Participatory Approach in Domestic Water Demand Management

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Abstract: Water is an important resource for all people, but it is a scarce resource. For this reason, the people should come together with the government to manage this resource. With public participation, perception can be changed and this can lead to a change in attitude. Public participation is also important in that policymakers can get valuable feedback that they can use to make more informed decisions and to promote public acceptance. This study focuses on assessing the level of the consumers' participation in water demand management and to estimate their willingness to participate in water demand management. The study also focuses on determining the different socioeconomic factors associated with their willingness to participate in water demand management. A standard questionnaire is formulated in a structured manner and filled by a representative stratified sample of 600 households in the Greater Amman area. The willingness to participate in water demand management was analyzed using the Probit model and Chi^2 test was used to tests the statistical significance of the cross tabulations. The results show that the majority of the interviewed consumers were willing to participate in demand management and prefer more direct forms of participation. The results also show that the willingness of the interviewed consumers was dependant mainly on their age and average income. The respondants are more responsive to penalties rather than rewards when it comes to taking measures aimed at reducing water consumption. When making policies, the policymakers should take into consideration the measures the consumers are more responsive to. More studies on consumer's responses and preferences should be conducted.

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Introduction

The problem of water shortage is a direct result of the increase in urbanization, industrialization, a relatively high population growth rate which stands at about 2.2%, and by the present population of 5.85 million which is expected to reach 8 million by the year 2025. This means in the future there will be even more pressure on the limited water resources especially in the urban areas of Greater Amman (DOS, 2009, Phillips *et. al.*, 2009). Batarseh (2006) stated that, "Increasing water scarcity is a major problem in many parts of the world today and Jordan is experiencing a severe water shortage that made it one of the most water deprived countries in the world."

All surface water systems are not enough for Jordan's demand. Mohsen, (2007) stated that, "These three major surface water systems had all become undependable, due to the upstream diversion and over-pumping by Syria and Israel leaving Jordan with the rest, as in the case of the Jordan and Yarmouk Rivers. On the other hand, the Zarqa River system has been severely affected by water pollution from industries in the Amman – Zarqa area that includes 70% of Jordan's small to medium sized industries."

Groundwater is also not an option if Jordan is going to be prosperous. Ground water in the country is of two types. It is either renewable or non-renewable. Non-renewable ground water, or fossil basins, consists of more than one groundwater aquifer system. The main aquifer systems in the country are Amman Wadi el Sir, Ram, and Basalt aquifer – they make up 80% of Jordan's known groundwater. The annual safe yield for these aquifers is about 275 MCM and this is clearly not enough for the country.

The water shortage is proving to be very expensive and it has had an impact on the Jordanian economy. Iskandarani (2001) stated that, "...because of this rationing program, people are usually forced to invest in water tanks and buy additional water from private vendors for example at high prices sometimes in order to satisfy their water needs and improve the water supply reliability."

The country will face a crisis if something is not done to solve the water problem. Salman and Al–Karablieh (2006) stated that, "The living standards had

increased in Jordan during the second half of the 20th century, raising the per capita consumption of water to the current per capita use of 86 L/day which is among the lowest in the world." For this reason, the gap between water supply and demand threatens to widen significantly. By the year 2025, if the current trends continue, the per capita water supply will fall from the current 144 L/day per person to only 64 L/day, putting Jordan in the category of having absolute water shortage (MWI, 2007).

Over the years, water demand in Jordan has been satisfied mainly through supply management practices, however, no single action can overcome the water shortage in the country. Different actions are necessary to increase the overall water availability since options for developing new water resources are very limited. For this reason, they need to come up with new solutions was vital and demand side oriented management options were considered as a way to address the water problem in the country. One approach is to focus on reducing water demand by adopting different water conserving programs and improving water use efficiency. Another strategy is to use water pricing policy (Abu-Taleb, 2000; Al–Karablieh *et al*., 2006). Accordingly, the government's attempts to deal with water scarcity problem in Jordan had shifted from utterly focusing on supply management to demand management measures, especially after the establishment of Water Demand Management Unit by the Ministry of Water and Irrigation by the end of 2002. The main purpose of this unit was to undertake the responsibility of water demand management programs for all sectors in Jordan and to increase water use efficiency in and among industrial, municipal, and agricultural sectors while maintaining the social and economic benefits of water use.

Demand management is an objective-oriented approach aimed at reducing or modifying the timing or level of demand for fresh water to match it with available supplies level and to achieve a more efficient and cost-effective water use so as to ultimately have a more sustainable water resource management. Demand management programs are designed to promote conservation either through changes to the stock of resource using equipment or changes in consumer behavior. Behavior change in consumers can be promoted via education campaigns or through economic instruments such as pricing. White and Fane (2002) stated that, "A number of water demand management strategies exist and they can be broadly classified into water demand reduction strategies such as capacity building and educational or raising awareness campaigns and supply rationalization strategies such as water allocation and rationing."

Mechanisms of water demand management include; economic incentives like pricing or charges for water use and subsidies or rebates for more efficient water use that can involve either replacing water using equipment with more efficient types or through finding and repairing leaks in the existing distribution system, promotion of water saving devices, water rationing, technological upgrading and rehabilitation, improvements of distribution networks, and public education and regulations to increase public understanding of water policies to obtain behavior change in the general public towards water conserving behavior. Demand side management also includes the institutional arrangements regarding the water sector, which have a significant influence on allocations and consumption patterns. Al-Zu'bi and Al-Kharabsheh (2003) stated that, "The core of water demand management is demand reduction in urban and agricultural use of water without sacrificing quality of life and national growth and sustainability."

The major water demand management activity considered by the Jordanian government is water tariffs. This is the main financial instruments used to control water demand which had been increased in the past two years to recover operational and maintenance costs. Other water management activities by the Jordanian government are new building codes that have water saving futures and customs exemptions on water saving devices as a way of encouraging the use of water saving technologies primarily within institutions such as hotels so as to reduce water demand along with water conservation and public awareness programs (MWI, 2002).

Different projects have been initiated to enhance existing water supplies and services; one of the major projects is the rehabilitation of Greater Amman Water Distribution Network to reduce leakage. A combination of water pricing and regulatory measures also has been instituted to influence water demand, along with the development of water management infrastructure and the investment in water loss reduction programs covering Amman and the Northern Governorates. Another water demand management tools used in Jordan is carrying out public awareness programs. This is primarily a means of informing and educating water users about the seriousness of the water situation in Jordan since there is a general lack of understanding about the value and scarcity of water resources. Besides, any significant changes in water conservation or protection methods will require public support and participation.

This kind of programs can be used as a substitution for the other previously mentioned water demand methods which may be less acceptable to the general public. The Jordanian government believes that the public awareness program is a successful way of

reinforcing positive efforts and modifying undesirable behavior. The government believes that by supporting this program, the MWI can better achieve the Government's objectives in the water sector through the direct involvement of the people. It should be noted that along with the increasing the awareness of the general public, it is also important to increase the understanding of water conservation issues in Jordan among policymakers and the private sector (MWI, 2002).

The water users, as well as the general public who may affect and be affected by water management decisions, should be part of the decision making process. Public preferences and trends should be included and taken into account in analyzing alternatives and their economic effects. Decisions have to be based on public choices in order to minimize resentment. The public must have a choice in decisions of significant impact such as water conservation. Kolokytha *et al*., (2002) stated that, "The better the suppliers understand their consumers the more effectively they will be able to communicate with them."

However, the increased reliance on demand side management policies to manage existing water supplies is creating an extensive debate that focuses on both the effectiveness of alternative policy instruments in increasing efficiency and their equity implications for residential users. Some support higher residential water prices as a means of reducing demand (Scott *et al.* 2003), others argue that non–price policies constitute the only viable means to reduce residential demand (Salman *et al*., 2008, Al–Karablieh *et al*., 2006). But adopting demand side management approach have some benefits over using supply side management since using demand side approach reduce, and sometimes avoid, infrastructure costs which usually accompanies the establishment of new water supply projects through the downsizing of construction or upgrade of dams, treatment plants and pipelines and it also leads to the reduction in operating costs (Al-Zu'bi and Al-Kharabsheh, 2003). Nevertheless, it should be noted that supply and demand oriented instruments should not be used against each other. In each measure we may find economically and environmentally sound instrument. So in order to have a water management plan in Jordan, both supply and demand oriented measures should be taken into consideration.

This study is aimed at assessing the level of the consumers' participation in water demand management and in estimating their willingness to participate in water demand management. The study is also aimed at determining the different socioeconomic factors associated with their willingness to participate in water demand management.

The value of interaction cannot be overemphasized. Pröpper and Steenbeek (1998) stated that, "There should be an 'Interactive Ladder of Governance'", and they draw six parallel style of governance and role of participant according to an increasing degree of interactions between decision-maker and the participants (either targeted stakeholders or the public).

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Reich (1985) stated that, 'There are two traditions in modern politics to public decision making: (i) the administrator is an analyst which according to the rational-actor theory, bases public policy decisions on a maximisation of net-benefits (these are obviously value-laden and this point is not extended here), or (ii) the administrator acts as an inter-group mediator which according to the pluralist democracy theory bases public policy decision on arbitration between interest-groups.'

Pröpper and Steenbeek (1998) stated that, 'There should be an 'Interactive Ladder of Governance'', and they draw six parallel style of governance and role of participant according to an increasing degree of interactions between decision-maker and the participants (either targeted stakeholders or the public).

However, Rittle & Webber (1973) propose to characterise public's participation as a wicked process because there is no definite formulation of what participation is: a communication process like giving out information, or gathering people's opinion, or about sharing power in defining the problem, making a decision or implementing a policy. There are no stopping rules to indicate when participation stops; it can be one-off even short or long, or continuous involvement. A proposed type of participation is not right or wrong but good or bad in addressing the contextual needs (normative assessment). There is no ultimate test to evaluate the efficiency of participation (the output and/or the process); there is no consensual, comprehensive set of potential solutions. Various stakeholders will have differing view on acceptable or appropriate type of participation; the plethora of participative exercise and methods illustrate the diversity of potentialities. The details of the participative process will be the results of social interactions between engaged actors. Every situation is essentially unique so that there are no classes of solutions that can be readily and a priori applied to a specific case. Participation is issue and stakeholders

specific. The quality and quantity of social interactions between the several layers of administration (local to national) and between stakeholders are changing so that the level of organisation within a society affects communication flow, interests commitment and empowerment.

Al–Karablieh et al. (2006) stated that, 'the main problem that faces the water policymakers and water utility managers is the lack of adequate information to determine the performance of price and non – price instruments and their impact on their communities. Nevertheless, no formal considerations were given to analyze the influence of the different household characteristics had on the price and non-price policies. In addition, reliable estimates of price and income elasticties are both crucial along with the effect that any change in price might have on demand especially when a large capital development projects is planned.

Kolokytha et al. (2002) stated that, 'The water users, as well as the general public who may affect and be affected by water management decisions, should be a part of the decision – making process. Public preferences and trends should be included and taken into account while analyzing alternatives and their economic effects. Decisions should be based on public choices in order to minimize resentment'.

Mohsen and Al-Jayyousi (1999) stated that, 'There is a clear necessity for developing non-conventional water supplies, and there should be a high attention towards the need for conservation, management and efficiency improvement measures within the water sector. Moreover, water demand management options are being considered as means to address the water crisis in Jordan.'

Methods

Water management in the developing world is usually characterized by an over-dependence on government to plan, develop and operate water systems. But since water is an important resource for all people and because of its limited nature, the responsibility of its management should not be only on the governments, but the whole population. The level of the consumer's participation in water demand management was assessed using the participatory approach. Public participation approach in general is a process through which the views of all interested parties or stakeholders are taken and integrated into the decision making. As for participatory approach to water management in specific, it was defined according to the statements issued by the 1992 United Nations Conference on Environment and Development in Rio de Janeiro as water management involving users, planners and policy makers at all levels in which decisions are to be taken at the lowest appropriate level with public consultation and involvement of users in the planning and implementation of water management decisions. Participatory approaches can also challenge perceptions, leading to a change in attitude and agendas and they are useful in providing feedback to policy-makers.

The long- term impact and sustainability of water resources planning and implementation process will mostly depend on the effectiveness of public participation particularly in the full implementation of demand management. Public participation can gradually lead to higher quality, more informed decisions and it can promote public acceptance since it encourages having more input from the public and having the public actively contributed to the solutions.

There are two main levels of participation that could be distinguished. The first level is information supply which allows the access of the general public to background information. The second level is consultation which gives the public the right to react to plans developed by the authorities and the last level of public participation is active involvement and it refers to general public actively participating in the planning process by discussing different related issues and contributing to the solution (Mouratiadou and Moran, 2007). However, there are some basic conditions in order to ensure the success of participation and these are having a clear and reliable formal decision making process, having a high tolerance of direct public debate, and the wish of the community to reach through an open process to a certain level of agreement (Mermet, 1991). The participatory approach was used in the study by asking several questions that are aimed at determining the level of consumers' willingness to participate in water management in which the data obtained was analyzed using the limited dependent variable regression.

The willingness of the public to participate in water management is limited to willing or non-willing to participate (Kaliba, et. al. 2003, Lund, 1995, Howe and Smith, 1993). The functional forms most frequently used to analyze regression models were the dependent variable is a dichotomous variable taking the value 1 or zero are the linear probability model, the logit and probit models (Griffiths *et al*., 1993). In this study, the probit model was used to measure the factors affecting the public's willingness to participate in water demand management, defining Y_i as a sequence of dependent binary variables taking the values of 1 or 0, X_i is a K – vector of known explanatory variables, B_o is a K – vector of unknown parameters, F is a certain known function. Consider the following regression model as described by Maddala (1992):

$$y_i^* = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} + u_i$$

Where (y_i^*) is not observed. It is commonly called a "latent" variable, what is observed is a dummy variable (y_i) defined by:

$$y_i = \begin{cases} 1 & \text{if } y^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

Where (y_i) is a variable measuring the public's willingness or non – willingness to participate in water management, while β's are the socioeconomic factors, u_i is the error term. The probit and logit models differ in the specification of the distribution of the error term in u and the difference between this specification and that in linear probability model is that in the linear probability model, the dichotomous variables are analyzed as they are, while in the probit model we assume the existence of an underlying latent variable for which we observe a dichotomous realization (Maddala, 1992). In this study, a general probit model was used to measure the factors affecting the public's willingness to participate in water management.

To achieve the study objectives, a structured questionnaire was used and a Likert – response format questions was used to assess the need to improve water management using five-point scale with two available choices to qualify urgency, one neutral and two available choices to indicate that no urgency is perceived.

Data

The data used in this study was obtained from the field survey that was conducted on 2005 as a part of MEDITATE project that was funded by the European Union. The survey was collected on a representative stratified random sample of 600 households in the Greater Amman region. The sample was drawn by the Department of Statistics based on the frame provided the 2004 Population and Housing Census (DOS, 2006). The data was collected based on a face-to-face interview where the interviewers met the respondents directly and explained the questions to them. The survey covered socioeconomic information such as educational level, age, employment status and household income and expenditures in addition to data concerned with knowledge of drinking water cycle, water quantity, attitudes to participation, perception of water quality and socioeconomic data.

Results and Discussions

In order to initiate public participation, it is necessary to identify the public's perception of the need to improve the water management in their region and to assess their awareness of the need to manage water more efficiently. Hence, the population interviewed on the social survey had been given a five point scale with two available choices to qualify urgency, one neutral answer and another two choices to qualify that no urgency is apparent. 28% and 21% of the respondents believed that improving water management is overall 'very urgent' and 'urgent' respectively, while 23% and 14% of them consider it as 'not urgent' and 'not at all urgent' respectively. The results shows that the majority of the respondents with 64% were willing to be involved in any discussions and debates on the present and future management of water resources while around 14% of the respondents declared that they do not know whether they would like to be involved or not which indicates that they do not have enough interest.

The respondents' willingness to participate in water debates were regressed on some socioeconomic variables with their general description tabulated in Table (1) in order to determine which of these factors might affect the respondents' willingness to participate in water debates. The results of the regression analysis is presented in Table (2) shows that respondents whose age is between 56 and 65 years old has a positive effect on their willingness to be involved in water issues, meaning that they were more willing to be involved in water issues compared with other age groups.

However, the average household monthly income have a positive effect on the public's willingness to be involved in water issues, while the level of the respondents trust regarding the quality of their tap water has a negative effect on their willingness to be involved in water issues. When the respondents were given a list of different methods to be involved in water debates to rank according to their preference; around 43% choose to participate themselves in public debates and consultation as the most preferred method of participation, while 23.5% of the respondents choose electing spokespersons to represent their opinions as least preferred method of participation. These results clearly shows that the population sampled prefer the more direct forms of participation in water debates over those more distant forms of participation in water discussions such as electing spokespersons or voting on options.

The respondents' suggestions on improving the water management were drawn out through open question. The respondents either gave suggestions to improve water management under different categories or gave answers that could be categorized under 'no suggestion' which indicates that the respondents either have no suggestions to improve the water management or did not give an answer at all which might be due to their lack of interest or lack of knowledge or due to the fact that they are quite satisfied with the current level of water management efficiency. The majority of the suggestions proposed by the respondents were more on

the technical side of the water management; (increase supply, improve quality and maintenance), while other suggestions were more focused on the managerial issues such as reducing water costs and monitoring water along with some minor focus on the behavior towards water usage, that is, increase public's awareness regarding water use.

Table (1): The descriptive statistics of the explanatory variables

Variable	*Definition*	*Description*	*Unit*	*Mean*	*S.D*
Gen	Gender	The gender of the respondent	1: Female 0: Male	0.59	0.49
Age1	Age category in years	Respondent age of 18 – 25	1: Age 18 – 25 0: Otherwise	0.08	0.27
Age2	Age category in years	Respondent age of 26 – 35	1: Age 26 – 35 0: Otherwise	0.20	0.40
Age3	Age category in years	Respondent age of 36 – 45	1: Age 36 – 45 0: Otherwise	0.30	0.46
Age4	Age category in years	Respondent age of 46 – 55	1: Age 46 – 55 0: Otherwise	0.20	0.40
Age5	Age category in years	Respondent age of 56 – 65	1: Age 56 – 65 0: Otherwise	0.12	0.33
Age6	Age category in years	Respondent age of 65+	1: Age 65+ 0: Otherwise	0.09	0.29
Loca	Location	The location where the respondent is living	0: Urban 1: Rural	0.29	0.45
Ssup	Source of Supply	The source of water supply	0: Public 1: Private	0.02	0.15
HS	Household size	The number of persons living in the house	(1 – 10) individuals	5.94	2.37
Inc	Income	The average monthly household income	JD/month	310.02	701.32
HT1	Household type	Respondent living in a flat	1: Flat 0: Otherwise	0.45	0.50
HT2	Household type	Respondent living in semi – detached house	1:Semi detached 0: Otherwise	0.15	0.36
HT3	Household type	Respondent living in detached houses	1: Detached 0: Otherwise	0.40	0.49
Typown1	Type of ownership	Respondent who own the property	1: Owner 0: Otherwise	0.76	0.43
Typown2	Type of ownership	Respondent who rents the property	1: Renting 0: Otherwise	0.24	0.43
Emp1	Employment status	Respondent who is self employed	1: Self employed 0: Otherwise	0.26	0.44
Emp2	Employment status	Respondent who is working in private sector	1: Private 0: Otherwise	0.15	0.36
Emp3	Employment status	Respondent who is a civil servant	1: Civil servant 0: Otherwise	0.18	0.38
Emp4	Employment status	Respondent who is unemployed	1: Unemployed 0: Otherwise	0.41	0.49
Edu1	Educational level	Respondent who is illiterate	1: illiterate 0: Otherwise	0.13	0.34
Edu2	Educational level	Respondent who has basic education	1: Basic 0: Otherwise	0.59	0.49
Edu3	Educational level	Respondent who has bachelor degree	1: Bachelor 0: Otherwise	0.26	0.44
Edu4	Educational level	Respondent who has higher education	1: Higher 0: Otherwise	0.02	0.14
Urg	Urgency	Level of urgency to improve water management	Scale (1 – 5)	2.68	1.44
Know	Knowledge	Knowledge of the source of supplied water	1: Yes 0: No	0.38	0.49
Sugg	Suggestions	Suggestions given to improve water management	1: suggestion 0: No suggestion	0.87	0.34

PWC1	Perception of water consumption	Respondents who think they consume little water	1: Little 0: Otherwise	0.24	0.43
PWC2	Perception of water consumption	Respondents who think they consume neither too little nor too much water	1: Neither 0: Otherwise	0.62	0.49
PWC3	Perception of water consumption	Respondents who think they consume a lot of water	1: A lot 0: Otherwise	0.13	0.33
PWC4	Perception of water consumption	Respondents who don't know their water consumption	1: Don't know 0: Otherwise	0.01	0.11
WC1	Level of water consumption	Respondents who consume less than 50L/day	1: < 50L/d 0: Otherwise	0.13	0.33
WC2	Level of water consumption	Respondents who consume between 50 – 100 L/day	1: 50-100 L/d 0: Otherwise	0.16	0.36
WC3	Level of water consumption	Respondents who consume between 100 – 150 L/day	1: 100-150 L/d 0: Otherwise	0.09	0.28
WC4	Level of water consumption	Respondents who consume between 150 – 200 L/day	1: 150-200 L/d 0: Otherwise	0.11	0.31
WC5	Level of water consumption	Respondents who consume more 200L/day	1: >200 L/d 0: Otherwise	0.11	0.30
WC6	Level of water consumption	Respondents who don't know the level of their consumption	1: Don't know 0: Otherwise	0.42	0.49
Trust	Level of trust	Trust the quality of tap water	1: Yes 0: Otherwise	0.36	0.48
PWV1	Perception of water value	Respondents who think water is cheap	1: Cheap 0: Otherwise	0.07	0.25
PWV2	Perception of water value	Respondents who thinks water is neither cheap nor expensive	1: Neither 0: Otherwise	0.29	0.46
PWV3	Perception of water value	Respondents who think water is expensive	1: Expensive 0: Otherwise	0.58	0.49
PWV4	Perception of water value	Respondents who don't know the value of water	1: Don't know 0: Otherwise	0.06	0.23
WB1	Water bill	Respondents whose water bill is less than 10 JD/cycle	1: <10 JD/cycle 0: Otherwise	0.58	0.49
WB2	Water bill	Respondents whose water bill is between 10 – 50 JD/cycle	1: 10-50 JD/cycle 0: Otherwise	0.33	0.47
WB3	Water bill	Respondents whose water bill between 50 – 100 JD/cycle	1: 50 -100 JD/cycle 0: Otherwise	0.06	0.24
WB4	Water bill	Respondents whose water bill is more than 100 JD/cycle	1: >100 JD/cycle 0: Otherwise	0.03	0.17
Grey	Install grey water system	Willingness to install grey water system	1: Yes 0: No	0.73	0.44

The respondents were also asked to suggest some methods that they think would help reduce their households' water consumption and around 76% of the respondents had suggested at least one method to reduce their households' water consumption. The respondents suggested different methods to reduce their water consumption with around 8% of them recommending the use of water saving tools in the house to help reduce the water consumption, while 28.2% were going to reduce the quantity of the water used in their household for various uses like washing dishes, washing clothes or water used for cleaning the house in general, 11% suggested using washing water in other uses such as irrigating the garden.

People have different motives for changing their water consumption pattern and these motives could vary from environmental benefits to saving money. Knowing what motivates people most to change their water consumption will have a positive effect on the success of the different measures taken to encourage such a change. For this reason, the respondents were given six different reasons that might encourage them to reduce their water consumption habits and they were of three major types; social incentives, environmental incentives, and financial incentives, and the results showed that the majority of the respondents had supported all the proposed incentives to save water with more focus on the financial incentives (97%). Measures to manage water more efficiently will likely be more effective if the people affected by these measures are supporting them and the measures that were taken into consideration in this study were divided into financial measures such as imposing fines for illegal connections, polluters, meter manipulations and non-financial or physical measures like limiting new house building. Almost all respondents had

supported all the suggested measures to manage water more efficiently with more emphasis on the financial measures (99%).

Table (2): Results of Applying Probit Model on the Public's Willingness to Participate in Water Debates

Variables	*Coefficient*	*Std. Error*	*t - statistics*	*Probability*
Gen	-0.2917	0.1959	-1.49	0.136
Age2	0.3053	0.3395	0.90	0.369
Age3	-0.0721	0.2578	-0.28	0.780
Age4	0.3414	0.2769	1.23	0.218
Age5	0.5671*	0.3095	1.83	0.067
Loca	-0.3871	0.2445	-1.58	0.113
Ssup	0.5112	0.5920	0.86	0.388
HS	-0.0321	0.0422	-0.76	0.448
HT1	-7.4909	896.15	-0.01	0.999
HT2	-6.1246	448.15	-0.01	0.989
HT3	-5.7813	-	-	-
Edu2	0.2403	0.1869	1.29	0.199
Inc	0.1422*	0.0782	1.82	0.069
Emp2	-0.0031	0.2750	-0.01	0.991
Emp3	0.50898	0.2754	1.85	0.065
Typown1	-6.0720	1131.8	-0.01	0.996
Typown2	-5.4581	1131.8	-0.00	0.996
Urg	-0.0147	0.0636	-0.23	0.818
Know	-0.0660	0.1854	-0.36	0.722
Sugg	0.2603	0.2772	0.94	0.354
PWC2	-0.2644	0.2854	-0.93	0.330
PWC3	-0.7151	0.5233	-1.37	0.172
WC1	-8.4287	1120.4	-0.01	0.994
WC2	-6.5361	896.35	-0.01	0.994
WC3	-4.5245	672.26	-0.01	0.995
WC4	-1.6188	448.17	-0.00	0.997
WC5	-0.4550	224.09	-0.00	0.998
Trust	-0.3943**	0.1862	-2.12	0.034
PWV1	-9.3895	1299.4	-0.01	0.994
PWV2	-5.4679	866.32	-0.01	0.995
PWV3	-2.2681	433.16	-0.01	0.996
WB2	-0.3111	0.2338	-1.33	0.183
WB3	-0.2822	0.4964	-0.57	0.570
Grey	-0.0211	0.1858	-0.11	0.909
Constant	37.169	-	-	-
Count R^2 = 0.77 Pseudo R^2 = 0.2559 Observed Probability= 0.7112 Predicted Probability= 0.7728				
Log likelihood = -164.40 Chi^2 test= 320.08 Sensitivity [a] = 90.08% Specificity [b] = 46.23%				

*, ** and *** indicates significance at 10% level, 5% and 1% respectively.
(a) Correctly predicted willingness to participate in water management based on a 50-50 classification scheme
(b) Correctly predicted non-willingness to participate in water management based on a 50-50 classification scheme

The respondents were asked about their motivation to support certain water management measures and the changes in their behavior which could be encouraged by offering a financial incentive either in form of a reward or as a penalty. The participants were asked such related questions since the implementation of any policy is more likely be successful if peoples' reactions toward incentives or penalties is known and understood. The respondents were first faced with a situation if a new pricing policy should be introduced that is based on peak use and whether they would be willing to use smaller amount of water during peak hours and switch most of their water use to off–peak hours during the day and later at night if that was going to save them quarter of their normal water bill. About 46% said that they would be willing to reduce their water use if it saved them a quarter of their normal water bill, while 36.5% would not consider reducing the amount of water they normally use. The respondents willingness to switch most of their water consumption to off- peak hours if their water bill was projected to decrease by a quarter was regressed against different socioeconomic factors to assess their effect.

Table (3): Results of applying Probit model on the public's willingness to shift water consumption to off peak hours if their water bill would decrease by quarter

Variables	*Coefficient*	*Std. Error*	*t - statistics*	*Probability*
Gen	0.1611	0.1630	0.99	0.323
Age1	11.531	2042.9	0.01	0.995
Age2	9.7269	1634.3	0.01	0.995
Age3	7.3138	1225.8	0.01	0.995
Age4	5.1211	817.19	0.01	0.995
Age5	2.3410	408.59	0.01	0.995
Loca	0.5054**	0.2161	2.34	0.019
Ssup	-0.4387	0.8127	-0.54	0.589
HS	0.0180	0.0350	0.51	0.607
HT1	-6.9234***	0.8601	-8.05	0.000
HT2	-7.3392***	0.4968	-14.7	0.000
HT3	-7.3855	-	-	-
Edu2	-0.3388	0.2442	-1.39	0.165
Edu3	-0.2499	0.3561	-0.70	0.483
Inc	-0.0094	0.0645	-0.15	0.884
Emp1	5.3450	1838.6	0.00	0.998
Emp2	3.8555	1225.8	0.00	0.997
Emp3	1.9332	612.89	0.00	0.997
Typown2	0.4073*	0.2090	1.95	0.051
Urg	0.1220**	0.0554	2.20	0.028
Know	-0.0404	0.1539	-0.26	0.793
Sugg	0.3005	0.2550	1.18	0.239
PWC2	-0.0741	0.2521	-0.29	0.769
PWC3	0.0140	0.4737	0.03	0.976
WC2	-0.1949	0.2419	-0.81	0.420
WC3	-0.0719	0.2858	-0.25	0.801
WC4	-0.0073	0.2604	-0.03	0.978
WC5	-0.2340	0.3040	-0.77	0.441
Trust	0.0576	0.1687	0.34	0.733
PWV2	-0.0271	0.2693	-0.10	0.920
PWV3	-0.0523	0.3341	-0.16	0.876
WB2	0.5600***	0.2129	2.63	0.009
WB3	0.9648	0.4131	0.02	0.155
Grey	0.4988***	0.1645	3.03	0.002
Constant	-15.391	-	-	-
Count R^2 = 0.650; Pseudo R^2 = 0.109; Observed Probability= 0.5401; Predicted Probability= 0.5378				
Log likelihood = -224.9; Chi^2 test= 362.52; Sensitivity[a] = 73.74%; Specificity[b] = 54.76%				

*, ** and *** indicates significance at 10% level, 5% and 1% respectively.

(a) Correctly predicted willingness to participate in water management based on a 50- 50 classification scheme

(b) Correctly predicted non-willingness to participate in water management based on a 50-50 classification scheme

The results of the regression presented in Table (3) shows that the place where respondents live have a positive effect on their willingness to response to the suggested policy in which those who live in rural areas were more willing to shift their water consumption if it is going to reduce their normal water bill by a quarter. It also shows that the type of the place where respondents live in (flat and semi-detached houses) have a negative effect on their response to the suggested policy. It appears from the results that those who rent their houses were more responsive to the suggested policy than other respondents. It also seems that respondents who think that the need to improve water management is not that urgent were more responsive to the suggested policy than those who feel that the need is more urgent. The same could be said about those whose water bill is between 10 and 50 JD/cycle and the respondents who were willing to install a grey water system in their houses.

On the other hand, a cross-tabulation and the Chi^2 test were applied and the results showed that the type of the living accommodation of the respondents had a significant relation with their willingness to shift their water consumption to off- peak hours in response to peak pricing based policy as it appears in Table (4) in which people who lives in detached houses were more willing to response to the new water policy that those who lives in an apartment. But the respondents'

perception of water value does not seem to have a relation with their willingness to shift water consumption in response to a new pricing policy.

Table (4): Results of Chi^2 test for willingness to shift water consumption to off peak hours if water bill will decrease by a quarter

Willingness to reduce water consumption – rewards	House type			Perception of water value		
	Apartment	Semi-detached	Detached	Expensive	Neither expensive nor cheap	Cheap
Yes	50%	49%	57%	56%	55%	53%
No	45%	46%	38%	38%	39%	43%
Don't know	5%	5%	5%	6%	5%	52%
Chi^2 value	22.369			3.969		
Chi^2 p – value	0.004 ($p < 0.05$)			0.681 ($p > 0.05$)		

Table (5): Results of applying Probit model on the public's willingness to reduce water consumption if their water bill would increase by quarter

Variables	*Coefficient*	*Std. Error*	*t - statistics*	*Probability*
Gen	0.2338	0.1860	1.26	0.209
Age1	-10.937	1410.9	-0.01	0.994
Age2	-8.8860	1128.9	-0.01	0.994
Age3	-6.3485	846.59	-0.01	0.994
Age4	-4.2189	564.39	-0.01	0.994
Age5	-2.4234	282.19	-0.01	0.993
Loca	0.0572	0.2272	0.25	0.801
Ssup	0.5196	0.6763	0.77	0.442
HS	0.0003	0.0381	0.01	0.994
HT2	0.9586**	0.4575	2.10	0.036
Edu2	3.9388	1693.2	0.00	0.998
Edu3	7.9472	3386.3	0.00	0.998
Edu4	11.643	5079.5	0.00	0.998
Inc	-0.1451**	0.0648	-2.24	0.025
Emp2	-0.0255	0.2277	-0.11	0.911
Emp3	-0.1911	0.2104	-0.91	0.364
Typown1	-0.2328	0.2141	-1.09	0.277
Urg	0.0393	0.0618	0.64	0.525
Know	-0.1848	0.1626	-1.14	0.256
Sugg	0.4372*	0.2428	1.80	0.072
PWC2	0.2035	0.1641	1.24	0.215
WC2	-0.0487	0.2473	-0.20	0.844
WC3	-0.4891*	0.2660	-1.84	0.066
WC4	-0.9848***	0.2641	-3.59	0.000
WC5	-1.0610***	0.2956	-3.59	0.000
Trust	0.0694	0.1847	0.38	0.707
PWV2	-0.2057	0.3078	-0.67	0.504
PWV3	-0.3800	0.4012	-0.95	0.344
WB2	0.2728	0.2228	1.22	0.221
WB3	0.1934	0.4567	0.42	0.672
Grey	0.3356*	0.1749	1.92	0.055
Constant	18.071	-	-	-
Count R^2 = 0.846; Pseudo R^2 = 0.2147; Observed Probability= 0.8461; Predicted Probability= 0.9162				
Log likelihood = -179.7; Chi^2 test= 450.87; Sensitivity[a] = 97.34%; Specificity[b] = 14.63%				

*, ** and *** indicates significance at 10% level, 5% and 1% respectively.
(a) Correctly predicted willingness to shift water consumption (penalty) based on a 50- 50 classification scheme
(b) Correctly predicted non-willingness to shift water consumption (penalty) based on a 50-50 classification scheme

Another scenario was then presented to the respondents, in which they were asked if they would be willing to reduce their water consumption if their normal water bill would increase by quarter. The majority of the respondents with 77.5% stating that they were going to take some measures to reduce their water consumption if their water bill was projected to increase by a quarter. Taking these results and those

from the previous section, it seems that the participants are more responsive to penalties than toward rewards. A regression analysis was performed to test the existence of any relation between the willingness of the respondents to reduce water consumption if their water bill would increase and the different socioeconomic factors. The results of the regression analysis shown in Table (5) show that respondents who lives in semi-detached houses seems to be more responsive to the suggested policy than other respondents, while respondents who earn more income were less responsive to penalty based policies than less wealthier households. However, people who offered suggestion to improve water management and were willing to install grey water systems were more responsive to this policy, and those who consume higher water levels were less responsive to such policy.

The results of the cross-tabulation with the Chi^2 test are presented in Table (6) and it shows that the size of the household has an effect on the respondent's willingness to reduce their water consumption if their water bill would increase. Households with more residents are more responsive to the proposed policy. In addition, those who earn a higher income tend to be less willing to reduce their water consumption if their bill would increase than those who earn a lower income. However, the respondents' perception of water value had no relation with their response to the suggested policy.

Table (6): Results of Chi^2 test for willingness to reduce water consumption if water bill will increase by a quarter

Willingness to reduce water consumption – penalties	Household size			Household income			Perception of water value		
	1	5	9	<100	200-300	>500	Expensive	Neither expensive nor cheap	Cheap
Yes	60%	76%	82%	79%	73%	57%	80%	76%	78%
No	0%	15%	13%	14%	20%	24%	13%	15%	15%
Don't know	40%	9%	5%	8%	7%	19%	7%	7%	7%
Chi^2 value	31.041			21.189			4.258		
Chi^2 p – value	0.028 ($p < 0.05$)			0.02 ($p < 0.05$)			0.642 ($p > 0.05$)		

Conclusions

Participatory approach methods were used to assess the level of the consumers' participation in water management. A large number of the interviewed consumers believed that there is an urgent need to manage water more efficiently, hence the majority were willing to be involved in any debates or discussions regarding water issues and their willingness was affected by different factors such as their age and average income, preferring the more direct forms of participation over those of more distant nature. The majority of the suggestions proposed by the respondents to improve water management were more on the technical side of the water management; (increase supply, improve quality and maintenance), while other suggestions were more focused on the managerial issues such as reducing water costs and monitoring water along with some minor focus on the behavior towards water usage i.e. increase public's awareness regarding water problem and use. The respondents' responses toward different water management measures were also estimated and it was found that the interviewed consumers were more willing to reduce or shift their households' water consumption if their water bill was projected to increase. That indicates that the consumers are more responsive towards penalties than incentives.

These results are informative to water policy makers. When consumers are willing to participate in water demand management, any demand management policies will likely have a major impact since the consumers are accepting and supporting these measures. Policy makers should also take into consideration which measures the consumers are more responsive to when developing any new water demand policies. There should be a continuous effort to find out what consumers preferences are.

From the study, it is clear that the pricing polices alone are not expected to manage water efficiently since raising water tariffs will only affect people with lower income without decreasing their water consumption. It rather should be combined with DSM policies as an effective tool in managing water demand. Further evaluation and assessment of the non-price policies including DSM for municipal water uses should be carried out such as conducting surveys and interviews with the stakeholders. More studies on household water demand should be conducted to determine the specific socioeconomic factors that affect the water demand on a household level. Stakeholders' opinions should be taken into consideration when planning for water management policies. Adopting new technologies and devices to manage water conservation at the household level such as installing grey water system and using different water saving tools since many respondents were willing to try these new technologies. Increasing people's awareness regarding water use and conservation techniques through, for example, conducting awareness campaigns and awareness programs especially in schools and universities as well as to organizing workshops with different stakeholders. The different socioeconomic factors that affect water demand along the stakeholders' responses

to different policies should be taken into consideration when planning for water management policies. More efforts should be concentrated towards the promotion of DSM options among general public through educational programs and information campaigns. Carry out informative programs that aim to provide the public with more information regarding the quality of water supplied to their households in order to increase the level of their trust in water quality. Public participation and involvement should be promoted and adopted as a form of water demand management tools.

Most of the interviewed people believe that water is relatively expensive; hence the main motivation to reduce their water consumption was if it is going to save them money rather than saving the money of their country or for even environmental benefits. The respondents supported different actions to improve the efficiency of water management, ranging from financial measures as imposing fines polluters and non-financial measures as limiting new house building. The majority of the respondents were willing to reduce their water consumption if it's going to reduce their water bill, but more respondents were willing to reduce their consumption if their bill was projected to increase which indicates that respondents were more responsive to penalties than rewards when it comes to take some measures to reduce the quantity of their households' water consumption. The majority of the participants were willing to install a grey water system in their households indicating that DSM policies might affect the water demand by presenting technological change in the household equipments. Individual knowledge of the general information regarding water source seems to be affected mainly by their age and educational level. The different socioeconomic factors such as gender, location, household size, education level, house type and the respondents' perception of their water consumption all turned out to have a significant relationship with the actual quantity of the household's daily water consumption. The majority of the people interviewed tend to not trust the quality of their tap water and their perception depends on the location of their living, income and how much they think they are informed regarding water quality. Many of the respondents believed that tap water is of bad quality due to different reasons such as the bad taste, bad smell and the general belief that tap water is polluted, resulting in them preferring to consume other alternatives like filtered tap water or bottled water. Their choice was found to be affected by their perception of water quality and the level of their trust of water quality. Non-price policies are expected to have a major influence on water demand. The own price elasticity of demand and income elasticity for both estimated models were both inelastic. Which means that pricing policies might not be an effective way to manage water demand since any rising in water tariffs will only affect the lower income people without decreasing their water consumption. Socioeconomic factors such as the household size and the educational level was found to be significant in determining the level of water demand.

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