

SMART LIFE STYLES AND ARCHITECTURE FOR SUSTAINABLE WATER MANAGEMENT; PERSPECTIVE FROM A DEVELOPING COUNTRY

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Abstract

Purpose of the study: This study aims to evaluate smart lifestyles, especially in the context of washroom planning, to attain water conservation for sustainable development. Water is one of the essentials of life as we can not imagine our lives without water, so it is the primary need of the day to conserve as much water as we can. It is the harsh reality that water is being wasted without realizing its significance. This study aims to challenge the conventional ways of consuming water in our day-to-day life and aims to bring changes in how we can conserve and preserves this important natural resource.

Methodology: To get a clear insight into water conservation as well as its preservation, a survey was conducted at the 45 housing units of Apex Residency PCSIR II Lahore Pakistan which represents the middle class of our society. Interviewed were conducted from different age groups of each family. Water consumed per day by each member was estimated and further compared with water consumption to get a fair idea if they had been using smart lifestyles or not.

This study has made an attempt to consider modifications in three basic things; brushing, taking shower and washing hands and face. The data analysis was performed using SPSS ver.22

Main Findings: It was found that 156 liters of water per person is being used in just three activities in a day out of which 46 litres of water per person can be saved daily. However, it is very important to make a plan as to how to preserve it.

Applications of the study: local administration of Lahore should devise a local plan for viable water frugality. Smart washroom fixtures are a must while planning smart washrooms.

The novelty of the study: This study assessed and evaluated our local population at large and eventually facilitated us with local results, which truly represent how we deal with this important natural resource. We as a **Nation** need to discuss and analyse all these points in detail and should try to modernize our lifestyles to preserve as much water as we can in our day-to-day life.

Keywords: Water, Water Wastage, Brushing, Showering, Washing Face and Hands.

INTRODUCTION

Life without water is impossible. Preserve water. Preserve life.

One of World Water Day's slogans for saving water this year (March 2022) is "Groundwater, making the invisible visible." This is the most powerful slogan ever so if we don't learn to conserve water we will all be fish out of water. As water is the basic necessity for life and this ecosystem ([Arpke, 2006](#)) this highly valuable resource is becoming scarce due to which we have started to face water crisis in different parts of the world ([Distefano, 2017](#)). The reasons resulting in water shortage include; increasing population, depleting glacier resources, pollution of ground and surface water, global warming and the resultant changes in water cycle ([Beal, 2013](#)). The most important of these factors is the water wastage which can be managed. You never know the worth of water until the well runs dry. Nobel laureate Rick Smalley describes water shortage as the second most serious issue after the energy problem, which is threatening human survival in the coming 50 years ([Webber, 2016](#)). The water will be scarce and polluted and there will be serious problems with sanitation ([Zhang, 2020](#)). Almost one-fourth of the world population does not have access to safe clean drinking water according to World Health Organization ([Dong, 2013](#)); ([Mueller, 2012](#)).

Different freshwater resources are distributed unevenly in the world ([Sato, 2013](#)). More than 4 billion people live in regions where the scarcity of freshwater is threatening the biodiversity of the ecosystem and the security of humans ([Kılıç, 2020](#)). In the developing world, access to clean, fresh and safe water is a luxury which everyone cannot afford. Those without proper sanitation facilities are around 2.7 billion ([Shah, 2012](#)). The developing and the developed countries both are facing this problem but the magnitude is high in the developing world. The developed countries which are facing this issue to a lesser extent have the infrastructure, resources and political will to tackle this issue ([He, 2020](#)). However, the developing countries which are the most affected, lack the infrastructure, political will and financial capital to implement changes in water purification, distribution, and extraction facilities. In a nutshell, those who need to seriously implement changes lack the capacity while those with resources only need a little to do. Those who die annually of water-borne diseases are 3.4 million out of which 99 percent live in developing countries ([Hasan, 2019](#)).

Pakistan is an agricultural country. It enjoys an interesting geographical location in South Asia with an area of 796095 cubic kilometres and is the seventh largest country in the world according to population ([Jamil, 2019](#)). Glaciers in the North, annual Monsoon rains and the Indus irrigation system had been the backbone of agriculture for centuries in this region ([Qureshi, 2019](#)). However, the rapid increase of population in this region during the last century and urbanization

has resulted in the gradual depletion of this resource (Laghari, 2012). For generations, we never thought that one day we will have a shortage of water. Our habits, lifestyles and culture do not consider water conservation. Our irrigation system also wastes a lot of water. In Pakistan, agriculture is the backbone of its economy. So to us, the implications of water shortage are multifold. When Pakistan got its independence, at that time for each citizen of Pakistan, 5000 cubic meters of water was available, which has declined to the level of 1000 cubic meters. (Ishaque, 2017). Due to the lack of surface water, we have started the exploitation of the groundwater, the level of which has also started to go down (Khalid, 2020).

Types of water usage: Water can be used in a consumptive or non-consumptive manner. In consumptive usage, the water is utilized and is not available for re-use. This includes a portion of the water used for irrigation; for example, when the plants are watered, the water is absorbed by the roots, transpired then taken to all the parts of the plants and then accumulates in the form of biomass. Thus, water that is once consumed is not available for reuse. In non-consumptive usage, the water is again available but of low quality. It can be used for some other purpose, treated and re- consumed or is considered as waste. The domestic wastewater; could be collected and treated to remove the pathogens and after that, it is seen that such water could be used for portable and non-portable purposes. The largest non-consumptive use of the water is in the municipal and industrial supply. The consumptive use of water is for agricultural purposes mostly. The different functions of water have been explained in figure 1.

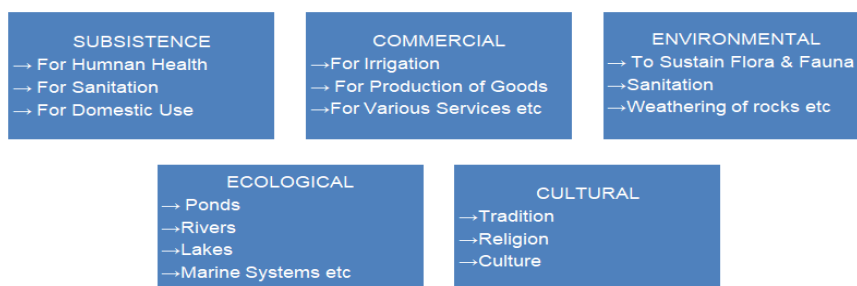


Figure 1: Different Functions of Water

Water consumption at home

Water is consumed at homes in performing different chores. The average family consisting of four members consumes 300 to 400 gallons of water. Bathroom followed by kitchen are the main places of water consumption.

COMMON AREAS OF WATER WASTAGE

Following are the most common areas where people waste water without realizing it:

- Teeth Brushing
- Showering
- Hand and Face Washing
- Flushing Toilets
- Washing Dishes
- Washing Clothes
- Watering Lawns
- Through Leakage

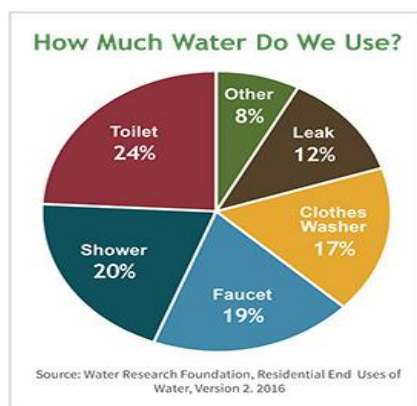


Figure 2: Water Research Foundation, Residential End Uses of Water, Version 2.2016_ Figure 2

Figure 2 given by Water Research Foundation depicts the daily water consumption. Mostly water is consumed in the toilet and after that water is used for taking bath. 13.7% of the water is leaked through the different pipes. 15.7% is wasted in faucets, 21.7% is used in washing clothes and 5.3% of water is utilized for other purposes ([Mayer, 1999](#)).

RATIONALE

Simple changes in our lifestyle can result in water conservation. Historically life in South Asia had always been comfortable with an abundance of water. Our habits and architectural behaviors have evolved without giving much value to water. In this study, this traditional way of life has been challenged.

OBJECTIVES

- To study water management in Apex Residency PCSIR II, Lahore Pakistan.
- To determine water wasted in these three basic activities of life
 1. Teeth Brushing
 2. Showering
 3. Hand and Face Washing
- To determine the quantity of water that can be saved by a smart lifestyle.

MATERIALS AND METHODS

This study has been conducted on Apex homes which is a 4 Marla housing scheme located in Lahore representing the middle class of our city. It consists of 45 houses and each house is 2 storeys and in more than 20% of the houses 2 families are residing. The water supply of these houses is through a water turbine which is turned on 4 times daily and water is stored in the fibre water tanks at the roof of each house, then the water reaches the taps through gravity. The turbine supplying water is run by 6 horsepower motor. It draws water from a depth of 450 feet through its 9 inches diameter pipe. The turbine draws water at the rate of 132 GPM according to its manual however when the main supply to the houses was turned off and the water was allowed to come out through the alternate valve and collected into the tank.

Water collected in the tank in 10 secs was found to be 22 gallons.

- **Water flow = 22 Gallons per 10 secs**
- **Water flow in 1 min=132 GPM**
- **Average time turbine is turned on= 80 min**
- **Total production per day= 80 x 132= 10560 Gallons**

Then going through the record register of the turbine which is maintained by the turbine operator it was found that it is turned on for 80 min per day. The total population of the housing scheme was determined by surveying each house and was found to be 225. Thus, determining the water consumption of this society per capita by the formula

--- Water consumption per capita = Total production/total population

= 10560/225

= 47 gallons or 213 liters approx.

The minimum water consumption recommended by UN is 50L and maximum is 100 L per day per person ([Gleick, 1996](#)).

I tried to figure out the areas of water wastage of this society and took three parameters

- 1) Teeth Brushing
- 2) Showering and Bathing
- 3) Hand and Face Washing

These parameters were taken on the ground that these waters saving measures can be taken by simple changes in our lifestyles and the minimum budget required to implement changes. At the same time, these changes require no alterations in infrastructure.

The survey was conducted, going to each house in the housing society and one resident was interviewed per house according to the questionnaire. During the survey in one of the houses, a man who brushed his teeth with a tap on was asked to brush his teeth while water usage was calculated by measuring the output. In the same house, the lady was asked to brush her teeth with a tap on only when required and the water usage was measured. The water consumption was calculated by putting the wash basin drainage pipe into the tub and thus calculated. In another house, a person was asked to wash hands and face with the tap continuously on and another person from the same house was asked to turn on the tap only when required and the water draining was measured by putting the wash basin drainage pipe into a tub and thus

calculated. In another house, the shower was left open for 10 min and water used was measured and thus calculated the amount of water lost.

Thus the water consumed in these three basic activities of life was calculated both using smart ways (usage of water by minimum water wastage by keeping the tap off during different activities) and the conventional way (usage of water with a lot of water wastage by keeping the tap on in different activities).

- **Water consumption conventional lifestyle = 81 L**
- **Brushing teeth with a tap on = 8 L**
- **Washing hands and Face with a tap on = 13 L**
- **Shower 10 min = 60 L (6 litres per min)**
- **Water consumption smart lifestyle = 35 Liter**
- **Brushing with a tap on only when using = 2 L**
- **Washing hand and face with a tap on only when using = 3 L**
- **Bathing with two 15 litre tubs = 30 L**
- **Water that can be saved using smart ways in just 3 activities of life = 46 L**

RESULTS

A total of 45 individuals were interviewed one from each house. Everyone in society is pleased with the quantity of water being supplied. None of the houses is equipped with modern high-efficiency water fixtures. The details of brushing habits are provided in Tables 1 and 2. Most individuals brush their teeth twice daily and leave the tap open, thereby maximizing water wastage. Hand and face washing details in Tables 3 and 4 show that most people leave the tap on. The water consumption is high as most individuals like to take shower instead of taking bath as explained in Table 5.

Table 1: Teeth brushing per day

Number	Frequency	Percent
1.00	14	31.1
2.00	26	57.8
3.00	5	11.1
Total	45	100.0

Table 2: Teeth brushing with tap on / of

Number	Frequency	Percent
on	31	68.9
off	14	31.1
Total	45	100.0

Table 3: Hand and face washing per day

Number	Frequency	Percent
2.00	2	4.4
3.00	14	31.1
4.00	7	15.6
5.00	11	24.4
6.00	6	13.3
7.00	5	11.1
Total	45	100.0

Table 4: Hand and face washing with a tap on / off

Number	Frequency	Percent
On	41	91.1
off	4	8.9
Total	45	100.0

Table 5: Showering/bathing

Number	Frequency	Percent
shower	31	68.9
bath	14	31.1
Total	45	100.0

- Actual water consumption by 45 persons (in these 3 activities) determined using this questionnaire=7013 L
- Actual water consumption (in these 3 activities) per capita =156 L
- Actual total consumption for 225 (in these three activities) persons = 35100 L
- Water that can be saved per capita had these people been using smart lifestyle = 40 L

DISCUSSION

Water is an important resource (Zhang, 2020). Researchers in the city of Lahore are lucky to have a good supply of water. In city of Lahore have underground water which people are using without realizing its importance. Our water resources are not unlimited and already the underground water level is going down. What we have today may not be available to our upcoming generations and they will have no option but to blame us. Even many areas of Pakistan have started facing major shortages of water (Hussain, 2020). It's better to act now. It's time for us to realize the importance of water. Our government and analysts need to formulate a water policy at the national level but at the same time, we just cannot get away from putting all the responsibility on our government. We also have a responsibility to conserve water. Other areas of water wastage also need to be addressed but the researcher chose these three parameters as these require no changes in infrastructure and no added finances. Based on these findings Researchers have summarized the results of this research in easy language and have shared these with the residents. The researcher found many of the ladies in the society were very much interested and eager to know the results. This eagerness to gain knowledge is a positive sign and shows how people are motivated to bring small changes in their lives. If the whole nation is ready to make small changes in their lifestyles, it can mean a bright future for our upcoming generations.

CONCLUSION

This study concludes that the water is being mismanaged in Lahore, Pakistan. In PCSIR phase 2 apex homes most of the residents are using water without realizing the importance of water conservation. By making simple changes in our lifestyles we can save a lot of water for our upcoming generations.

Following recommendations can be made based on these findings

- 1) While washing hands turn on the tap only when required
- 2) While brushing teeth turn on the tap only when required
- 3) Take bath using the tub

LIMITATIONS AND SUGGESTIONS FOR FUTURE WORK

This study evaluates how small changes in our lifestyles can conserve water. The main advantage of this study is that it provides us with our local data and values with local implications. However, the results of this study can not be applied to a national level. This study only evaluates three aspects of water usage. So it is recommended that a national multicentre study may be conducted evaluating other aspects of water usage as well.

CONFLICT OF INTEREST

There is no conflict of interest.

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