

39th WEDC International Conference, Kumasi, Ghana, 2016

**ENSURING AVAILABILITY AND SUSTAINABLE MANAGEMENT
OF WATER AND SANITATION FOR ALL**

**Linking water pricing with users conservation behaviour
in selected households in Lahore, Pakistan**

N. Fazal (Pakistan) & K. Sansom (UK)

BRIEFING PAPER 2553

Research was conducted to assess users' information, knowledge, attitude and practice in the usage of water and its conservation in Lahore and suggest appropriate options for policy makers to change the tariff structure and introduce water conservation programs. The present research is a preliminary effort to do so and uses mixed methods approach including; survey method (questionnaires, interviews), direct observations of households and case study and semi structured interviews to know the perspective of Water and Sanitation Agency (WASA) staff. The results show users waste a lot of water in various activities in daily life due to under pricing of water, lack of awareness and incentive for water conservation. Metering for all, rising block tariffs and awareness raising for water conservation is proposed.

Introduction and background

Pakistan lacks groundwater regulation, there is no law to protect ground water and there are huge challenges faced in managing the groundwater particularly depletion due to over pumping and poor governance (Bhutta et al., 2006). Due to poorly planned groundwater abstraction, the water table has been lowered in many areas which has resulted in increased pumping costs. Drinking water supply is predominantly based on groundwater while 35% of the demand for agriculture is also met by groundwater in Pakistan (ibid). Lahore is a mega city with a population of approximately 10 million which is totally dependent on groundwater and suffering from the issue of depleting water table due to massive pumping versus recharge (Mahmood et al., 2013). There is a strong possibility that the situation of groundwater will become much worse in the coming times due to excessive pumping (McIntosh, 2003). Groundwater meets about 50% of the potable water requirements and around 80% of domestic demand in Pakistan, while Lahore is totally dependent on groundwater for drinking and domestic purposes (Mahmood et al., 2013:123). Findings of many research studies have reported various issues due to misuse and degradation of ground water including bad governance and low tariffs (ibid). International research on efficient water prices and cost recovery of water supply in the developing nations suggests that price is a successful ultimate tool for managing the water demand (Wasike & Hanley, 1998). Water metering is successfully used to promote water conservation culture among the communities whereby water supply is charged on a volumetric basis just as it is done in case of other utilities (Qureshi et al, 2014). Currently, there is no law on domestic water conservation in Pakistan. There are no water restrictions of any sort on the use and abstraction of groundwater for domestic, industrial or agricultural uses which result in non-judicious and non-inclusive distribution and supply of water. There is no monitoring and control mechanism on the quantity and purpose of water use. WASA has just a rough estimation of per capita water supply and usage.

Research methodology

The present study investigates the water usage patterns, awareness, attitude and knowledge of individuals in households in Lahore, Pakistan about the importance of water conservation and finds the link of price with water wastages and recommends volumetric pricing with rising block tariff by the utility. The main aims of the study were to:

1. Assess users' information, knowledge, attitude and practices in the usage of water and its conservation in Lahore, as well as review the feasibility of introducing utility financial measures to encourage the conservation of water, such as volumetric water charging and rising block tariffs.
2. Explore the unknown facts about the prevalent users' behavior about water conservation at household level and measures taken, if any, to minimize the water wastage; and
3. Suggest most appropriate options for policy makers to change the tariff structure and introduce the water education and conservation programs.

Mixed methods approach was used for data collection including; document review, survey (questionnaire and interviews) and direct observations to collect data from households while for collecting perspective of WASA, document review, case study and semi-structured interviews were used. Random sampling was done in five different zones of WASA in every zone 10 households were selected for the survey and interviews. Households were selected at different locations in Lahore city with willingness to participate in the study on the basis of meter type, education level and plot size. Surveys of 50 households were conducted while observations of 10 households were made. While for semi-structured interviews of WASA staff total 5 officers were interviewed including top management. For collecting data survey questionnaire was designed. The responses of the collected data were put in excel spreadsheet for compiling and analyzing the data. While limitations of the research included; shortage of time, resources, likely errors in the reported information by the respondents and reluctance in sharing water bills.

Water services in Lahore

Domestic water is mainly supplied by Lahore WASA to the users at 204 l/p/d through 491 tube wells (WASA, 2014:33) in Lahore city. WASA supplies water to about 78% households in its serving areas in most urban parts of city (Allama Iqbal Town, Aziz Bhatti Town, Ganj Baksh Town, Nishtar Town and Ravi Town) while in non serving areas (Cantonment, Model Town, Defence and various private housing schemes) it supplies to 50% homes and the rest of the 50% get water from other sources; private water suppliers (societies etc), Public Health and Engineering Department (PHED), hand pumps, standposts or direct pumping using small suction motor or pumps (Qureshi et al 2014) (Rauf & Siddiqi, 2008). Over the years groundwater management has become a worsening problem in Lahore due challenges faced by WASA including:

- Low and unrevised tariff due to political resistance since 2004 (WASA, 2014)
- Lack of volumetric tariff which does not encourage efficient use
- Malfunctioning of water meters- only 8% meters are presently working
- Weak system for billing and collection
- High unaccounted for water (45%) due to unauthorized connections and transfer losses (Urban Unit, 2014:21)
- Lowering of water table at the rate of 1m /year due to over pumping and misuse (WASA, 2014)
- Poor financial performance and huge gap between operational income & expenditures (WASA, 2014).

There are total 634,664 water connections in Lahore by WASA, 32% are unmetered, 68% are metered and 62% include domestic connections (WASA, 2014: 69).

Two types of tariffs exists:

1. Flat rate (unmetered) based on plot size, annual rental value of property or ferule size.
2. Metered-on actual water usage. For homes with faulty meters flat rate is applicable (WASA:2014:69).

Total domestic water usage in Lahore is about 3.79 million cubic meters (MCM) per day and 1,384 MCM/year (Qureshi et al 2014:15). Average water consumption per households is 54m³/month. Water production cost incurred by WASA is USD 0.63 /m³ and USD 3.47 per connection, besides other heavy costs like staff salaries, electricity for water pumping, O & M etc. While average revenue WASA receives per connection is USD 2.74/month. Financial performance of WASA is inadequate due to the huge gap between income and expenditure.

Results and discussion

Direct observations

Direct observations were made for half day each at 10 households and their water consumption was observed. It was found that people leave the tap open for almost 80% of their activities (laundry, dish washings, cleaning of teeth, bathing, hand washing, washing bike/car etc) and use it when required basis for 20% of chores. It was found that majority of the households consider water a gift of God and a free good which nature has granted them and there should be no check and balance over its usage. An important aspect of this identified behaviour is the utilization of services of servants, as at the majority of homes housewives do not perform various water related chores and servants work who do not bother about the importance of water or its conservation because of being illiterate and lack of information about water source, scarcity, importance or depletion. The house owners do not observe closely or say to the servants to use less water while performing various tasks. When servants were asked questions why they use lot of water their answer was to complete the task in short period of time.

Survey questionnaire

Survey Question 1: To what extent people are aware of water scarcity and importance of water conservation. Is it a factor contributing to water inefficient behavior at the household level"? The data was collected through surveys and the summary of responses are given in Table 1.

Indicators	(Responses %)	(Responses %)
Ground water as finite/infinite resource	Finite (62%)	Infinite (38%)
Knowledge about water scarcity	Know (54%)	Don't know (46%)
Basic knowledge about water conservation	Yes (24%)	No (76%)
Perception that some water is wasted daily	Yes (68%)	No (32%)

The results show that significant number of households are not aware of water scarcity, its importance and conservation which results in their wasteful use of water in various ways. A great number of users think that water is an infinite resource. However majority of respondents accepted that they waste some amount of water but they do not know about conservation. They have no information about basic water things.

Survey Question 2: "What are current users' behaviors in relation to water usage and conservation at household level? The data was collected through surveys and the summary of responses is given in Table 2.

Activities performed by HH for water use	Methods %	Methods %
Bathing	Shower (72%)	Bucket (28%)
Shaving	Open tap (54%)	Mug (22%)
Tooth brush	Open tap (82%)	Mug (18%)
Dish washing	Open tap (50%)	As required (40%)
Cloth washing	Open tap (56%)	As required (44%)
Food preparation	Open tap (42%)	As required (58%)
Hand washing	Open tap (74%)	As required (26%)

Toilet flushing	Always use WC (66%)	Only when defecate (34%)
Gardening	Open tap (42%)	Sprinkler (22%)
Overflow prevention device installed on roof tank*	Yes (58%)	No device (34%)

The survey results show that majority of the activities performed by users are done with open tap instead of using water containers. This wastes significant amount of water; shaving, toothbrush and hand washing are the activities in which due to carelessness lot of water gets wasted. Toilet flushing every time using the water closet also wastes significant amount of water. Large amount of water gets wasted due to lack of over flow prevention devices at 34% of households which is alarming. It was also found that majority of the people are not aware that they are using water imprudently and they could avoid easily through modifying their behaviour or taking small measures which could make a difference in saving significant amount of water.

No significant difference was found in the water consumption pattern, behaviour or attitude of both types of households during surveys (questionnaire and interviews) and direct observations methods in terms of:

- Water use while performing various activities in the households;
- Water wastage;
- Information or knowledge of respondents about water conservation and methods.

Survey Question 3: "What is the average volumes of water consumed per month for different types of households from WASA's records and in actual practice"?

WASA record showed that average water consumption per connection was 54m³/month. In the survey it was found that volume of water was not mentioned on the bills of households paying flat rate and for those paying volumetric rate majority of the meters were unfunctional and in reality they were paying flat rate as well. Whereas some of the households having working meters did not agree to show their bills. While sole volunteer household who shared the bill water, consumption was 447L for two months which was considered to be due a faulty meter and the total amount paid to WASA by that household for one year water supply and sewerage services was equivalent to 35 US dollars.

The results show that households have little or no incentive to use water efficiently due to under pricing of water and non-functional meters; there is no driving force for households to use water sustainably than the ones who are paying flat rate. Prevalence of flat rate instead of volumetric tariff for all is an important reason of careless water behaviour. The only incentive for 38% households who are conscious about water conservation is to save on electricity because of high price of electricity to reduce the pumping cost of water for storing in their above ground storage tank. Otherwise, they are not conscious about the water saving while the rest of the 62% even do not feel attracted to use less water even to save on energy.

A finding of the survey shows that the majority of the respondents perceive the present price of water low (26%) or medium (70%). In addition, 60% of respondents are willing to pay on the basis of meter reading and 38% even showed willingness to pay on the basis of rising block tariff (RBT). Sixty six (66) % think that water should be charged on volumetric basis and majority (62%) consider that their water consumption will significantly reduce if you will have to pay per litre of water usage while 30% thought likely minor changes in their water consumption. 62% respondents thought that they can reduce 20% of their water daily water consumption easily with small efforts/modification in the lifestyle.

Lahore WASA staff were asked to share their views about what type of water tariff structure options would be appropriate for Lahore to encourage water conservation, to be more affordable to low income users, and enable better cost recovery? Semi structured interviews were conducted with WASA staff and it was learnt that: Volumetric tariff is appropriate for: water conservation good cost recovery for WASA and equally affordable for poor households

Survey question 4: "How could volumetric based water tariffs be implemented effectively at Lahore WASA"?

It was learnt through semi structured interviews of WASA staff that by taking following measures volumetric tariff can be successfully implemented in Lahore city.

- Political support and uptake of the issue
- Water conservation legislation

- Donor financing for initial investment
- Institutional arrangements required for volumetric tariff would include:
 - Introduction of auto meter reading concept and isolation of distribution network zones
 - Setting of system for reduction of non-revenue water (NRW);
 - Isolation of distribution network zones;
 - Installation of flow meters at tube wells and inlets points
 - Water flow meters at the inlet points of every zone Training and capacity building of WASA staff
- Installing modern meters (that cannot be tampered) at consumer's connection
- Out sourcing of meter reading & bills distribution
- Penalties for meter tampering for users/ WASA staff
- Intensive awareness raising campaign about water conservation

This suggests that the Lahore WASA staff are aware of what is required to enable better water conservation.



Photograph 1. Servant washing the house with pipe

Source: Nosheen Fazal



Photograph 2. Servant washing with pipe and a window glass at a home

Source: Nosheen Fazal

Conclusions and recommendations

Poor water tariff, lack of incentives for water conservation and mismanagement of water distribution by Lahore WASA (high non-revenue water, non-functional meters etc) are the factors responsible for inefficient water usage. There is also a strong need to address the sheer lack of knowledge and awareness of the water users and community on the need of water conservation and replacing their wasteful habits with more responsible lifestyle so that vulnerability of groundwater resource to further scarcity and depletion may be stopped or even reversed. Findings of the study are consistent with many other earlier studies which suggest that price is the "ultimate tool" for managing demand of water (Wasike and Hanley, 1998) and metering for conservation (Qureshi, et al 2014).

There are other utilities in the developing world also face similar problems. A multi-pronged approach is needed to address such water resource challenges and enhance cost recovery; these include:

1. Adequate financial and legal autonomy of the water utility is necessary to enable them to decide and implement water pricing without undue political interference.
2. Installation of good quality water meters to promote conservation of water amongst the consumers and increase cost recovery.
3. Introduction of effective groundwater monitoring and regulation of abstractions.
4. Carefully planned awareness raising amongst the consumers to promote increased water conservation, including the provision of overflow prevention devices at each property.
5. Effective volumetric pricing based on meter readings is a key solution to control wasteful water withdrawal practices and generate revenues for the water utility. The use of Rising Block Tariffs (RBT)

will encourage conservation, while also being more equitable. This is because those using less water will pay for their water at a lower tariff rate compared to consumers who use larger quantities of water.

6. Tariffs would also need to be increased as services improve, moving towards cost reflective tariffs.

Providing good evidence to support policy changes will be necessary, so further studies on water demand management in Lahore and elsewhere are recommended.

Acknowledgements

Special thanks to households for participating in surveys, interviews and allowing to make observations of their activities and officers of WASA for sharing their views.

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Contact details

Kevin Sansom is Lecturer and Project Manager at WEDC. Nosheen Fazal works as Deputy Director at PIDA, Lahore, Pakistan

Nosheen Fazal, Deputy Director
Punjab Irrigation Department, Lahore
Pakistan, n.fazal-07@student.lboro.ac.uk

Kevin Sansom, Lecturer
WEDC, Loughborough University, UK
K.R.Sansom@lboro.ac.uk