

38th WEDC International Conference, Loughborough University, UK, 2015

**WATER, SANITATION AND HYGIENE SERVICES BEYOND 2015:
IMPROVING ACCESS AND SUSTAINABILITY**

Saving water in the home: investigating water conservation in Kingston and St. Andrew, Jamaica

N. Patterson (Jamaica) & S. Kayaga (UK)

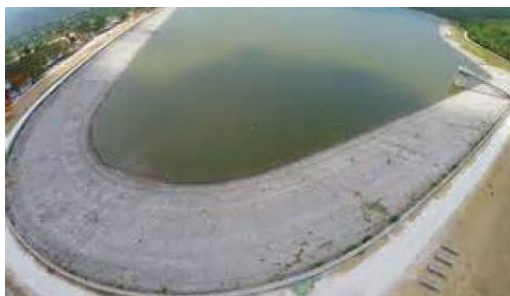
REFEREED PAPER 2150

Water supply in the city of Kingston and St. Andrew, Jamaica is under intense pressure because of increased population demand, water pollution and severe drought. A shift from the traditional supply driven approach to water demand management as a complementary tool or alternative is required to guarantee a sustainable future. Through a case study research design that incorporates semi-structured questionnaires, the water conservation behaviours and perception of 238 households in Kingston and St. Andrew, Jamaica, were assessed to determine their impact on water demand. Strategies that could be applied to improve water availability were also explored. Results indicated that water was inefficiently used, especially for bathing, washing, dishwashing and gardening. Also, residents were not objective in how they viewed themselves as water users. The paper concluded public awareness campaigns were needed to promote efficient water use. There is need to research the effect of price on water consumption.

Introduction

Many cities around the world today continue to face the challenge of providing sustainable water supplies to meet the demands stemming from rapid population growth and economic development. In the midst of this dilemma, available water quantities continue to dwindle as a result of profligate use, growing pollution, and by the major impacts of climate change such as increasing periods of drought and unpredictable variability in rainfall patterns. The problem of water scarcity is more critical in cities of developing countries as two thirds of the world's urban dwellers live in these areas (Vairavamoorthy, Gorantiwar & Pathirana, 2008). The city of Kingston and St. Andrew (KSA) in Jamaica is no exception to these challenges.

Water shortage has been a major problem in the KSA for several years as saline intrusion and nitrate contamination have depleted over 60% (104.3million m³) of its available groundwater supplies (Mandal and Haiduk, 2011). Growing population and extreme periods of droughts further compounds the water availability problem. In 2014, the city's two major storage facilities, Mona reservoir and Hermitage Dam experienced an unprecedented decline causing storage levels to fall to 37% and 21% of their capacities (Thompson, 2014).



Photograph 1. Mona Reservoir



Photograph 2. Hermitage Dam

The diminishing water quantity coupled with increasing consumption have placed mounting pressures on the major water service provider, National Water Commission (NWC) to identify solutions to secure sustainable water supplies for the KSA population. The traditional supply driven approaches conceptualized by the NWC to address water scarcity requires high capital investments and draws on the finite water resources from various sections of the island.. This approach is unsustainable and therefore other strategies and initiatives such as water demand management are needed to alleviate the pressure on freshwater supplies, and to influence demand so that sustainable use of this scarce resource can be achieved.

Research has shown that, in many countries, the marginal cost of exploiting supply-side options is usually higher than implementation of demand side options. For instance, research carried out in Alexandria, Egypt under the EU-funded SWITCH Project between 2006-2011, all the nine demand management options considered in the study (e.g. tariff reform, appliance efficiency regulation, retrofit of water devices, system leakage reduction) had lower annualized unit costs, compared to supply-side options (e.g. wastewater reuse; groundwater exploitation for green space irrigation, desalination for coastal resorts) (Kayaga and Smout, 2011; White et al, 2011).

There are several demand management strategies that could be considered to address the water scarcity problem in the KSA. These include the use of alternative water sources such as rainwater harvesting, treatment and reuse of the saline and nitrate contaminated water, also water conservation at both utility and end user levels. However the determination of the costs and benefits of these options are out of the scope of this research.

This research investigated the behaviours and perception of residential water users in the KSA to determine how water demand management (WDM) measures could be deployed to manage their water consumption..

(Sharma and Vairavamoorthy, 2009) purported that water conservation is the largest source of available water in cities and there is a growing body of evidence that it is cheaper, faster and better to increase the efficiency of water use. Therefore the implementation of technical/structural changes; awareness and public education programmes are tools that could be employed to affect the efficient use of water in the homes.

Methodology

The study adopted a case study methodology, which utilized semi structured questionnaires administered to 238 NWC customers from five communities, Brandon Hill, Temple Hall, White Hall, Papine and Cherry Gardens/Norbrook in May - October 2014. These communities were stratified into poverty quintiles (low, low-middle, middle, upper middle and upper) based on the most recent KSA Poverty Map generated in 2008 by the Planning Institute of Jamaica and the University of Technology. . The questionnaires were designed to produce data that allowed statements to be made about the KSA population water conservation practices, perceptions and knowledge and how they led to increase water consumption. It also sought to identify the socioeconomic groups where inefficient water use was widely practiced. The researcher and two NWC personnel administered the questionnaires over a five-week period. Key findings are presented in the proceeding paragraphs.

Results and discussion

The data were coded and transferred to Microsoft Excel spreadsheets where they were collated and used to create charts, graphs and tables to visually identify patterns and trends. Statistical analysis was used to analyze the data using the mode to identify its central tendency.

Domestic water conservation behaviours

Bathing

The research found that 76% of the respondents bathed by showering. Most persons had a shower twice per day that lasted between 6-10 minutes. The length of time and their shower frequency strongly indicated that the water used for showering was more than what was required for sanitary purposes. With a standard showerhead providing 2.5 gallons per minute (9.46 litres) (USEPA, 2012), a six- minute shower twice per day required at least 30 gallons or 113 litres of water. According to (Howard and Bartram, 2003) this volume could supply all the water consumption needs (including hygiene) that an individual would need per day. Therefore showering was done for leisure rather than hygiene. Such behaviour could also be due to habits or routine and such behaviours may be modified through the application of educational programmes.

Washing

With regards to the washing of clothes, the survey found that 45% of the respondents washed by hand, while the other 56% used machine only or a combination of machine and hand washing (Figure 2). On average, households that used a washing machine, washed clothes once per week and most persons washed when there was a full load of clothes. Though this was a positive sign that this water-using amenity was used efficiently, there were also signs that water conservation was needed. When combined, almost half of the population washed two or more times per week and 28% of all machine users wash with half empty loads. Water conservation was particularly needed in the upper income areas as even though water was scarce, 70% of these persons washed two or more times per week.

Dishwashing

As it relates to washing dishes, half of the population used the filled sink method to wash dishes, which is a good indicator that not much water was wasted during this process (Figure 3). However this behavior may be as a result of the water supply situation that existed during the period when the survey was carried out as the results showed that the use of running water for dishwashing was more frequent in the communities where water supply was more reliable. This was more evident in the Mid- Upper and Upper income areas as more than half of these individuals either used running water, dishwasher or other methods such as combination of a plugged sink and running water in their dishwashing chores.

Gardening

182 of the 238 respondents indicated that they had a garden and more than 80% indicated that they used drinking water all the time or sometimes in for gardening activities. This habit was widely practiced in the middle to upper income areas where gardening may be important to their lifestyle. This behaviour signifies that there is major potential for the promotion of water use efficiency and this objective can be achieved by using water of less quality, as plants do not require high quality water for sustenance.

Water saving devices

The survey found that water saving devices were not commonly utilized in the KSA as 79% of the households indicated that they did not own or were unsure if they owned a water saving device. This demonstrated that technical water demand management measures are an essential initiative that needs to be implemented in the area to foster efficient water use. A positive signal that technical measures would be feasible is that 65% of the residents who do not have a water saving device indicated that they would be willing to buy one if they were given an incentive, however some persons (35%) were unsure and unwilling purchase water saving devices. Maybe their response was due to lack of information on these products and their potential benefits. Therefore they were not motivated to make the change voluntarily.

Perception on water conservation

The success of household water demand management strategies is also dependent on how much is understood about people's perception regarding water use.

The survey found that the respondents did not have the right sense concerning conservative water use, as only a very small percentage (1.9%) admitted that they were wasteful. They did not have an objective view of themselves concerning their attitudes towards water consumption versus how they actually saved water. Water wasting behaviours such as washing dishes with running water, watering plants with drinking water, and using hose to wash cars were perceived as normal or conservative behaviour. This shows that residents need a clear definition of water conserving activities so that they can have a standard by which to judge their conduct and make adjustments accordingly. Despite these misperceptions on their water uses, 73.1% indicated that they were willing to take further steps to conserve water. The main reasons for their willingness is that they felt that this adjustment in behaviour would contribute to solving the water shortage in the area (42.5%) and that they would benefit from reduced water bills (39.8%). These findings show that WDM educational programmes that highlight reduced bills and the seriousness of the water shortage would influence their decisions to reduce water consumption.

Perception on price and awareness of water consumption

A key element of this research was to explore if the KSA residents were aware of their water consumption. It was found that 90% of the residents were unaware or not sure of their monthly water consumption. This

high level of unawareness and uncertainty signify that customers may not understand or know how their water bills are constructed; the current price they pay for water is so small that it does not prompt them to take note of their water consumption or their properties are unmetered and therefore their actual consumptions are not recorded. If persons are unaware of their water consumption it is highly unlikely that they are practicing water conservation.

Regarding their water price, 55% of the respondents thought the price of their water was expensive. This sentiment was shared by all income categories. Since majority of the population were unaware of their water consumption but yet they perceive their water bill to be expensive, there is anecdotal evidence that their water consumption may not be dependent on price. Detailed studies on the effect of price on household water consumption were outside the scope of this study.

Conclusions and recommendations

The assessment of the current water conservation practices at the domestic end use level demonstrated that water was not efficiently used in the KSA. Wasteful practices were primarily manifested in residents showering and laundry activities, which are the two highest demands for water in the home. Inefficient water use was also seen in the residents gardening practices as high quality drinking water was used to accomplish this task for which water of lesser quality could be used to achieve the same purpose. There are opportunities for the promotion of water conservation to improve the overall water use efficiency.

While wasteful water practices were observed mostly from the Low- Mid to Upper income communities, behaviour modification was primarily needed for Mid-Upper to Upper income as they were identified as the high water users. People in these categories owned more washing machines and washed more frequently than the other groups. The use of running water to wash dishes was more also prevalent among these groups.

Though the residents were not objective in the way they viewed themselves as water users, water demand management measures would gain high social acceptability if the seriousness of water scarcity is emphasized and if they were informed how water conservation activities lead to reduced bills. More than half of the population, however, thought their water was expensive. Although they had this perception it did not seem to impact on how they used water, as many were unaware of their water consumption. We proposed that further research be done to examine the extent to which price affects household consumption.

It is recommended that the NWC undertake water conservation campaigns, which adequately informs its consumers so that they will voluntarily make decisions to save water. These programmes should emphasize the current and future environmental challenges and how this and other issues such as population growth and deteriorating water quality are leading to water scarcity problems. The campaigns should also demonstrate water saving techniques while underscoring how efficient conservation practices lead to reduce water bills.

There are various cost effective means that the NWC could use to promote efficient water use which includes: The use of television and radio where the NWC could package water conservation messages in feature stories to highlight the issues surrounding the causes of water scarcity, the need for water conservation and practical demonstrations on how water saving can be achieved. These stories could be aired as a feature during the local prime time news in order to capture more listeners. Also because 50% of Jamaicans have access to the internet, social media use via instant messaging, emails, blogs and the use of pop up ads on the NWC website are potential effective instruments to promote awareness especially among the younger population who tend to waste more water.

Partnership with Jamaica Information Service (JIS), a government agency mandated to disseminate information to enhance public awareness and increase knowledge on issues of national importance could also play a role by featuring these messages as part of their public broadcast. Direct Communication with consumers using cost effective means such as the packaging of bill stuffers with customers' bills; the use of video presentations or exhibits on water conservation can be presented to students and teachers when they tour water treatment facilities. Raising awareness among children are good vehicles for promotion of water conservation as children usually share their knowledge with adults.

As the study found that the implementation of technical WDM measures would be feasible for reducing domestic water consumption, this is an option that could be considered. However, the lack of regulatory framework and inadequate information on how and where residential water is consumed along with the customers appliance stock efficiency, would limit this application in the short term. As the prospects for the installation of water saving devices is good, it is recommended that the government and the NWC undertake domestic water end use studies in the KSA to generate the required data. This would enable the development

of effective strategies and policies to reduce consumption. As domestic end use studies require high level of expertise and costly technology (Makki et al, 2013), significant support from the government would be required in terms of obtaining aid from multinational or bilateral aid institutions for financial support and expertise to facilitate this venture.

It is also recommended that the NWC undertake further studies to ascertain the costs and benefits of using alternative water sources as well as determining if the tariff being charged to customers is appropriate for water conservation.

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Contact details

Nadine Patterson
Clark's Town, Trelawny, Jamaica W.I.
Tel: (876) -360-9653
Fax: (876) -940-2735
Email: nadine.patterson@nwc.com.jm

Sam Kayaga
WEDC, School of Civil and Building Engineering,
Loughborough University
Email: s.m.kayaga@lboro.ac.uk
www: <http://wedc.lboro.ac.uk>
