Comparative Analysis of Communal Prepaid Meters and The Delegated Management Model in Finding Solutions That Work for The Urban Poor

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Abstract

Sub-Sahara Africa water utilities are characterized as being unreliable, poorly financed and do not always have pro-poor strategies. The running theme is poor management, ineffective maintenance, inaccurate billing and high non-revenue water. This study did a cursory review of how several utilities in the region are dealing with this challenge, but found that two utilities in Kenya were outstanding. As such the objective of this study was to compare two service delivery strategies conveyed in Nakuru and Kisumu (Kenya) and to examine to what extent “these tools are addressing these concerns.” Specifically, the study investigated Communal Prepaid Metering (CPM) in Nakuru and the Delegated Management Model (DMM) in Kisumu. Focus group discussions, key informant interviews, questionnaires and document review were methods used to collect the data needed. Results showed that after implementing the CPM and DMM, there was increase in demand for utility water, increased access to water, less time required to fetch water, there was a reduction in the cost of water, reduction in incidence of waterborne diseases and a reduction in non-revenue water from above 50% to less than 10%, in the urban poor areas. The two water utilities are now categorized as medium to high performers by the Water Services Regulatory Board. It was therefore concluded that Communal Prepaid Metering and the delegated management model are viable options for water service providers for improving water service delivery to the urban poor who dwell in peri-urban areas.

Key Words: Urban Poor, Delegated Management, Prepayment, Metering

1.0 Introduction

Water service providers in Africa face multiple challenges when serving their constituents, especially the urban poor (UN Habitat, 2016). They tend to underperform as evidenced by the report of non-revenue water figures that are on average, higher than 50% (Trémolet & Hunt, 2016). This is due to poor technology and poor management arrangements that lead to low billing collections (Heymans et al. 2014). The urban poor are the victims of these inefficiencies. Waters utilities find providing water to urban poor areas as problematic. This is because the areas are often poorly planned without straight lined roads and grids to lay the water pipes. In addition, there are often more occurrences of vandalism to water infrastructure and inordinate preference to illegal connections. The reality though is that 72% of residents of sub-Saharan urban cities live in these communities, representing a population of up to 231 million people (Onyango, 2017). Nevertheless, these people have every right to access decent water services.

Key indicators that inform whether or not a utility is performing or struggling include water quality, the cost of water to the consumer, coverage, time and distance to fetch water from the nearest point and non-revenue water. These are used by the world in the International Benchmarking Network for Water and Sanitation Utilities (IBNET) (World Bank, 2016). (Trémolet & Hunt, 2016) confirm this by including similar performance indicators such as potable water, need for extra treatment and actual cost of water per unit volume. McDonald (2011) also states that “the majority of water users tend to prefer ease of access to water as performance indicator of water service providers”.

In trying to address water provision concerns, in South Africa, the water utility, Johannesburg Water, implemented an individual prepaid metering project in Phiri in Johannesburg in 2003 (Dovey & King, 2012). This new technology, while being very customer friendly, was resisted by the residents because they felt that there was an impropriety on their right to access the 6m³ free water as provided for in their constitution (Heymans et al. 2014). As such, the individual prepaid metering project, was unable to gain acceptability and ended abruptly. In Malawi, WaterAid in collaboration with Lilongwe Water Board tried the water-user-association approach with considerable success (Baietti et al. 2006). This approach basically mobilizes communities to manage a collection of metered communal water points, while the water board developed a pro-poor unit that focuses on urban poor issues. Since the establishment of the water user associations, Lilongwe Water Board has been able to improve its revenue collection and understand the challenges in providing water to low income areas (Collignon & Vezina, 2016). In Uganda, there was a pilot prepaid project, which involved individual connections. In this case, the meter was considered too costly for low income consumers and the water service provider struggled to get customer acceptance (World Bank, 2016). In Kenya, the Water Kiosk model has been practised. In this model, water points are metered and sell water directly to consumers who come to the water points. This water kiosk model has also been tried by Hawassa in Ethiopia (Njoroge, 2011). In other places where water service providers are unable to cope with the rapid growth of the peri urban areas, such as Maputo, private operators mushroom to fill the gap (Dovey & King, 2012). These private operators ran their own metered water systems and may account for over 60% of the mass required water supply. They are often unregulated with no control on their tariff, coverage and water quality (Mbuvi et al., 2012).

These are examples within the sub-Saharan African water sector demonstrating that there are challenges in water provision for peri-urban areas. It is also evident that water utilities have tried to come up with solutions, and at times, communities have tried to create their own solutions to meet the supply gap. However, these efforts, while being different from each other, have not been innovative and there isn’t enough evidence to suggest that the interventions have helped to improve the respective situations.

In Kenya, was service is also characterized as being unreliable, poorly financed and much unfocused, especially when serving poor communities (Carter et al., 2011). For instance, most people are supplied with very scanty services, with perhaps a standpipe or a communal water point, which is also, badly maintained (WSTF, 2015). Although Kenya went through reforms in 2002, many utilities still have poor management, unqualified staff, under registering meters, illegal connections, frequent bursts, old networks, under billing, it is apparent that
the urban poor will remain the major victims of these poor services (WSFT, 2015). In Nakuru and in Kisumu, two Kenyan cities, the problem is exemplified even more because the water utilities are struggling with low coverage (69%) and very high non-revenue water (52%) in the low income areas (WASREB, 2011). The objective of this study therefore was to compare two service delivery strategies delivered in Nakuru and Kisumu and to examine to what extent these tools improve water service delivery for the urban poor.

2.0 Materials and Methods

2.1 Study area

This study was carried out in Nakuru and Kisumu in Kenya (Figure 1). Kisumu is the third largest city in Kenya while Nakuru is the fourth largest city. By the year 2017, the projected population was 760,000 in Nakuru and 600,000 in Kisumu. About 80% of the Nakuru and Kisumu populations live below the poverty line and are concentrated in the densely populated peri-areas (UN-DESA, 2017). In terms of water supply, 70% of the population in Nakuru is served by the Nakuru Water and Sanitation Services Company (NAWASSCO) with over 40,900 metered connections (WASREB, 2011). In Kisumu, WASREB (2011) reported that 29% of the population is provided with water by Kisumu Water and Sewerage Corporation (KIWASCO) with over 14,000 metered connections, as detailed in Table 1.

Table 1: General water provision information in the study areas (Source: WASREB, 2011)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nakuru Town</th>
<th>Kisumu Town</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population in service area</td>
<td>674,789</td>
<td>525,313</td>
</tr>
<tr>
<td>Population served</td>
<td>472,352</td>
<td>153,083</td>
</tr>
<tr>
<td>Percentage of population served</td>
<td>70.0%</td>
<td>29.1%</td>
</tr>
<tr>
<td>Number of metered connections</td>
<td>40,910</td>
<td>14,084</td>
</tr>
<tr>
<td>Non-Revenue Water (NRW)</td>
<td>47%</td>
<td>62%</td>
</tr>
<tr>
<td>Drinking water quality compliance (KEBS &amp; WHO standards)</td>
<td>64%</td>
<td>91%</td>
</tr>
<tr>
<td>Average distance to the nearest water point</td>
<td>850 meters</td>
<td>625 meters</td>
</tr>
</tbody>
</table>

Figure 1: Location of study areas
2.2 Conceptual Model

The communal prepaid metering (CPM) is a tool that is used to provide water to urban poor communities. The meter is activated using a token, which each resident can purchase from the water service provider. The tokens are uploaded with credit at designated pay points and the resident can draw water up to the amount credited to his/her token. The delegated management model (DMM) on the other hand, uses district meters which are placed in a reticulation network to define hydraulic and geographic boundaries. These boundaries help to determine how much water has entered a predetermined area and how much is consumed. In the DMM, a master operator is responsible for an area and is billed by the utility through a master meter which is at the entry point of the delegated area. The master operator in turn bills residents in his area and is also responsible for operation and maintenance in the delegated area. In this study, the CPM model was installed and tested in Nakuru while DMM model was installed and tested in Kisumu (Figure 2).

![Figure 2: Conceptual model for CPM and DMM](image)

In total, there were 91 communal prepaid meters installed in Nakuru and 6 master meters in Kisumu between 2011 and 2012. The installed prepaid meters targeted 15,000 people in the six low-income settlements in Nakuru (i.e. Kaptembwe, Rhonda, Gialani, Mwariki, Lanet Hill, and Kiratina) (Figure 1). In Kisumu, 1,557 metered connections were installed, which included 17 institutions including 7 schools (4,450 students) and 2 medical facilities, 1 kiosk (that serves an estimate of 200 households), and 1,539 connections serving approximately 2,353 households (10,400 people).

3.0 Evaluating the service delivery approaches

3.1 Data requirement

To fully appreciate the dynamics of serving the peri-urban areas in Nakuru and Kisumu, data was sought for key evaluation parameters in the water service provision sector. These parameters were: potable water, non-revenue water, the cost of water, water coverage, and access, walking distance to the nearest water point and incidence of water-borne diseases (which were obtained through field visits).

Potable water is water that is considered safe to drink (WSTF, 2015). It’s treated, cleaned or filtered and meets local established drinking water standards. Non-revenue water (NRW) is the amount of water produced for which revenue is not received (World Bank, 2016). NRW is usually caused by a number of factors, such as water losses from leaking pipes, or commercial losses such as malfunctioning meters that charge households too little, and even theft (illegal connections to the water network, for example). This challenge is often magnified in developing countries where the poorer communities are usually worst affected with inadequate or no access to safe water (Tremolet & Hunt, 2016). Water service providers (WSP) with low NRW are considered to be high performing. When a service provider is commercially viable, it will be able to derive an appropriate cost of water services that is used as a baseline for when doing their annual plans, and when they apply for tariff adjustments (Nyarko et al., 2006). Water coverage, is a measure of how much of a given population is served with potable water, for more than 20 hours a day. A WSP which attains 75% coverage in an area is considered to be high performing (Collignon & Vezina, 2016). Access to water is a key indicator of peri-urban water supply and is measured by the proportion of the population with access to an adequate amount of safe drinking water located within a convenient distance from the user’s dwelling (Brocklehurst, 2004). In urban areas, a walking distance of not more than 200 meters from a public stand post to a home may be considered reasonable walking distance (WHO/UNICEF, 2012). In urban poor areas, reasonable walking distance implies that a person does not spend a disproportionate part of the day fetching water. Worldwide, over one billion people use unsafe water and insufficient hygiene account for an estimated 9.1 % of the global burden of disease and 6.3 % of all deaths, according to the World Health Organization (WHO/UNICEF, 2012). This burden is disproportionately borne by children in developing countries, with water-related factors causing more than 20 % of deaths of people under age 14. Nearly half of all people in developing countries have infections or diseases associated with inadequate water supply (Brocklehurst, 2004). As such, the reduction of water borne diseases is a critical factor in water service delivery.

3.2 Data collection

Data on the six (6) evaluation parameters were collected using observations during field visits, using interviews with water users and water service providers and from the existing literature. Interviews were conducted using pre-designed structured and semi-structured questionnaires.
Further to this, focus group discussions were carried out in Nakuru and Kisumu. In Nakuru, participants came from the low-income settlements of Gilani, Kaptembwa, London, Ronda, Mwariki and Manyani they were twelve in total and all were landlords. In Kisumu, the FGDS comprised landlords and tenants. Participants came from the Obunga, Manyatta, and Nyalenda settlements which are mostly not connected to water lines and therefore, who as tenants rely on shallow wells, water vendors and water kiosks. Overall, 78 individuals participated in the FGDS: 32 in Nakuru and 46 in Kisumu. There were 4 FGDS in Nakuru and 6 FGDS in Kisumu. The participants comprised of 17 landlords, 17 tenants, 11 water vendors, 24 water Kiosk owners, 1 borehole owner and 10 master operators. The purpose of the FGDS was to assess community needs and priorities for, interest in, and willingness to pay for water services and also to provide insight into the experiences and perceptions of the low-income, urban population with regards to urban poor water services. The FGDS were conducted over a four-day period, two days each in Nakuru and Kisumu. Discussions were facilitated in Kiswahili and English in Nakuru, and Kiswahili, English and Luo in Kisumu. Each discussion session averaged 2.5 hours in duration.

4.0 Results and Discussions

4.1 Communal Prepaid Meters

Prior to the installation of the prepaid meters in Nakuru, the baseline survey highlighted several key issues:

- 60% of the Nakuru population lives in low-income settlements.
- Households paid an average of KES 6.3 (USD 0.08) per 20-liter versus a connected household which pays KES 1.2 (USD 0.01) for 20 liters.
- 16% of people obtained water from rain water, rivers, wells and other sources.
- 25% of respondents also purchased water from water vendors where the source and quality of the water was unknown.
- According to the NAWASSCO strategic plan, 2011 - 2016, (NAWASSCO, 2013) for those without access to the water distribution network, water contamination occurred commonly causing water borne diseases such as typhoid, cholera and dysentery, and water-based diseases such as Schistosomiasis and Onchocerciasis. The report noted that the incidence of diarrheal infections was significant within the total burden of disease in the city.

These findings confirmed that there was a strong demand for water, that people paid more than five times as much for 20-liters of water than consumers who were connected, and that the unknown source and quality of water had significant impacts on people’s general health and well-being. Through analysis of NAWASSCO MIS reports, it was found that the two largest low-income settlements (Kaptembwa and Rhonda), with a population of 160,000, had only 2,000 connections covering less than 5% of the population. According to the June 2011 billings and collections report at NAWASSCO, 428 (21%) of the 2,000 accounts had a disconnected status due to overdue payments. The survey and the focus group discussions confirmed that people resist individual connections because of the high initial cost of a household connection and, more importantly, the fact that most families live in rented accommodations and do not want to make this investment, as they were not landlords.

Through key informant interviews with NAWASSCO, it was noted that the water service provider received 300-600 complaints every month, the majority of which were related to inaccurate meter readings and suspected overbilling. From this information, it was determined that individual household connections were not a commercially viable option for the company in low-income areas. NAWASSCO management was not satisfied with its current options due to the reasons noted above and wanted to explore alternative delivery mechanisms. Individual prepaid meters would not address the concerns as they were also costly ($200 per meter) and would still lead to consumers not wanting to connect or invest. Communal prepaid meters, however, were the preferred option for NAWASSCO, because the survey revealed that 87% of those interviewed said they were willing to draw water from a CPM, as the cost of the investment lay with the utility, and the customers were only paying for water drawn. With this system, consumers upload small amounts of credit to a “token” at NAWASSCO zone offices or other available pay points, enabling them to access safe and affordable water from the meter. The meter shows the consumer their credit balance and the amount of water received.

As a result of this intervention, instead of paying an average of KES 6.3 (USD 0.08), consumers now pay KES 1.2 (USD 0.01) per 20 liters. For most households, this means a total monthly water bill of KES 265 (USD 3.23). In addition, the consumers save time spent fetching water due to close proximity to water points and because NAWASSCO manages the number of tokens per meter to ensure minimal waiting time. To use the system, consumers first upload credit at NAWASSCO zone offices in the low-income settlements.

The pre-paid meter system presents strong potential for commercial viability in delivery to the low-income settlements for NAWASSCO. Collections are 100%, with no provisioning for bad debts and no write-offs. A technology platform minimizes cash handling and fraudulent activities in the field. Paperless transactions also eliminate the need to print and post water bills, thus resulting in cost savings. Furthermore, existing staff manage the meters, and no meter reading and collections follow-up is needed.

NAWASSCO had installed 91 meters. The number of token holders was 1,824, bringing the estimated number of beneficiaries to 9,120 in 8 low income areas of Nakuru. (Kaptembwe, Rhonda, Gilani, Mwariki, Lanet Hill, Kiratina, Lakeview and Pipeline). After the pilot was rolled out, 115 beneficiary households were surveyed to assess the project effect. The study focused on improvements in the ease of access, reliability and affordability of water, and provided a critical analysis of the benefits and challenges of the pre-paid meter system and customer satisfaction levels in an effort to identify lessons learned for scaling-up. Below are a few of the key findings:

- Time spent collecting water. Before the meter, 67% of beneficiaries spent 1 hour or more daily collecting water. After the meter, 92% spend less than 15 minutes.
- Meter Benefits. In ranking the meter benefits, 54% stated more convenience (time/distance), 20% said lower cost and 17% said higher availability.
- Meter complaints. 53% of respondents had no complaints about the meters. 22% complained of water rationing and 14% noted meters not working.
- Community outreach and education. 90% of respondents said they learned about the meters from NAWASSCO. 73% of respondents said they understood everything about the system. 27% said they would have liked more information on how the system worked and/or the token deposit fee required.

The survey results show that the public pre-paid meter project is of benefit to consumers. Consumers are happy with the time saved in searching for water and the reduced cost of water.

The demonstrated improvements in customer service on account of communal water prepayment motivated NAWASSCO into expanding their reticulation, knowing fully
that the benefits generated from the prepaid intervention would trickle to the other arrangements. Therefore, NAWASSCO considers prepaid meters as cutting edge and the appropriate strategy for improving coverage in low income communities, and intends to take their pilot to scale.

4.2 The Delegated Management Model

Under the Delegated Management Model, KIWASCO provides bulk water to master operators, who then assume responsibility for installing connections, conducting routine maintenance, and carrying out billings and collections downstream of their bulk meters. Master Operators are typically selected by the local communities. In this study, there were some specific modifications to the DMM which were suggested and implemented, i) district metering to align the geographic management areas to the corresponding hydraulic areas, ii) micro financing to enable consumers to pay for new connections upfront and pay through amortized billing iii) and the selection of master operators who are part of the community, known by the people to enhance acceptability of the model. These were proposed and implemented as key modifications to the DMM. The proposed changes that were adopted by KIWASCO made the subsequent results interesting.

Prior to the study and the implementation of the DMM, acceptability was at a low, and consumers were not connecting to the network. The water utility also struggled with basic operation and maintenance. The findings showed that:

- About 60% of the Kisumu population lives in low-income settlements.
- The primary sources of water for households were:
  - Water vendors 37%
  - Water kiosks 25%
  - Piped connections 13%
  - Boreholes 10%
- Although 96.2% of Kisumu respondents could access a water source within 30 minutes, 37% and 25%, respectively, complained of water rationing and dirty water.
- Households without metered connections spent an average of KES 1,056 (USD 12.88) per month on water at an average of KES 6.7 (USD 0.08) per jerry-can.
- 58% of households expressed a willingness to borrow in the future to finance water needs.

Nyamasariawas identified as a strategic population center in Kisumu without access to KIWASCO water. A total of 80 questionnaires were administered through personal interviews and four focus group discussions were held. The findings included the following:

- 60% had lived in the area for 2 or more years, more than half of these in the same house.
- 39% owned their home.
- Households spent an average of KES 823 (USD 10) per month on water and received an average of 3.16m$^3$ of water. The relationship between earnings and expense on water was statistically insignificant, indicating that people spent for water regardless of income level.
- The primary source of water for households were:
  - River 40%
  - Water vendor 25%
- 66% of Nyamasaria respondents spent 1 or more hours daily to fetch water.
- In the focus group discussions, residents expressed a willingness to be connected to a supply system that was reliable, affordable and of good quality.
- Residents indicated that a cost of KES 500 (USD 6.10) per month for water services would be acceptable and favourable to them.

The baseline study showed a high demand for paid-for water from KIWASCO as well as significant financial, time and health impacts due to the lack of a water connection. This demand was further evidenced in a two-week community education and outreach campaign carried out by the water service provider, during which more than 1,500 households registered for a connection.
In response to this high demand, KIWASCO had successfully piloted the Delegated Management Model. The DMM delegates the management of lines in low-income areas to community groups and had dramatically reduced non-revenue water rates in the pilot area from ~80% to 6%. KIWASCO had developed clear DMM guidelines for water tariffs, customer service, financial compliance, billing and collections, maintenance, internal audits and general oversight. According to the results of the key informant interviews, with the water service provider, the DMM:

- Improved system monitoring leading to reduction of Non-Revenue Water
- Supported penetration of services in low-income settlements
- Reduced the tariff to the community
- Improved health
- Created employment and enhanced business skills in the community
- Reduced staff-resident interface, hence reducing opportunity for corruption
- Reduced costs to KIWASCO
- Resulted in more timely billing and collections

By April 2013, KIWASCO had connected approximately 4,525 people at the household level (through household connections and one kiosk) and 4,450 students at schools (through seven schools). KIWASCO also connected two health clinics to water. KIWASCO had collected KES 1,150,680 (USD 14,033) in connection fees (which include a KSH 200 (USD 2.44) application fee, KSH 1,500 (USD 18.29) connection fee, and KSH 1,000 (USD 12.20) meter deposit). Below is a comparison of a few of the key findings on the effect of the DMM project:

- **Time spent collecting water.** 94.5% of beneficiaries spend less than 30 minutes per trip to collect water, compared to 40.7% previously.
- **Quality of Water.** In both studies, more than 80% of beneficiaries indicated that good water quality was the most important thing to consider when collecting water. Before the DMM, only 33.7% thought their water had an excellent smell, while 82.6% said the water tasted excellent. After the connections, 75.8% ranked the smell of the water as excellent, and 94.5% noted that the taste of the KIWASCO water was excellent.
- **Maintenance by KIWASCO.** Since KIWASCO DMM, 87.9% of households rated maintenance of the piped system by KIWASCO as excellent or good.

The survey results and beneficiary testimonies so far show that the piped connections are of benefit to consumers. Only one person did not prefer the piped connections to other sources of water.

KIWASCO is bulk selling its water to master operators who are drawn from the community. In order for the DMM to be successful, the selection of the master operator was found to be very critical. They are chosen after a very publicly advertised and competitive procedure. Only the best individual or the most deserving local firm is engaged. They do ensure that the contract is followed in detail. The contract with the utility is to bill customers, collect revenue and perform minor maintenance in their respective areas. Having paid the utility a bulk rate for consumption, master operators can retain any extra revenue. The result of this thoroughness is that the Kisumu DMM has been one of the most successful PPP’s on the continent.

Through the DMM the utility reduces administrative costs and has brought services closer to the customer. The model offers low income dwellers more options to select a level of service that they can afford and that they find convenient: individual connections, communal water points and commercial kiosks. The research found that the reason for this was that by KIWASCO reducing the new connection fee, and also arranging that it can be paid instalments through a microfinance agency which pays in full, on behalf of the customer, while KIWASCO recovers that cost in instalments through amortization in the monthly bills. As a result, up to 85% of those in Nyalenda (piloted area) opted for individual connections because of reduced connection fee from microfinance agency. On the other hand, 40% of Nyamasaria residents also connected to the KIWASCO network.

### 4.3 WASREB Rankings

At the beginning of the study, in 2011, the two water service providers, NAWASSCO and KIWASCO, were struggling to perform and the two of them were among the lowest ranked water service providers in Kenya, as ranked annually by the
Water Services Regulatory Board (WASREB). NAWASSCO was ranked 28th in 2010 and KIWASCO was ranked 32nd in the same year. This is derived from Impact, which is WASREB’s main tool for public reporting. It documents the performance of Kenya’s water services sector annually. It is meant to spur comparative competition in the sector, thus creating impetus for institutions to improve their performance. After the implementation of the Communal Prepaid Metering in Nakuru and the Delegated Management Model in Kisumu, the two water service providers are now categorized as medium to high performers, a significant improvement, which is attributed to the two interventions (WASREB, 2018). NAWASSCO is ranked #3 in 2017 and KIWASCO is ranked #2 in 2017 in 2010.

5.0 Conclusions

The introduction of prepaid metering is a good strategy for water service providers, but when dealing with peri-urban areas, where the urban poor dwell, communal prepaid metering is viable and the preferred option. On the other hand, the delegated management model with improvements is a replicable option for water service providers in increasing access of water to the peri-urban areas. In Kisumu, and this initiative has seen non-revenue water rates fall from 80% to 6%. The success of the delegated management model in Kisumu leads to the conclusion that this model is replicable in sub-Saharan Africa.

In conclusion, both models, the communal prepaid meter and the delegated management model are workable and will improve the way service is done to the urban poor dwellers in peri-urban areas.

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