

## EXPLORATION OF DOMESTIC WATER DEMAND ATTITUDES AND BEHAVIOURS USING AN ONLINE SURVEY IN ATHENS, GREECE

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### ABSTRACT

The urban water system's sustainable evolution requires tools that can analyse and simulate the complete cycle including both physical and cultural environments. One of the main challenges is to understand the society's water demand behaviour and the way policy measures affect it. The effects of these policy measures are a function of personal opinions that subsequently lead to the formation of people's attitudes. These attitudes will eventually form behaviours.

An online survey was developed that aims in gathering information regarding the domestic water attitudes and behaviours of urban households. The online survey was addressed in Athens' residents and requested information regarding the environmental consciousness and the attitudes regarding water conservation. Additionally, the respondents were asked to identify the water appliances they use in their household and the number of times they use each appliance per day. Finally, the respondents were asked to identify the number of times that they were going to use each of their household water appliances if they were aiming to a low or high water conservation level.

This work presents the design and the analysis of the results of the online questionnaire. It presents conclusions derived about the attitude of Athenian households towards water conservation. Finally, this work proposes focal points that decision makers might want to concentrate their efforts so as to increase the effects of water demand management measures.

**Keywords:** domestic water demand behaviour, online survey, water conservation attitudes, water demand management

### 1. Introduction

Urban water systems are increasingly pressurised by climatic conditions, population change, resource limitations and ageing infrastructure (Ferguson *et al.*, 2011). Even though globally freshwater resources are not yet scarce, their unequal distribution may create sources of tension between different social groups within a river basin (Pahl-Wostl *et al.*, 2010). The uncertainty regarding whether attitudes and intentions to conserve water lead to actual sustained water conservation and savings (Russell and Fielding, 2010) creates a need to utilise social sciences in the exploration of the decision making process.

Domestic water demand is made up of different water uses that may be divided into two separate categories: those for covering everyday basic needs (or non-discretionary) and those for covering discretionary uses (Willis *et al.* 2011). The shift towards non-materialistic needs (Inglehart, 2008) has made many basic water needs to include a large discretionary component, such as showering or bathing for relaxing and not for sanitation purposes (Willis *et al.*, 2011).

Household water demand is intrinsically linked to the water demand behaviour. Questionnaires may provide information regarding the use of the water technologies of a household. In addition, it is possible to include questions that ask information regarding water use habits. However, one must take into consideration that answers to such questions might be biased and unrepresentative of the true water use (who counts how many times they use the toilet? etc.).

Household diaries might work better, nevertheless it has been identified that households' perception on water use is highly mismatched (Beal *et al.*, 2011). However, a solution could lie upon smart metering, where new technology smart meters gather information regarding the frequency, volume and time of use of all the water using technologies of a household.

This work presents the design and the analysis of the results of an online questionnaire that was created to gather quantitative data of water demand attitudes and behaviour from Athenian households. Significant conclusions are derived regarding the attitude of Athenian households towards water conservation and thus the opportunity of decreasing household water demand by targeting water aware households. This paper is divided in three parts, firstly the questionnaire design is presented, then the results of the online survey are given and finally interesting conclusions are discussed. Finally, this work proposes the focus of policies so as to increase the effects of water demand management measures.

## **2. Questionnaire design**

The investigation of behavioural patterns may employ quantitative methods for social psychology research such as questionnaires that allow the gathering of personal opinion data (Wisker, 2007). A quantitative socio-psychological research of Athenian water users was held during 2013 so as to gather data regarding water demand behaviour and environmental and water conservation attitudes.

The questionnaire used the New Ecological Paradigm (NEP) scale, designed by Dunlap *et al.* (2000) for measuring environmental attitudes. This method consists of 15 questions that cover five dimensions of environmental issues: reality of limits to growth (1,6,11); anti-anthropocentrism (2,7,12); fragility of nature's balance (3,8,13); rejection of exemptionism (4,9,14); and possibility of ecocrisis (5,10,15) (see Figure 1). Respondents are offered five answer options from Strongly agree (2) to Strongly disagree (-2) to indicate their level of agreement. The sum of the responses indicates the total NEP score. Based on previous studies (Aronson *et al.*, 2005) mean NEP score is 53.3, with a higher score indicating a pro-environmental behaviour.

Furthermore, questions regarding the environmental concern were added as a good predictor of pro-environmental behaviour (Dolnicar *et al.*, 2011). In addition, the attitude towards water conservation was estimated using questions such as "I shouldn't conserve water if the rest of my community overuses" and "Water conservation is necessary because of water scarcity" (Dolnicar *et al.*, 2011). Respondents were offered five answer options from Strongly agree (5) to Strongly disagree (1) to indicate their level of agreement. The questions were divided into two categories: those that the strongly one agrees with, the more positive is towards water conservation (4, 7, 8, 12) and those that the strongly one disagrees with, the more positive is towards water conservation.

Moreover, the questionnaire included questions regarding the water billing period (monthly, bimonthly, quarterly etc) and the water bill in terms of water (cubic meters) and euros charged. Additionally, the respondents were requested to identify the water using appliances and amenities that their house has by selecting them from a list. Subsequently, the respondents were asked to select the frequency of use of the appliances and amenities of their household and the frequencies of use of them if they were aiming at a low or high water conservation. These questions were included in an effort to identify the percentage change of the appliances' frequency of use for different levels of water conservation. Furthermore, water saving behaviour (Gilig and Barr, 2006) was investigated using questions that required the identification of water saving behaviours that the respondents were undertaking. Finally, the respondents were asked to identify the degree of influence from various sources regarding water use behaviour. The questionnaire concluded by requesting a number of socio-demographic characteristics.

## **3. Online survey's results**

The online survey's main aim was to extract specific information regarding the water demand behaviour of households in Athens. It was decided to gather such information using an online

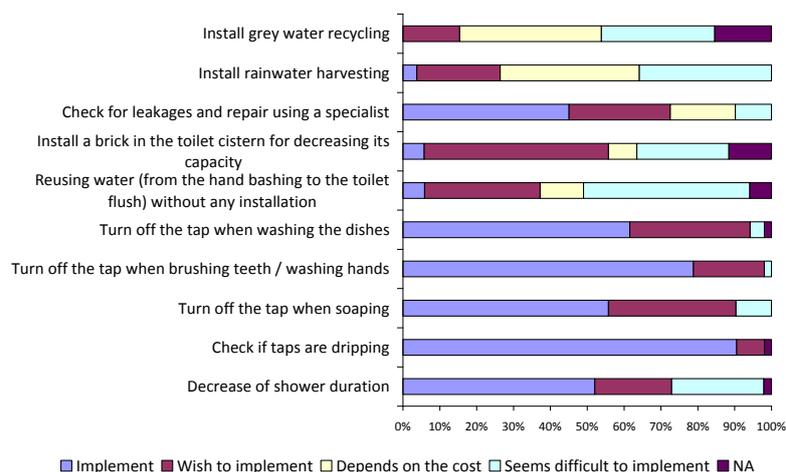
survey since the time needed for completing the questionnaire was high (more than 30 min) making it almost impossible to use other means, such as phone or door to door, for answering the questionnaire.

The online survey was addressed to people that lived in Athens. The online questionnaire was published using the free online survey tool Survey Expression and a notification was sent using social media and email services to about 100 people living in Athens, out of which 88 filled out the questionnaire. From those that responded, 61 (70%) completed the entire questionnaire. 77% of the respondents were aged between 18-34 years old. The majority of was single (60%), had a high educational background (92%), lived in households with 2 or more members (77%), owned their house (65%) and lived in an apartment building (89%).

The majority of the participants consume less than 40 cubic meters of water and pay less than 40 euros per 3 months of water use. Regarding environmental issues, the majority of the people indicated that they feel somewhat worried about the state of the environment, feel that they have an average environmental conscience and that they are somewhat informed regarding the state of the environment. In addition, only 11% of the sample scored as environmentalists, receiving a score of more than 53.3 in the New Ecological Paradigm question. The majority of the people that answered the survey (54%) scored as medium to high environmental consciousness in the New Ecological Paradigm scale.

The majority of the respondents reported that they had a high interest about water resources conservation, water scarcity reduction and willing to invest in water saving appliances. Nevertheless, the majority of the installed appliances are not water efficient and therefore water conservation behaviour is mainly owed to the frequency of use of the appliances. The survey showed that people are willing to decrease the frequency of use of the toilet flush, hand basin, kitchen sink and watering the plants so as to conserve water but not the frequency of use of the washing machine, dish washer and shower.

The answers regarding certain behaviours that Athenian households do, so as to conserve water pinpointed that people are not willing to implement alternative technologies so as to decrease their water use because they feel that it is either expensive or difficult. Nevertheless, the participants have shown that they believe they act in a water saving way by turning off taps whenever they do not use water (Figure 1).



**Figure 1:** Potential household actions to conserve water

#### 4. Discussion

The socio-demographic analysis showed that the sample included mainly young, single and highly educated respondents. This was expected since the questionnaire was distributed using social media and email. Nevertheless, the analysis of the answers presents some very interesting conclusions that are presented in the following paragraphs.

More than 25% have no idea about how much water they consume while only 5% are ignorant about the amount of money they pay for water. This realisation could be attributed in the fact that people do not really care about the amount of water they use and focus on their actual everyday actions and their cost in terms of water.

In addition, when the answers of the water conservation attitude measurement were combined, a 30% of the sample was identified with having a positive opinion towards water conservation. This is also strengthened by the fact that 70% of those scored with above average environmental consciousness had a negative opinion towards water conservation. Nonetheless, those with above average environmental consciousness still had in general a more positive opinion towards water conservation than the rest of the sample.

One interesting fact is that Athenians do not choose to decrease the frequency of use in the high consuming water uses of showering and clothes and dish washing. This may be attributed to the fact that Athenians have a high self-image in terms of environmental protection and water saving thus making them believe that they are already "doing their best" (Gerakopoulou and Makropoulos, 2014).

In 2012, another quantitative social research using online questionnaires was implemented by the Mediterranean SOS Network NGO that was focused on 11 Greek cities (Attiki, Volos, Ioannina, Heraklion, Thessaloniki, Kalamata, Kozani, Lamia, Xanthi, Patras and Rhodes). The questionnaire was filled by 1600 citizens, with 40% (479) living in the Attika region. The main findings of that survey were that people are not well informed regarding the origin of the water they use in their household, the amount of water that is consumed by their in-house appliances and the total amount of water they consume (MEDSOS, 2012). These results are in accordance with the results of the presented online survey.

## **5. Conclusions**

The focus of the online questionnaire was to gather information regarding the water demand attitudes and behaviours in Athens, Greece. In addition, the online questionnaire aimed at identifying the public's perceptions regarding water conservation and its connection with their every day behaviours.

One of the main challenges, of water demand management, is to understand the society's water demand behaviour and the way policy measures affect it. The effects of these policy measures are a function of personal opinions that subsequently lead to the formation of people's attitudes. These attitudes will eventually form behaviours. The results of the online survey identified, that policy makers may try to concentrate their efforts, in raising the awareness regarding the amount of water used by the different water appliances, their importance and the water saving potential.

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