanitation services for poverty reduction.

¹⁸ Interview, 10 November 2009.

cattle being watered there (as the researchers noticed in one case). Some people referred to the lake for water, which was even further away. The easiest way to obtain water was by buying it from bicycle vendors, but for many people this alternative was quite (if not too) expensive (being in the range of 10 to 20 Ksh. per jerry can of 20 litres).

Study methods

The ideal way to assess the impact of an intervention is to ‘measure’ the situation before and after the intervention. Because a situation analysis *before* the intervention in Wandiege and Katuoro had not been done, two alternative ways were employed. The first one is to appeal to the respondents’ memories regarding the situation before the intervention and the current situation. The second one is to compare the current situation in Wandiege and Katuoro with the current situation in Bandani, i.e. with an area in Kisumu that is regarded to be comparable with the situation in Wandiege and Katuoro before the intervention in a number of ways, in particular the access to water situation.

Fieldwork took place in November 2009. A number of study methods were employed, including direct field observations, focus group discussions with officials of the Wandiege project and with a women’s group in Katuoro, informal interviews with relevant stakeholders,¹⁹ as well as collecting water samples for water quality analysis (in Wandiege and Bandani)²⁰. The bulk of the fieldwork, however, consisted of a household survey in the three areas. In all areas, 60 households were targeted to be interviewed. In *Wandiege* and *Katuoro*, these 60 were split into two groups, namely a group of households with an individual connection to the water system (thought to be the group with maximum benefit from the project) and a group without an individual connection. In *Wandiege*, the households *with* a private connection were selected by using the metre chambers: from (almost) all metre chambers, one metre (= a private connection) was randomly selected. The households *without* a private connection were selected as the nearest neighbour of the households with a private connection. Since most households in *Katuoro* appeared to have a private connection, these households are somewhat over-represented in the sample. *Bandani* is less densely populated than the other two areas and is characterised by a clustered settlement pattern. With the help of the local chief, two households were randomly picked from each cluster. A total of 60 households were interviewed. An overview of the selected households in the three areas is presented in Table 1.

¹⁹ From KIWASCO: the Milimani-Nyalenda Manager, the Corporate Communications and Public Relations Manager and the Commercial Manager. From Katuoro: the Treasurer of the Katuoro Water Supply project, the Programme Officer for Environmental Health of the Pandpieri project (Nyalenda), employees in the Katuoro water office and several water kiosk owners. From Wandiege: Chairman of the Board of the Wandiege Community Water Supply Project and a doctor at Wandiege Hospital. From Kisumu Municipality: the Chief Public Health Officer and the Nursing Officer in Charge of Primary Health Care. Additional interviews, especially in Wandiege, took place in September 2011 and May 2012.

²⁰ Because the water in Katuoro is KIWASCO water, informants from the laboratory where the tests were done said the water there was safe because it was chlorized.

Table 1 Number of selected households by area

	Wandiego	Katuoro	Bandani	Total
With individual connection	27	39	0	66
Without individual connection	36	22	60	118
Total	63	61	60	184

Source: Household survey, 2009.

The preferred respondent – and this was the case in 84% of the interviews – was the female spouse or female household head, being the person responsible for the households' water supply. In the remaining households, either the male head or another adult household member was interviewed.

Findings

Table 2 shows two basic household characteristics: an index for the household welfare level (HWI²¹) and the average household size. As for welfare level, the households in Wandiego and Katuoro were better off than those in Bandani. The higher welfare level applies in particular to the households with an individual connection in the two areas,²² which shows that these are the households that could afford the costs for such a connection. The welfare level of the unconnected households in both Wandiego and Katuoro is comparable with that of the households in Bandani.²³

Table 2 Selected household characteristics by area

	Wandiego (N=63)	Katuoro (N=61)	Bandani (N=60)
Average household welfare index (HWI)*	15.7	14.1	9.3
Average household size (persons)	4.7	4.2	4.8

* Based on the relative cost of 7 household possessions if bought new from the market or shop. The cheapest item (radio) was given 1 point and the dearest (motorbike) 16 points, meaning that a motorbike was about 16 times more expensive than a radio. The 'values' for the other five items were as follows: cell phone 2, gas cooker 3, TV 6, bicycle 10 and fridge 12. The (theoretical) minimum score was 0 and the maximum 50.

Source: Household survey, 2009.

The households' main water sources are presented in Table 3 (the households in Wandiego and Katuoro with an individual connection to the piped water system have been left out here). Despite lacking an own individual connection, for almost all (unconnected) households in both Wandiego and Katuoro, piped water appeared to be the main source of water: almost two-thirds fetched water at a water kiosk or a public

²¹ For the calculation of the household welfare index (HWI), see note with Table 2. The scale of the seven items scores a Cronbach's alpha of 0.702, which, according to the literature, points at a strong scale (see Ching Chung 2011: 37).

²² Wandiego: 22.0 (N=27); Katuoro: 16.3 (N=39).

²³ Wandiego: 10.9 (N=36); Katuoro: 10.1 (N=22).

Table 3 Main water source of the households without an individual connection by area (%)

	Wandiege* (N=36)	Katuoro* (N=22)	Bandani (N=60)
Piped water – neighbour's	30.6	22.7	-
Piped water – water kiosk / public standpipe	63.9	72.7	-
Roof catchment / rain water	5.6	-	-
Shallow well / borehole	-	-	6.6
Private water vendors	-	-	23.3
Surface water	-	4.5	70.0
Total	100	100	100

* The 'connected' households all fall under the category "piped water – individual", hence they have been omitted here.

Source: Household survey, 2009.

standpipe, while almost one-third had access to the individual connection of a neighbour. In contrast, most of the Bandani households' main water source was surface water, which was cheap but not clean/safe. For instance, the Soko Kogweno spring overflows as a 'stream' and some households collected water from this overflow (Photo 2). For about a quarter of the Bandani households, private water vendors were the main source of water, which is relatively expensive (and often also not clean/safe).



Photo 2 School girl drinking severely contaminated water at Soko Kogweno spring in Bandani [photo: Howard Ching Chung, 2009]

Problems with main water source and coping with water scarcity

The people in the three areas faced various constraints regarding their main water supply (Table 4). By far the most common complaint was about the high costs involved. This applies in particular to Bandani, where people were quite dependent on private water vendors, especially during the dry periods. The figures in Table 4 also show that although in both Wandiege and Katuoro a major water improvement intervention has been implemented, the people in Wandiege were much more satisfied with the costs involved than the people in Katuoro.²⁴

Table 4 Major problems with main water source by area (%)*

	Wandiege (N=63)	Katuoro (N=61)	Bandani (N=60)
High costs	30.2	55.7	86.4
Irregularity of water supply	20.6	44.3	30.0
Rationing/blackouts/interruptions	28.6	6.6	5.0
Broken pipes/leakages	3.2	26.2	1.7
Water is dirty/contaminated	3.2	16.4	23.3
Queuing	3.2	3.3	18.3
Water is salty/hard	27.0	-	-

* Only problems that were mentioned by at least 10% of the respondents in either area are presented here. Various other problems were mentioned by less than 10% of the respondents in either area, such as 'breakdown of pump' (Wandiege), 'low pressure' (Katuoro, Bandani), 'source too far' (Bandani), 'theft of pipes/metres' (Wandiege), 'insufficient water in dry season' (Bandani), 'worms in water source in wet season' (Bandani), 'occasionally overtreatment' (Katuoro), 'repairs wait too long' (Katuoro) and 'bad management' (Katuoro).
Source: Household survey, 2009.

Water supply in Kisumu is not very reliable. During the dry season, water may become scarce because rivers and wells run dry and/or roof catchment cannot be practised because there is no rain. Moreover, power blackouts are quite common, which means that water cannot be pumped, hence the piped water system falls idle. Many of the surveyed households reported regular periods of water scarcity (lasting between a week to a month) during the year prior to the interview, which were caused by such reasons.

Quite a number of respondents complained of dirty water, often in combination with broken pipes and/or leakages. Two respondents, both with an individual connection, in Katuoro expressed it as follows:

'From the source, water is clean, but the main problem is the pipes. Leakages and broken pipes. That's why people continue to have contaminated tap water.'

'The pipes are being vandalised by people or cars and once broken, waste water will mix and the water will be contaminated.'

Queuing was mentioned as a serious problem by several respondents in Bandani, particularly in the dry season:

'There is only one water point serving a large population.'

²⁴ This is confirmed by the actual costs per month people had to pay for their water (see Table 5 below).

‘It takes a lot of time and quarrelling as you struggle to get water.’

‘You are battling for water when people are many.’

And one of them added that in such situations, “the water vendors are selling water at a high price”.

The rainy season brings again other problems, given the following statements:

‘When it rains, sewerage mixes with water in the pipes. So you have to run the taps for about 10 minutes to get clean water.’ [Katuoro household with individual connection]

‘During the rainy season, worms swim in the water (...).’ [Bandani household]

‘When it rains it is difficult to walk on the mud to look for water.’ [Wandiege household]

‘When it rains there is a lot of mud, so the water source gets contaminated.’ [Bandani household]

Almost two-thirds of the respondents had experienced periods of water scarcity during the year prior to the interview (Table A1 in the Appendix). Conspicuously, this percentage was highest in the area with the ‘best’ water supply system (Wandiege) and lowest in the area with the ‘worst’ system (Bandani). This relatively high percentage in Wandiege may be caused by the frequently mentioned blackouts causing the one pump to be idle.

During periods of water scarcity, people have to resort to alternative water sources. As with the ‘problems’ mentioned above, these varied considerably between the three areas (Table A1). Wandiege is an area lacking springs, boreholes and shallow wells, so people opted for either water vendors or the (very dirty) Nyamasaria River or water from the main KIWASCO pipeline near the Nakumatt supermarket, which is quite far away for most of the households in the area.²⁵ Katuoro, on the other hand, does have springs, boreholes and shallow wells, which were mentioned by several households as alternative sources of water. About one-quarter of the Katuoro households indicated to use stored water during water scarcities; storing water apparently being a preventive measure for the frequent irregularities in the water supply (see Table 4). Finally, in Bandani, the most frequently mentioned alternative water source was a spring further away, followed by private water vendors and water from the lake.

Obviously, people encountered problems as a result of periods of water scarcity (Table A1). Most respondents mentioned two or three problems, most frequently water being (very) expensive, queuing and the long distance to the alternative water source(s). The relatively high percentage of the Wandiege households complaining about water being very expensive during scarcities may have to do with the relatively low price people have to pay for their water during ‘normal’ times (see Table 5 below). The overall way to cope with water scarcity was to reduce water consumption (Table A1), most so in Wandiege. Conspicuously, quite a number of households in Katuoro and Bandani indicated that they did not (try to) cope; instead, they “saw no alternative” and/or “just waited”.

²⁵ In 2012, a connection was made between the KIWASCO system and the Wandiege system, making life likely to be somewhat easier in this respect.



Photo 3 Water kiosk in Nyalenda [photo: Caroline Cage]

Water supply and livelihood

Table 5 presents a number of water-related indicators that are supposed to be of influence on the households' livelihood.²⁶ The first indicator concerns the *time spent on fetching water*, including walking to and from and waiting ('queuing'). Households in Wandiege and Katuoro were in this respect much better off than their counterparts in Bandani who spent about twice as much time on fetching water. The households in Katuoro spent the least amount of time to fetch water, less even than in Wandiege. That is because there are many water kiosks there and households with an individual connection sold water to their unconnected neighbours.

As for the *amount spent on water*, these were lowest in Wandiege and highest in Bandani. Based on this figure and the actual water consumption per household per day (also in Table 5), it is possible to assess how much – on average – per jerry can of 20 litres was paid for the quantities of water actually consumed. The results show that compared to Wandiege, the Katuoro households paid 46% more for their water and the Bandani households 83%. In addition, costs are also made for the treatment of the water. Almost all households (95%) said they treated the water – even in Wandiege and

²⁶ One has to realize that these figures are averages; hence, the variation within each group can be considerable.

Table 5 Water-related characteristics by area

	Wandiego (N=63)	Katuoro (N=61)	Bandani (N=60)
Time spent to fetch water (minutes per day) ¹	27 ⁵	21 ⁸	45
Amount spent on water last month (Ksh.)	537 ⁶	709	804 ⁵
Costs per 20 litre jerry can ² (Ksh.)	2.4	3.5	4.4
Water consumption per household per day (litres)	152 ⁷	137	123
Water consumption per capita per day (litres)	32.3	32.6	25.6
Incidence of water-borne diseases ³ (%)	23.0	21.7	43.1
Access to improved sanitation facility? ⁴ (% yes)	22.5	26.3	1.8
Sharing sanitation facility? (% yes)	67.7	71.2	94.5
If yes, with how many persons?	22	14	39

Notes: 1) Including walking and waiting ('full cycle').

2) Estimation based on 'costs of water last month' and 'water consumption per household per day'.

3) Period from January to November 2009.

4) Improved pit latrine and flush toilet; the latter were very few.

5) Only households without an individual connection (N=36). One outlier (180 minutes) is excluded.

6) Two outliers (> Ksh. 6000) are excluded.

7) Two outliers (2400 and 6000 litres) are excluded.

8) Only households without an individual connection (N=22).

Source: Household survey, 2009.

Katuoro, despite the fact that the water provided in these areas is supposed to be potable. The most common way of treatment was by using chemicals (about 80%; mainly Waterguard), while the others practiced boiling (using charcoal or firewood). On average, households in the three areas spent about 70 Ksh. per month on treatment.

The amount of water a household consumes depends not only on the household's water need, but to some extent also on the distance to the water source(s) and the costs involved. The latter two factors may explain the differences in *water consumption per household per day* presented in Table 5. Despite the larger households in Bandani (see Table 2), daily water consumption was lower there than in both Wandiego and Katuoro. The same applies to the *water consumption per capita per day*. The UN suggests that each person needs 20-50 litres of water a day to ensure their basic daily requirements for drinking, cooking and cleaning.²⁷ The figures in Table 5 show that the Bandani households were at the bottom line in this regard, but also that the situation in Wandiego and Katuoro was somewhat better.

An important element of household livelihood concerns the health of the household members. Some of the basic factors contributing to the people's health are access to clean water (thus reducing the risk of getting a water-borne disease) and access to a decent sanitation facility. As for the quality of water, both the KIWASCO water in Katuoro and the water supplied by the Wandiego Water Project were clean in the sense of potable, while all other sources in the three areas were not (at all).²⁸ This may to a

²⁷ See http://www.unwater.org/statistics_san.html.

²⁸ Samples were taken and tested in a laboratory from the Nyamasaria River In Wandiego (which used to be the most important water source before the project and still an important alternative source of water when the system is not functioning) and a protected spring, an unprotected spring and a protected shallow well in Bandani. See Mutune (2012), p. 43, Table 4.8.

large extent explain that the *incidence of water-borne diseases* appeared to be considerably lower in Wandiege and in Katuoro compared to Bandani.

As for sanitation, one of the activities of the Wandiege project was the construction of eco-sanitation and sand-platform latrines. As could be expected, especially the households with an individual connection benefitted from this.²⁹ The unconnected households' access to sanitation in both Wandiege and Katuoro appeared to be about as bad as in Bandani, being mainly dependent on dirty public latrines.³⁰ Another worrisome aspect of sanitation in the three areas concerns the large number of people with whom the latrines were shared (Table 5), particularly in Bandani.

The water interventions compared

Respondents in Wandiege and Katuoro were asked in how far the water intervention in their neighbourhood had been beneficial for their households. The findings (Table 6) show that on the whole the respondents were fairly positive in that it had reduced the costs for water and the time spent on fetching it, the water supply was more regular and it had reduced the incidence of water-borne diseases. Some indicated to have benefitted in terms of food and income-generating activities. Table 6 also shows that the Wandiege households were more satisfied with the water intervention than the Katuoro households, especially regarding the reduction of costs, fetching time and diseases. Overall, people were quite satisfied with the intervention: on a scale of 0 to 10, households in Wandiege appreciated the intervention with an 8.4 and in Katuoro with a 7.5. A female kiosk owner in Katuoro was very clear about it: "It had a good impact, the DMM model", thereby referring to the past when many people faced shortages of water, there were long queues at the water points, the water was not safe and there were more cases of diseases. And for herself, "it's a source of daily employment".

Table 6 Respondents' perceptions on the benefits of the water intervention by area

	Wandiege (N=63)	Katuoro (N=61)
Spend less money on buying water than before the intervention	80.0%	52.5%
Spend less time on fetching water than before the intervention	74.1%	58.3%
Water supply is more regular than before the intervention	54.4%	62.1%
Reduced the incidence of water-borne diseases	67.2%	45.9%
Benefitted from the project in terms of food and income-generating activities	22.0%	15.5%
General satisfaction with the project*	8.4	7.5

* Based on the question "are you generally satisfied with the project?" and the following answer categories: "yes, very much" (10), "yes" (7.5), "indifferent" (5), "not really" (2.5) and "not at all" (0); N=63 and N=61, respectively. Hence, the theoretical maximum is 10 and the theoretical minimum is 0.

Source: Household survey, 2009.

²⁹ Households that can afford an individual connection can likely also afford some type of improved sanitation. The survey showed that in both Wandiege and Katuoro, 41% of the households with an individual connection had access to improved sanitation as well, against only 9% and 0%, respectively, of the non-connected households.

³⁰ Personal observation during fieldwork.

The respondents in the two areas with the water intervention (Wandiego and Katuoro) were also asked about any challenges or problems they encountered with the project. The most frequently mentioned replies are listed in Table 7. The most conspicuous finding is the fact that for each of the mentioned challenges, the two areas show an opposite picture. First, the percentage of respondents saying that they did not encounter problems was much higher in Wandiego than in Katuoro, which is in line with the higher overall appreciation figure mentioned in the previous paragraph. Second, almost half of the Wandiego respondents complained about interruptions in the water supply due to power blackouts, while none of the Katuoro respondents did. This had most likely more to do with breakdowns of the water pump than with power blackouts in this part of Kisumu, as can be deduced from the comments of some respondents in Wandiego:

‘Sometimes, low voltage does not permit pumping water. The pump breaks down occasionally and it takes two weeks to repair it.’

‘When there is power shortage, they wait for a day or two. When their pump collapses, they take days to rectify this.’

*Table 7 Challenges/problems with the water intervention by area (%)**

	Wandiego (N=53)	Katuoro (N=44)
No challenges/problems	32.1	11.4
Electricity/blackouts	43.4	--
Broken pipes/leakages	1.9	43.2
Sometimes inadequate/irregular water supply	--	22.7
Salty water	15.1	--
Bills/price too high	1.9	15.9
Poor management	--	13.6

* Only those challenges/problems are listed that were mentioned by at least 10% of the respondents in either area. Source: Household survey, 2009.

Third, another complaint mentioned in Wandiego but not on Katuoro concerned the salty taste of the water. Although the quality of the water from the borehole was good, i.e. potable, several respondents indicated that they did not use the water for the preparation of tea due to its salty taste.³¹ Finally, the comparatively high percentages of the other four problems in Table 7 mentioned in Katuoro and hardly or not in Wandiego – broken pipes/leakages, inadequate/irregular water supply, high prices, and poor management – can all be related to one overall problem: bad management. This was expressed by some respondents in various ways, either in a more general way – ‘lack of skilled manpower to manage the project’, ‘no qualified staff to run the project’, ‘the

³¹ This problem was also recognized by the management of the Wandiego Company. It was solved in 2012 when the Wandiego water supply system was connected with the KIWASCO network, in combination with the construction of a large water tank filled with KIWASCO water (see Owuor & Foeken 2012a).

management is not transparent’ – or more specifically – ‘it takes long to repair bursts and leaks’, ‘pipes are not laid deep enough, so they break easily’. As one respondent stated,

‘The problem is proper management for better daily running of the project instead of low pressure and breakages of pipes which normally leads to loss of water.’

In short, while the Wandiege consumers had very little to complain about the management of the Wandiege Water Company, the Katuoro consumers were quite dissatisfied in this respect. One wonders in how far this has to do with the different management systems in the two areas, i.e. the 100% community-based character of the Wandiege water system and the delegated-management model in Katuoro.

The respondents in Wandiege and Katuoro were also asked about any participation or involvement in the project. Again, there are marked differences between the two areas: whereas one-third of the Wandiege respondents indicated to have been involved at any stage of the project, this applied to only 5% of the Katuoro respondents. These percentages were fairly stable through time. The most common types of involvement in Wandiege were either financially – ‘became member’ (ad Ksh. 200), ‘bought shares’ (from Ksh. 1000 to Ksh. 2500) – or materially – ‘digging of trenches for laying pipes’. Some had played a supervisory role (as well), while one respondent appeared to be the treasurer of the company.

Connected versus unconnected households

Because it was expected that households with an individual connection to the main pipe would benefit and be involved more than households without an individual connection, the sampling in the project areas was stratified to obtain a sufficiently large group of both types of households for comparison purposes. Results are presented in Table A2 in the Appendix. First of all, the top row shows that – not surprisingly – there is quite a difference between the welfare level of the two groups, confirming once more that the households with an individual connection are generally those who can afford it. As for the perceptions on the benefits of the intervention, the connected households were more positive than the unconnected ones, especially in terms of the regularity of the water supply and the reduction in the incidence of water-borne diseases. Concerning the challenges and problems encountered, a mixed picture arises from the figures in Table A2. For instance, the unconnected households complained more often about the power blackouts, while the connected households had more problems with broken pipes. The level of participation was about the same in the two groups and the same applied to the overall satisfaction with the project.

The reason for the less-than-expected differences between the two groups is that the levels of benefits and involvement do not only depend on whether one has an individual connection or not, they are also area-specific, especially how the situation was before the intervention. For instance, the unconnected households in Katuoro were the least positive about the benefits of the intervention, resulting in an overall satisfaction score of 6.6, which is quite low compared to the 8.8 among the unconnected households in Wandiege (which was the highest score). And in terms of involvement in the project, none of the unconnected households in Katuoro had had any involvement, while the

participation rate of the connected households in Katuoro was lower than both the connected and unconnected households in Wandiege. But given the sensitization and implementation process in Wandiege, this finding does not come as a surprise.

Conclusions

Three informal settlements in Kisumu were compared in terms of water provision and livelihood. In two of the areas (Wandiege and Katuoro), a major water intervention had taken place, whereby in the one (Wandiege) the community had taken things completely in their own hands (culminating in their own, officially registered water company), while in the other (Katuoro) the community and KIWASCO (Kisumu's major water provider) had joined hands (the delegated management model). In the third area (Bandani) nothing of the sort had happened.

The study shows that water interventions in informal settlements do have a positive impact on the households' livelihood: time spent on fetching water is much less, which is particularly relevant for women and their daughters; the costs for water are far less, which is partly due to the special rates charged at water kiosks; partly as a result of these two factors, water consumption per household and per capita is higher; and the incidence of water-borne diseases is less due to the fact that the water is clean(er). As could be expected, the households with an individual connection benefitted most from such interventions. That applies also to sanitation, because almost all households with access to an improved sanitation facility were households with an individual water connection (but not the other way around!).

Despite all these advantages, quite some complaints could also be heard among the people in Wandiege and Katuoro. In general, the people in Wandiege were more positive about the intervention and its impact than the people in Katuoro. From the survey results, this is not easy to explain. Yet, it could very well have to do with the differences between the areas regarding the water supply situation before the intervention. And it may also have to do with the fully community-based character of the Wandiege intervention, meaning that one is not "at the mercy" of KIWASCO, as one of the officials of the Katuoro project described the project's relation with this powerful institution.

Whatever the challenges faced by either type of intervention, they both deserve to be replicated in other informal settlements in Kenya and beyond. In case a (bad functioning) water supply system is already in place, the delegated management model seems to be the obvious choice (see also Castro & Morel 2008), but if no such system exists, the example of Wandiege may be attractive, given that there is donor funding, a very committed and dedicated team to manage the project, and strong support from the community.

Appendix

Table A1 Coping with periods of water scarcity by area (%)

	Wandiege (N=63)	Katuoro (N=61)	Bandani (N=60)	Total (N=184)
% of households experiencing water scarcity	76.2	60.7	51.7	63.0
<i>Alternative sources of water*</i>	<i>(N=46)</i>	<i>(N=36)</i>	<i>(N=31)</i>	<i>(N=113)</i>
- private water vendors	34.8	8.3	19.4	22.1
- KIWASCO	26.1	5.6	12.9	15.9
- spring	-	16.7	38.7	15.9
- river	32.6	2.8	-	14.2
- borehole	6.5	16.7	6.5	9.7
- stored water	2.2	25.0	-	8.8
- lake water	-	5.6	19.4	7.1
- shallow well	-	16.7	-	5.3
- other	10.9	14.0	3.2	8.0
<i>Problems due to water scarcity*</i>	<i>(N=48)</i>	<i>(N=37)</i>	<i>(N=31)</i>	<i>(N=116)</i>
- water (very) expensive	79.2	35.1	51.6	57.8
- much time to fetch water / queuing	47.9	40.5	48.4	45.7
- water source (very) far away	33.3	37.8	54.8	40.5
- water (may) not (be) clean	18.8	24.3	51.6	29.3
- insufficient water for domestic use	18.8	10.8	6.5	12.9
- cannot wash/clean, etc.	14.6	8.1	9.7	11.2
- outbreak of diseases	16.7	2.7	-	7.8
- other	25.1	5.4	19.4	17.2
<i>Coping with water scarcity*</i>	<i>(N=47)</i>	<i>(N=36)</i>	<i>(N=30)</i>	<i>(N=113)</i>
- reduce domestic water use (incl. recycling of water)	83.0	52.8	56.7	66.4
- don't cope / no alternative / just wait / don't know	8.5	33.3	23.3	20.4
- buy water storage tanks / store water	10.6	13.9	6.7	10.6
- find alternative water sources / fetch water from far	8.5	2.8	10.0	7.1
- other	29.7	11.2	6.6	17.7

* Totals exceed 100% due to multiple answers.
Source: Household survey, 2009.

Table A2 Wandiege and Katuoro: connected and unconnected households compared

	Connected	Unconnected
<i>Household welfare level</i>	<i>(N=66)</i>	<i>(N=58)</i>
Average household welfare index (HWI*)	18.6	10.6
<i>Perceptions on the benefits of the water invention (%)</i>	<i>(N=66)</i>	<i>(N=58)</i>
- Spend less money on buying water than before the intervention	71.4	60.7
- Spend less time on fetching water than before the intervention	71.0	60.7
- Water supply is more regular than before the intervention	75.0	40.0
- Reduced the incidence of water-borne diseases	63.6	48.2
- Benefitted from the project in terms of food and income-generating activities	20.6	16.7
<i>Challenges/problems with the water intervention (%)</i>	<i>(N=58)</i>	<i>(N=39)</i>
- No challenges/problems	20.7	25.6
- Electricity/blackouts	17.2	33.3
- Broken pipes/leakages	31.0	5.1
- Sometimes inadequate/irregular water supply	15.5	2.6
- Salty water	10.3	5.1
- Bills/price too high	12.1	2.6
- Poor management	10.3	0
<i>Participation/involvement in the project (%)</i>	<i>(N=66)</i>	<i>(N=58)</i>
- Any involvement in the project	20.0	18.2
<i>General satisfaction with the project</i>	<i>(N=64)</i>	<i>(N=56)</i>
- Average score**	8.0	7.9

* For calculation of the HWI, see note with Table 2.

** See explanation with Table 6.

Source: Household survey, 2009.

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