

Awareness of Water Wastage and Attitude towards Water Conservation in a domestic setting in Dhaka, Bangladesh

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Abstract— Dhaka the capital of Bangladesh is a mega city with a population of about 16 million. It is predicted to be the second largest city of the world by the year 2015. Such exponential growth adds tremendous pressure on the city's renewable but finite water resources for domestic consumption. Domestic water supply is primarily sourced from ground water whose levels are decreasing rapidly. Deep aquifers are becoming progressively infringed, making sustainable water resources development a challenging task.

This paper aims to analyze the general awareness level and attitude towards water conservation in Dhaka households. A single cross-sectional study was undertaken on 105 households particularly focusing on the housewife since she is responsible for teaching family members and domestic helps regarding water conservation. The study delves into the main reasons of water wastage, the role they would like to play in aiding water conservation, motivations behind water conservation and the willingness to change lifestyle to reduce wastage of water. Results indicated that individuals are influenced to save water out of concern for future generation and through habits of other groups. The study is pertinent in understanding psychological factors and designing campaigns to promote the cause of water conservation in Dhaka.

Keywords- Water Consumption, Awareness, Attitude, Conservation, Domestic Setting

I. BACKGROUND AND MOTIVATION

One of the most pressing issues of the world today is the conservation and preservation of natural resources. With the combined effects of a growing population and increased water consumption, management of existing resources has become a critical issue for water management authorities worldwide (Gregory & Di Lio 2003: 1262). Although the technical and economic success of the 21st century has enhanced standards of living, simultaneously it has also placed a heavy burden on our natural environment (Iyer & Kashyap 2007: 32). The emerging scarcity of water is pertinent in discussions related to sustainability of the present form of economic development, sustained water supply, equity and social justice, water

financing, pricing, governance and management (Shaban & Sharma 2007: 2190). The escalating demand on potable water resources resulting from increasing populations, droughts and unpredictable weather patterns due to climate change is commonplace in many parts of the world (Willis et. al. 2011: 1996). Experts predict that one of the main environmental challenges faced by humanity in the 21st century is the problem of scarcity and poor quality of water for human consumption (Corral-Verdugo et. al. 2002: 247).

Given the grave situation regarding scarcity of pure drinking water, water conservation and water consumption patterns are issues that gained importance. Unfortunately, research shows that although climate change is a key consumer issue with 59% of consumers worldwide, this is not reflected in consumer behavior (Rettie et. al. 2013: 9).

The above discussion holds serious implications for Dhaka, the capital city of Bangladesh. It is a mega city with a population of about 16 million and growing at an annual rate of around 5%, one of the highest amongst the Asian cities. The United Nations predicts that by 2015, Dhaka's population will exceed that of Mexico city, Beijing or Shanghai. Such a growth rate adds tremendous pressure on the city's renewable but finite water resources for domestic consumption. On one hand, its ground water level is decreasing rapidly whilst the recharge zone of the deep aquifers that supplies 80% of the city's safe drinking water, is becoming progressively encroached. The combined effect of this is making sustainable water resources development an extremely challenging task (Hossain et al. 2013: 2). Though Dhaka is surrounded by rivers, surface water withdrawal from adjacent rivers is not a viable option for this city because of high levels of industrial pollution from unregulated waste disposal (Hossain et al. 2013: 2). The exponentially growing population puts immense pressure on the existing water supply system resulting in substantial annual deficits. Dhaka Water Supply and Sewerage Authority (DWASA) is primarily responsible for providing water to about 90% of Dhaka Metropolitan Area (DMA). The total water demand for Dhaka has increased from 150 million liter (ML) in 1963 to 1760 ML in 2003 resulting in deficits to increase from 30ML in 1963 to 260 ML in 2003 (Hossain & Bahauddin 2013: 41).

Due to unplanned urbanization the recharge area of the city is decreasing significantly with time. It is observed that the water level is declining at the rate of about 2 to 3 m per year depending on the locations (Hossain & Bahauddin 2013: 41). In summer, scarcity of water is acute at many places of Dhaka city. It is worsened due to frequent load shedding and fall in groundwater level. Water shortage in Dhaka will be a key issue for its sustainable development in the future (Khatun & Amin 2011: 427).

This acute scarcity of water is reported in leading dailies and covered on national media on a regular basis. However, general observation shows that, despite the grave impending effects, mass people are still not reacting to the implications until and unless they are directly affected. Shifting residents to sustainable water consumption practices requires the installation of awareness, understanding and appreciation of the environment of water (Willis et. al. 2011: 1997). Since most of the studies conducted on this issue focused more on the institutional side, we wanted to know the level of awareness on water scarcity in common households. As household water consumption is a key factor in determining overall water consumption, we decided to focus on water consumption in the kitchen, a key component of household water consumption. In doing so, we decided to study the level of awareness and attitude towards water conservation amongst housewives, who run the household, particularly activities pertaining to the kitchen.

II. OBJECTIVES OF THE STUDY

The primary objective of the study is to gauge the attitude towards water conservation amongst housewives, who are mainly responsible for overlooking household water consumption. We felt it was an important area to begin with because, determining motives for saving water are key elements in designing educational urban water saving strategies (Willis et. al. 2011: 1996). However, as research shows that attitude towards water use are poor predictors of actual water consumption (Gregory & Di Lio 2003: 1282), we also tried to look into other factors that may have impact on water consumption. There are a wide variety of such factors including level of involvement, price of water and the perceived role of self and society in the conservation process.

The other objective of the study is to find out what were the main causes of water wastage in a household and from the respondents' perspective, how this wastage could be reduced. Through this, we intended to find out how willing the respondents' are in bringing about changes in their lifestyle, for water conservation.

III. METHODOLOGY

A. Procedures and Participants

The study was divided into two parts, starting with an initial exploratory study followed by the final study. In the initial exploratory study, we conducted personal in-depth interviews of 10 housewives belonging to the middle class

segment of Dhaka city. We used our personal contacts to reach out to the interviewees. The interviews were unstructured and our main objective was to gain insights into their general level of awareness regarding monthly water bill, source of water, number of family members, and their overall attitude towards water conservation. On the other hand, we also arranged interviews with advertising agencies dealing with social awareness campaigns. Our research assistant conducted in-depth interviews with two representatives from two leading advertising agencies, who have experience in designing social awareness campaigns. The findings suggested that one of the most challenging tasks in such campaigns was to make people change their behavior. Based on the responses, we developed a questionnaire with both open and closed ended questions. The questionnaire was translated into Bangla for ease of communication with the target interviewees. The Language Department of North South University was involved in the translation process to keep the context of the questions intact. The questions covered basic demographic information, overall awareness level regarding water supply and scarcity, level of involvement in water conservation, main reasons behind water wastage in the domestic setting, attitude towards water conservation, motivations behind reducing water wastage and the willingness to bring changes in lifestyle for reducing water wastage.

B. Data Collection

The questionnaire was distributed to 105 students of North South University, who volunteered to gather data from their respective mothers/aunts/sisters, who were in charge of running a household. The students were given clear instructions in class, regarding how they should pose the questions, and detailed explanation of the likert scale used. An audio instruction was also posted in a class website, with clear instructions in English and Bangla for reference purpose. The data was tabulated and entered into a spreadsheet by research assistants, and analyzed using SPSS and Minitab.

C. Findings

i. Findings from in depth interviews

Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads- the template will do that for you.

As mentioned before, we interviewed ten female head of the households to gain insight into their ideas and attitudes about the usage and wastage of water in the household. We found that none of the respondents had any idea about the monthly cost of water supply, and some of them believed that the monthly cost was fixed. This is not true and the water supply company in Dhaka city does not have a fixed rate scheme. Being homemakers, the respondents did not have their own income and all the bills were paid by their husbands. This

contributes to their lack of knowledge regarding the cost of water supply.

Bangladesh is a riverine country with more than 700 rivers flowing through it¹ and long monsoon seasons. Therefore, the respondents mistakenly believe that the water supply they get at home comes from the rivers. This is not so, since most of the water comes from underground sources that are depleting fast. In the end, their motivation for water consumption comes from ethical reasons or leaving behind more resources for the future generation. However, their husbands were more inclined to conserve water due to economic reasons.

All the interviewees had children and domestic maids at home. They mentioned that these two groups are more likely to waste water due to lack of understanding and education. They are willing to guide these groups to conserve water, however, they were unwilling to change their lifestyle for the sake of conserving water. The general consensus seems to be that lifestyle is more important than conservation.

ii. Findings from the Quantitative Study

The main study was conducted upon 105 housewives residing in various parts of Dhaka. The reason we are targeting housewives for this study is because, previous studies show that females generally display a higher level of environmental concern as well as exercise a higher degree of participation across a wide range of environment oriented consumer practices. Research gives substantial evidence of prominence to females when assessing green consumerism. The stereotypical female role as a local 'caretaker' extends to the protective attitude towards environment (Gronhoj & Olander 2007: 220). Also, Women consume significantly more water than men, not because they are wasteful but as the result of higher level of involvement in chores that require water consumption (i.e. washing dishes, watering plants) and activities traditionally seen as "women duties"(Corral-Verdugo et al. 2002: 255). As an intervening factor on water consumption behavior, the consumers' level of involvement can affect his or her everyday water usage activities, and higher involvement would result in lower consumption (Gregory & Di Lio 2003: 1266). However, in our study we found that there was not a very high level of involvement with water usage.

We found that 61% of the respondents did not know their water bill. Likewise, 43% of the respondents said that their water bills are fixed. As mentioned earlier, the water supply company does not provide any fixed amount subscriptions. On investigating, we discovered that many property owners / landlords charge a fixed amount to each tenant and this is a part

¹ [ref: link: http://www.banglapedia.org/HT/R_0265.htm see bottom of page] MAH Khan, 'Environmental aspects of surface water development projects in Bangladesh' in AA Rahman et al ed, Environment and Development in Bangladesh, Vol 2, University Press Ltd, Dhaka, 1990; Haroun Er Rashid, Geography of Bangladesh, University Press Ltd, Dhaka, 1991.]

of what they term as "service charge", covering security, waste disposal fees and water bill for the apartment. Therefore, the respondents do not see any seasonal or behavior based fluctuations on their water bill. Once again, we find that the majority of population do not know the source of the water supply with only 19% correctly stating that the water comes from underground sources. This information and with other demographic information is given below in Table 1.

Table 1: Awareness regarding water bill and source

Variable	Categories	%
Awareness of bill amount	Aware	39.05
	Unaware	60.95
Bill amount	Fixed	42.86
	Variable	57.14
Perceived source of water	Rivers	20.95
	Underground	19.05
	Others / don't know	60.00
Running hot water at home	Yes	45.71
	No	54.29

The impact of gender differences in environmental concern and action between family members on the consumption pattern of a household is a largely unexplored area (Gronhoj & Olander 2007: 218). Hence, we wanted to find out in our surveyed households, who were responsible in inculcating more environmentally friendly behavior. The findings indicate that 64% of water conservation steps are taken by the female head of household, while 69% of the responsibility of communicating water conservation steps to other family members is also fulfilled by the female household. This makes them an important segment to target and design social messages to. Table 2 shows the higher involvement of women in this sector.

Table 2: Women's Role in Water Conservation

More serious about water conservation	Husband	36.19
	Self	63.81
Likely to teach children and family about water conservation	Husband	31.43
	Self	68.57

Households in Bangladesh typically have a large number of members. They have one or more domestic aids who are typically female (from now on referred to as "housemaids"). The number of times laundry was done in a household varied between 5 to 6 times a day, making it quite high. This is possible because despite the presence of washing machines, a lot of clothing is hand washed by the housemaids. This information is given below in Table 3.

Table 3: Household members and water consumption

Variable	Mean	SD	95% CI (lower)	95% CI (upper)
Number of family members in the household	5.13	1.897	4.766	5.500
Number of housemaids	1.66	0.7804	1.5156	1.8177
Monthly expenditure on housemaids (in BDT ²)	3797	2191	3373	4221
Laundry per week	5.514	2.489	5.033	5.996

We looked into the overall attitude towards the idea of water conservation. We measured the responses in a Likert scale with score 1 being least important and score 5 being most important. Due to the erratic supply of water, the respondents correctly understand the scarcity of water in the city. However, the respondents blame distribution as much as usage for causing this shortage. They believe that their role is a little more than the government's role and their personal initiatives will be explored later. The responses are summarized in a Table 4 below.

Table 4: Perception towards Scarcity of Water

Variable	Mean	SD
Dhaka city is facing a scarcity of water	4.29	0.79
Human actions is influencing water availability	3.94	1.14
Knowledge of impending water crisis for future generation	3.85	1.03
Own role is significant compared to government role	3.46	1.30
Distribution is not the problem, rather usage	3.01	1.20
Overall knowledge level of the issue	3.71	0.68

We tried to determine the respondents' perceptions about what causes water wastage in the household. The primary reason for water wastage as per the respondents is the carelessness of the housemaids. Having a servant is a culturally accepted state of being in Bangladesh. Most families, starting from the lower middle class, hire a maid as soon as they are able to afford one. The three most common domains of housework are cooking, cleaning and looking after children (Khalil & Kabir 2014: 55). Since these individuals come from generally poor family background with low level of education, it is unlikely for them to understand the repercussions of water wastage. The next important reasons for water wastage are keeping the taps running while washing dishes and laundry. This is not surprising as previous research shows that different

methods of washing and doing laundry makes the control of water use highly dependent on the individual. For example those washing dishes by hand may have different methods, such as pre-rinsing, rinsing and piling of dishes under running water and each one would have a different level of water consumption. These differences become very important when attempting to encourage households to reduce water usage within the home (Randolph & Troy 2008: 445). Amongst the lesser important reasons were children wasting water, since they do not understand the implications. The least important factor as seen by the respondents is the lifestyle and luxury they are used to. However, this is actually an important source of water consumption. Culturally, we are used to using many different types of cooking pots, utensils and serving dishes when serving our meals. Additionally, serving food to the guest is also an elaborate cultural affair and results in a lot of washing. However, from our survey, it seems that people are not willing to acknowledge this and therefore changing this pattern is likely to be difficult. This is in line with previous research which shows that many green practices involve more than one family member (who may suggest, support, question or oppose). Since influencing individuals is a challenge, influencing the family is likely to be a greater challenge when several family members need to agree on changing firmly established consumption habits (Gronhoj 2006: 492). The responses are shown in Table 5.

Table 5: Common Reasons for Water Wastage

Variable	Mean	SD
Maids being careless about using water	4.40	0.71
Keeping taps running unnecessarily while doing laundry	4.20	0.80
Keeping taps running unnecessarily while washing dishes	4.13	0.84
Unattended children wasting water	3.99	0.70
The lifestyle and luxury we are used to (e.g. using many different types of utensils and crockery)	3.61	0.91

The need for consumer-citizen participation in the development of more sustainable consumption patterns has been emphasized in the last decades (Gronhoj 2006: 492). For this reason, we asked the respondents a set of questions regarding their perception of personal effort on conserving water. The strongest consensus was in the fact that they believe water wastage is a serious issue for the environment. They also agreed that they should continuously monitor and identify the causes of water wastage in their household. The belief that changes in lifestyle would help in reducing water wastage ranked third in this category. This is in line with the fact that most people do not consider lifestyle as a major contributing factor in water wastage as found in the previous section. Willingness to work towards reducing water wastage ranked even lower and the lowest ranking came to steps already taken to conserve water. The findings indicate that although most people are aware of the severity or repercussions of water wastage and also the fact that they should take some action, they have not taken any active steps to conserve water and are still unwilling to change their lifestyle patterns for the same. This reinstates previous studies which show that, while

² 1 USD = 80 BDT (approximately)

environmental awareness is a necessary condition for environmental action, it does not appear to be sufficient. Awareness of such issues does not lead to environmentally conscious behavior (Gregory & Di Lio 2003: 1264).

Table 6: Willingness to Make Changes

Variable	Mean	SD
Water wastage is a serious issue for the environment	4.31	0.72
I should continuously monitor and identify what is causing water wastage in my household	4.24	0.53
If I can make some changes in my lifestyle and household I will be able to save a significant amount of water	4.22	0.73
I'm willing to work towards reducing water wastage	4.06	0.68
So far I already have taken several steps to conserve water	3.53	0.87

In studying environmentally friendly behavior, economists have focused on the role of incentives, particularly monetary incentives, whereas social psychologists looked at altruism or guilt to influence such behavior. This has resulted in a wide and disparate array of factors without any comprehensive model predicting such factors (Easwar & Kashyap 2007: 33). Motives for saving water are among those significant predictors. Some people save water because it's a valuable resource, for cooperation with a conservation campaign, for paying less for the consumed resources, as well as for punishment (i.e. fines) for excessive water consumption. In general, literature shows that, the more motives a person has for saving water, the most he conserves this resource (Corral-Verdugo et. al. 2002: 248).

We tried to find out factors which our respondents believed would motivate them in conserving water and reduce wasteful consumption. The highest ranking was given to social conservation, which means, most people would be motivated to conserve water if they observed their reference groups engaging in similar action. This is an important indication because, past studies show that, at times, individual consumers cannot readily adopt waste reduction behavior and certain strategies are only feasible if implemented collectively (Bekin et al. 2007: 281). The second motivating factor is if they see that the future generation would have access to much less water, followed by an appeal to provide water to those who cannot afford water, since it is wasted by those who can. This shows that the respondents are influenced by emotions and guilt regarding water conservation. The lesser important motivating factors were restrictions on the amount of water to be used and the cost of water. This again shows that, for our sample, monetary incentives were less effective than guilt and emotions. The pricing of water was initially predicted to influence consumption but the belief has been recently dispelled (Willis et. al. 2011: 1997). Part of the reason for this could be the fact that as a nation we are more emotional. Also, previous studies show that, if water users are unaware of the amount of water they are using, pricing controls become meaningless (Randolph & Troy 2008: 447). People are

unaware of their usage because, as already identified, water consumption is still a matter of low involvement. 42% of our sample pays a fixed bill, which automatically reduces their interest in the amount of water used. Research demonstrates that in most cases, residential water is mostly price inelastic because of its low relative cost to other life essentials (Willis et. al. 2011: 1997).

Table 7: Incentives for Saving Water

Variable	Mean	SD
If your neighbors, friends and family are trying to conserve water	4.14	0.69
If you see that the future generation and your children will have access to much less water than what you got	4.03	0.79
An appeal to provide water for those who can't afford it as it is wasted by those who can	3.99	0.87
If the government puts restriction on the amount of water you can spend	3.41	1.06
If government increases the cost of water significantly	3.19	1.21

With regards to specific steps that the respondents may be willing to take, we see that they are quite enthusiastic about communicating with children and other family members regarding water conservation. They are also interested to teach their housemaids about small steps that can be taken to reduce water wastage. However, as already mentioned earlier, it seems that the target market is unwilling to bring about changes in lifestyle to help this issue. This matches our previous findings of the reluctance in the change of lifestyle for conserving water.

The respondents do agree that, they have tried to reinforce 'greener' behavior on the maids by asking them to switch off lights and fans when not in use, and believe that, training the maids can be an important source of water conservation. This is because, although the housewives are responsible for the overall supervision of housework, the main water consuming activities of the kitchen, like washing food items and dishes, and cleaning of the kitchen is generally done by the housemaids.

Table 7: Willingness to Change

Variable	Mean	SD
Communicate more with children and family members about reducing water wastage	4.41	0.57
Try to teach maids about water conservation	4.12	0.65
Change the way dishes are washed and learn a new method.	3.54	0.92
Change the way clothes are washed and learn a new method.	3.53	0.82
Serve food on the table on cooking dishes and not serving dishes	3.02	1.12

IV. CROSS TABULATION AND CHI-SQUARE TESTS

We ran several chi-square test on pairs of variables like awareness of bill with availability of washing machines. We found no meaningful associations.

A. Two-Sample tests and Correlations

We tried to find statistically significant difference in the mean scores for overall awareness of the issue of water wastage, based on groups. The groups were defined as those who owned and did not own washing machines and those who were aware and not aware of their water bills. Two-sample T test comparing means did not result in any statistically significant conclusions.

Some weak correlations were found between pairs of variable. Once again, the main variable of interest was the overall awareness of the issue. We found that those who had higher scores in the overall awareness were more likely to take initiatives to conserve water.

Variable	Correlation with overall awareness score (significant at 95%)
Water wastage is a serious issue for the environment	0.217
I should continuously monitor and identify what is causing water wastage in my household	0.275
If I can make some changes in my lifestyle and household I will be able to save a significant amount of water	0.299
I'm willing to work towards reducing water wastage	0.203

We also wanted to measure if there are any correlations between the attractiveness of a type of motivation with overall awareness of the issue. Increased awareness is weakly correlated with favorable attitudes towards appealing to those who cannot access water and influence of peer group. However, we found weak negative correlation with the fear of rising water costs, indicating that those who are more concerned about the issue are likely to react negatively if the government increases the cost of water.

Variable	Correlation with overall awareness score (significant at 95%)
a. An appeal to provide water for those who can't afford it as it is wasted by those who can	0.251
b. If your neighbors, friends and family are trying to conserve water	0.276
c. If government increases the cost of water significantly	-0.245

There was an expected strong correlation between the mean score of believing that housemaids can be trained to conserve

water with the mean score of personal experience of bringing about change in housemaids' behavior previously. The correlation value was 0.626, significant at 99%.

B. One-Way ANOVA

As a continuation of attempting to group our respondents by the level of awareness, we used one way ANOVA for overall awareness, with the factor being how often they cooked. Our respondents were in one of 4 groups, namely those who cooked several times a day, once a day several days a week and once a week. We found that overall awareness did vary by these groups, with statistically significant differences in mean level of awareness between the group who cooked several times a day and the group that cooked once a week. This indicates that people who cook more often are likely to have less awareness about water wastage issues as opposed to those who cook less often. The ANOVA output is given below.

One-way ANOVA: average awareness score versus cooking type

Source	DF	SS	MS	F	P
cooking_type	3	4.524	1.508	3.49	0.019
Error		101	43.698	0.433	
Total		104	48.222		

S = 0.6578 R-Sq = 9.38% R-Sq(adj) = 6.69%

Individual 95% CIs For Mean Based on Pooled StDev

Cooking type	N	Mean	StDev	-----+-----
Multiple daily	29	3.4759	0.7395	(----- -*-----)
Once a day	21	3.7429	0.4781	(----- -*-----)
Multiple weekly	29	3.6483	0.7438	(-- -----*-----)
Weekly	26	4.0385	0.5769	(-----*-----)
		3.30	3.60	-----+-----
		4.20		

V. CONCLUSION

The findings are important for many reasons. Firstly, we realize that, since water consumption is a habitual behavior, it does not require much cognition to make everyday decisions. The level of involvement in water conservation is likely to be heightened when conservation becomes personally relevant (Gregory & Di Lio 2003: 1266). Therefore, although awareness about scarcity of water is high, campaigns need to be designed to show how exactly everyone is going to get effected by this.

Our in-depth interviews with two leading advertising agencies fortunately gave us insights on social messages for

two distinct groups, the urban population and the rural population. We learnt that, for the urban population, messages regarding changing behavior always face the greatest resistance. The challenge is getting people off that inertia, invade into their system and modify it. As audiences, they love messages with stories relevant to them. Therefore, emotional and moral appeals are likely to work with this segment.

On the other hand, since we have identified from our study that the domestic helps can play a significant role in this conservation, we need to understand the best way to communicate with them. The biggest challenge for communicating with this target market is their lack of education. As per our experts, this segment does not understand the importance of long term thinking over short term benefits. The message has to have some element of drama to catch their attention but at the same time, also needs to communicate specific information which they will understand. Since this segment is usually good with numbers and symbols (Malhotra & Mangrulkar, 2001 pp. 56), clearly specifying the amount of water wasted and how it would actually benefit saving that water is likely to work for them.

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