

**STUDY THE WILLINGNESS TO PAY FOR DOMESTIC WATER,
APPLIED IN GIA LAM DISTRICT, HA NOI****Bui Thi Thu Hoa¹, Loan Thi Doi²**

Abstract: *Water demand and water pollution problems are increasing rapidly day by day in the world. Therefore, water is considered as one of the scarce resources which may be exhausted in the 21st century, especially for domestic water. Water demand management is one of approaches to understand clearly the customer behavior as well as their willingness to pay (WTP), which contribute to water management efficiently. In this article, a contingent valuation method (CVM) is applied to study WTP and factors that affect the WTP for domestic water services in Gia Lam district with selected households. The result shows that their willingness to pay is still quite low. The highest level is about 3,000 VND/m³, accounting for 22% and only 2% of households are willing to pay more 6,000 VND/m³, compared to the current water tariff. Education level, sex and income are the main factors that influence to their WTP.*

Keywords: Willingness to pay, domestic water

1. INTRODUCTION

Water resources play a key and important role in our lives, especially for human activities. Water resources are limited although renewable, they are depleting by the day without well-controlled management with changes in weather conditions, economic development and population growth rapidly. Inspire increasing efforts from water suppliers to improve the quantity and quality of water, it is needed to study the consumer behaviors and their response to water services, which aim to understand clearly from the demand side. In other words, studying the consumer behaviors will provide more information for the suppliers to have an efficient water management plan and strategy. This has been expressed in many researchers, which have reported that water resources should be valued as one kind of asset (Griffin,2006). According to the economic approach, the allocation can be efficient by market principles. However, it is not easy to apply economic tools in water sectors because of its market failures

such as monopoly, externalities, public goods, etc. Therefore, it is difficult to understand the water user and supplier behaviors compared to other markets because of the missing market – oriented pricing mechanism. Water valuation is considered as a reflection of a water user’s understanding clearly of the behavior between demand and supply sides. Contingent valuation method (CVM) is considered as one of the methods applied to estimate of water values, especially in natural and environmental resources. A CVM was employed to understand the water user’s behavior as well as the factors influencing their willingness to pay in Gia Lam district, Hanoi.

2. METHODOLOGY

As the other natural resources, water resources contain use and non-use values. One of the high values of water comes from daily life, especially for drinking purposes. Water directly contributes to production activities with high economic values such as agriculture, industry, etc. The other non-use values of water are types of services such as tourism, aesthetics and entertainment. However, it is not easy to estimate the actual value of water because of its

¹Division of Economics, Thuyloi University, Vietnam

² Thuyloi University, Vietnam

market failures characteristics. One of the most commonly used methods in the water resources sector to estimate the water value is the contingent valuation method (CVM).

CVM is one of the methods to determine economic value of non-market goods and services through questionnaires and interviews. This approach is based on hypothetical scenarios which aim to find out the reaction or behavior of respondents. This method has two main advantages: CVM relates to both use and non-use values of environmental resource goods and services, and measure the changes of benefit in term of monetary value through willingness to pay (WTP) and willingness to accept (WTA) estimation (Perman et al., 2003). There are various studies using the CVM to study the value of domestic water and the main factor affecting WTP. Kidu used the CVM method to study the improvement of domestic water supply service in Nebelet town, Ethiopia. The results showed that 96% of respondents were willing to pay for the provision of improved water service (Kidu et al., 2015). CVM is applied to study WTP and factors influencing WTP in Ramallah, Palestine. The majority of people are willing to pay extra for water supply if water is provided sufficient in terms of quantity and quality (Ibrahim and Robert, 2010). Age, volume of water, and household income are the main factors that affect significantly to WTP.

In this paper, CVM is applied to evaluate the current water service as well as to find out the factors affecting WTP by asking directly about their WTP about the water supply services based on face-to-face interviews with 50 randomly selected sampled households. Those households are stratified and selected randomly in Gia Lam district, where the Duong River surface water factory has been operated to supply water in Ha noi. The studied respondents are currently using water from the Duong River surface water factory, divided into two groups: a group of households who are using directly the water supply system of this factory which

represented for the new connection and other group is transferred from the old connection to the new water supply system of the Duong River factory. The respondents from Long Bien district, Trung Mau and Phu Dong commune and Dong Anh district are stratified and selected randomly, which represents the users from the new and old connections. The respondents from the Long Bien district are represented for areas using water from the old connection from Hanoi Water Joint Stock Company No.2. Dong Anh area is the place where people use water directly from the Duong River factory, a new connection. Trung Mau and Phu Dong commune - where the Duong River Surface Water Plant is located are also selected to investigate. In each area, households were selected randomly based on the low, middle, and high income criteria.

3. RESULTS

Socioeconomic background of respondents

Data from the survey indicated that of these sample households, 26 households (52%) were women whereas the remaining 48% were males. The age of the surveyed households ranges from the minimum of 22 to a maximum age of 60, with average age of 37. The level of education attained by the respondents was generally high. Most of them (40%) have completed their college level education, 14% of them have bachelor and engineer degrees. About 12 respondents (24%) have high school education while the rest of them have primary education level. The monthly average household income is 13.59 billion *dong*. About 27 (54%) households have income below 10 billion *dong per month*, 32% of households were in the 10-25 billion *dong* and the rest have more than 25 billion *dong*.

Water supply system

Water is supplied for the households in these areas through operation of Hanoi Water Joint Stock Company No.2 and Duong River surface water factory. The Duong River surface water factory was started to be constructed in 2016, inaugurated phase 1 and put into operation in

2019. The factory is located in Trung Mau and Phu Dong commune, in Gia Lam district. With a total investment capital of nearly 5,000 billion VND and water treatment technology of European standards, the designed capacity aims to reach from 300,000 m³ per day and night in 2020 and by 2030 to 600,000 m³ per day and night and 900,000 m³ per day and night in 2050.

With the goal of supplying water to the entire northern area of Ha Noi and some neighboring areas such as Hung Yen, Bac Ninh, the retail price for the household is proposed average 10,246 VND/m³ and applied block pricing mechanism with subsidized by the government and wholesale price to other factories at 7,700 VND/m³ (Table 1).

Table 1. Water rate

No	Volume	Price	VAT tax (5%)	Environmental protection fee (10%)	Total price
1	First 10m ³	5973	298.65	597.3	6869
2	10m ³ -20m ³	7052	352.6	705.2	8109.8
3	20m ³ -30m ³	8669	433.45	866.9	9969.4
4	Above 30m ³	15929	796.45	1592.9	18318

Source: Joint Stock Company of Duong River Water, 2016

Water consumption and household's willingness to pay

According to the survey, water quality is assessed on the basis of the naked eye through the color and smell of the water, people have the most objective assessment of quality. Water quality is assessed by investigation in Figure 1. The results show that the majority of households (78.78%) think that the current water quality is at normal level, but 12.12% of respondents think it is quite poor and 8.8 % is poor and only about 2% is good.

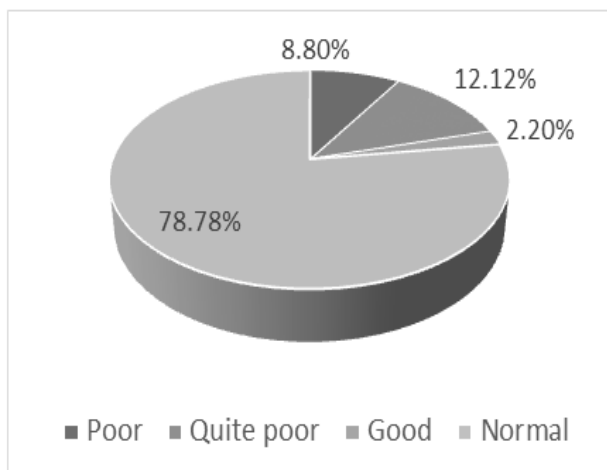


Figure 1. The water quality assessment of households

The average volume of consumed water per month of each household is quite different between areas. In urban areas such as Long Bien district, the average water consumption of a household ranges from 20m³ - 30m³ month and the highest consumption of a household can be reached to 60 m³/month. For suburban areas such as Gia Lam and Dong Anh district, the volume of water used per household is less than Long Bien district, which ranges from 2 m³ to 20 m³/ month. The main reason is explained by their habit of water use from wells for a long time and are not accustomed to using tap water. So it is difficult to convert their behavior from drilled well water to tap water.

With the higher standard of living, the demand for clean water for the people is increasing. They are willing to buy bottled water or water purifiers that have clean and secure water. According to the investigation, 40% of households are using bottled water, and water purifiers in studied areas. On average, they have to pay 120 thousand VND per month for 6 bottles with 20 liter per bottle to buy bottled water for drinking and cooking. The cost of using a water purifier and boiling to get 1 liter of water is about 27,467 VND/liter which

not included the initial investment for equipment.

This study also investigated their willingness when water quality is improved compared to the current water supply condition. The result shows in Figure 2. Compared to the current water tariff, they are willing to pay extra for one unit of water which is about 3,000 VND/m³, accounting for 22% and 18% of households are willing to pay with an additional price 1,000 VND/m³. The higher education level is, the higher willingness to pay for clean water is. They are well aware of the importance of clean water for daily life. However, 16% of respondents do not pay extra for enhanced water sources because most of them are still accustomed to using drilled well water. It can be seen that the demand for clean water, ensuring the quality of the people is very high. They are willing to pay more compared to the current price rate if the water quality is improved.

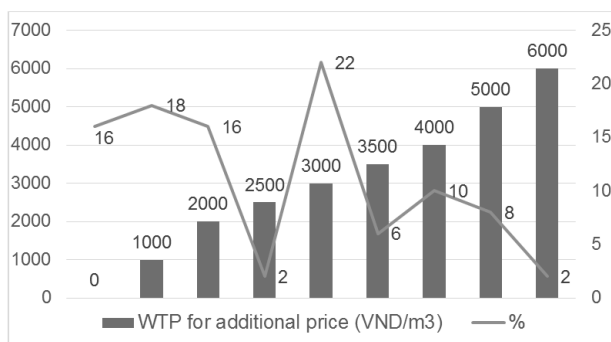


Figure 2. The WTP for additional price of one cubic meter water

In order to find out which factors affect the people's WTP, OLS regression model is estimated by using R language. *Added price* is the dependent variable which is presented for their WTP and *Income, Education and Sex* are independent variables. The regression equation is shown as the below:

$$\text{Added price/} \\ Im^3 = \alpha + \beta_1 \text{Income} + \beta_2 \text{Education} + \beta_3 \text{Sex.}$$

The estimated coefficient of the model is statistically significant and has the expected sign in affecting the household's willingness to pay for domestic water. After running and checking for defects of the model with R-squares = 47.47%, there was no multicollinearity problem. The model is perfectly suited. The testing results show the variance of variation for *Income* and *Education, Sex variables* show homogeneous variance. The Figure 3 below shows the hypothesis testings for OLS regression for this model are satisfied. Testing the phenomenon of multicollinearity, the statistical results show the VIF values of three independent variables are all less than 2, so the model does not have the multicollinearity problem. The independent variables can explain 44.04% of the impact of income and education, sex on people's willingness to pay for one cubic meter of water. It can be seen that the education variable is the most influential impact to the determination of willingness to pay. Based on the current prices, they are willing to pay more 504 VND/m³ for water quality improvement when their education level increases by one level. When income increases by one unit, education level is fixed, their willingness to pay more 0.0515 VND/m³, compared to the current water price.

There is a difference between male and female in willingness to pay for water. These results of the model are quite suitable with the fact of water uses in selected areas which most people in Gia Lam, Dong Anh district accept the current water supply condition even though their perception wants to improve water quality. In addition, the study area is mainly a rural area with low average income, low educational level and their habits of using water are mainly from drilled wells and rainwater. Therefore, it is difficult to change their perception in choosing the suitable water sources. As a result, their willingness to pay for extra water is quite low, even education level and income are the main factors that influence positively to their WTP.

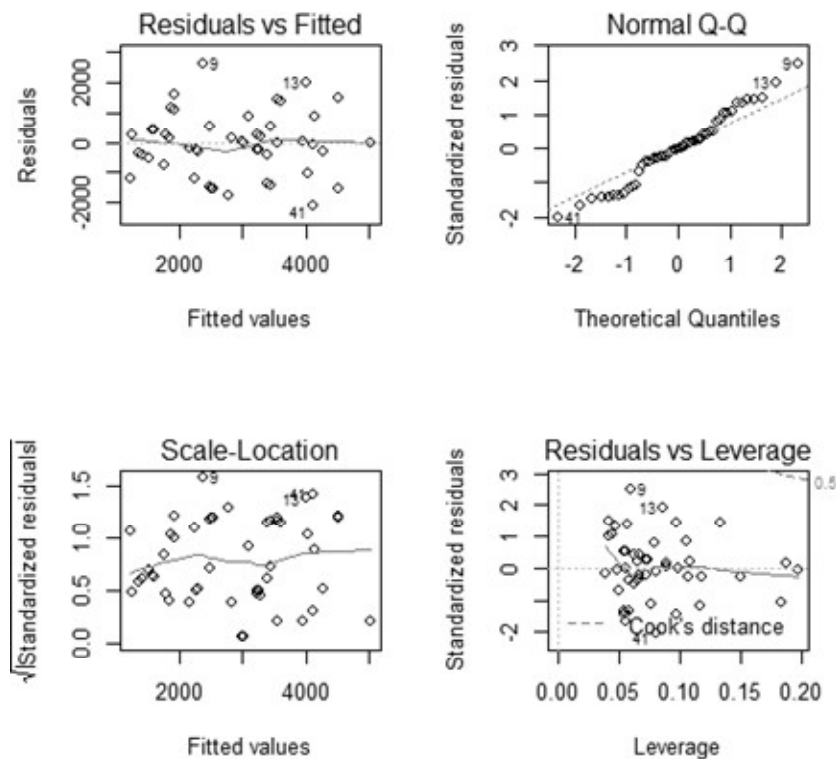


Figure 3. The hypothesis testings for OLS regression of the model

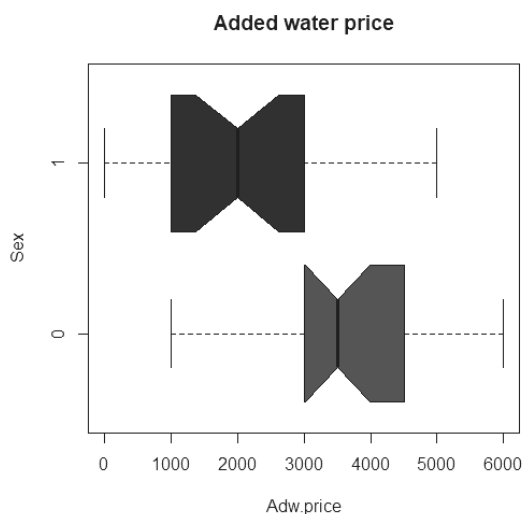


Figure 4. Comparing WTP between man and women (0: women; 1: men)

The willingness to pay more compared to the current price for water quality improvement is also quite different between men and women. The result shows that women are willing to pay more 3,000 VND/m³ compared to men (2,000VND/m³) (Figure4). This can explain that most women are in charge of family activities so they are willing to pay extra to improve water

quality in order to ensure the health of their family members. It can be seen that sex is also a factor which influence directly to WTP. Understanding the water demand through their perception, willingness to pay and the factors impacting WTP will provide more information for the suppliers or managers to have strategies more efficiently.

4. CONCLUSION

Water resources are facing the risk of serious pollution and depletion day by day, therefore the high quality and safely domestic water is needed to improve and provide for communities. Although there are still limitations in this study such as lacking the comparison to other center areas in Ha Noi to find out the differences between WTPs, the results illustrate the modeling approach to understanding deeply from the demand side. There are about 22% of respondents willing to pay more 3000 VND/m³, 1000 VND/m³ account for 18% and only 2% of respondents willing to pay more 6000 VND/m³ compared to the current price to improve water quantity and quality. The result shows that the

education level, and income variable has positive impact and sex has negative impact on their willingness to pay. Education level has a higher impact on WTP than income factor. The willingness to pay for women is higher than for men. Understanding the consumer's behavior is

quite important for the suppliers and the policy makers as well in managing water resources sustainably and efficiently. Therefore, it is needed to enhance studying the demand management in water resources management and planning.

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Tóm tắt:

NGHIÊN CỨU Ý MUỐN THANH TOÁN PHỤC VỤ DỊCH VỤ CUNG CẤP NƯỚC SINH HOẠT, ỨNG DỤNG TẠI HUYỆN GIA LÂM, HÀ NỘI

Ngày nay trước nhu cầu sử dụng nước cũng như tình hình ô nhiễm môi trường ngày càng gia tăng, tài nguyên nước được coi ngày càng khan hiếm, thậm chí có bị cạn kiệt trong thế kỷ 21. Quản lý cầu sử dụng nước được cho là một trong những cách tiếp cận hướng đến tìm hiểu hành vi cũng như ý muốn sẵn sàng thanh toán của người sử dụng, có thể giúp công tác quản lý tài nguyên nước một cách hiệu quả. Trong bài viết này, nhóm tác giả sử dụng phương pháp tùy chọn ngẫu nhiên (CVM) để nghiên cứu ý muốn thanh toán của người sử dụng, cũng như các nhân tố ảnh hưởng đến ý muốn thanh toán đối với các dịch vụ cung cấp nước hiện tại, và ứng dụng tại huyện Gia Lâm. Kết quả nghiên cứu cho thấy, mức sẵn lòng chi trả thêm so với mức giá nước hiện tại ở khu vực nghiên cứu còn khá thấp, chỉ có khoảng 22% các hộ sẵn sàng trả thêm 3000 đồng/m², và chỉ có 2% hộ gia đình điều tra sẵn sàng trả thêm 6000 đồng/m³. Nghiên cứu cũng cho thấy biến trình độ giáo dục, giới tính và thu nhập là những nhân tố tác động trực tiếp đến mức sẵn sàng thanh toán của người dân.

Từ khóa: Ý muốn thanh toán, nước sinh hoạt

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