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Household's Willingness to pay for Domestic Water Supply using Contingent Valuation Method

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It was reported that about 1.1 billion people in the world lack access to improved water supply. This is due to population growth and rapid urbanisation, which may consequently increase in coming years unless serious massive investment in supply infrastructure are undertaken to stem the tide (Adjeju et al., 2009). Massive investments for domestic water supply infrastructure are required as well as reforms in the operation and maintenance of the system to increase efficiency.

Chennai, a city of almost seven million people in Tamilnadu state, is one of the most water-stressed cities of India. While the population keeps skyrocketing, the amount of water available for them is dwindling. Scarcely intensified conflict between different stakeholders which cannot be resolved while there remains a great institutional vacuum. However, to meet the present water demand by the affordable individual families are intending to buy bottled water in urban Chennai at different levels. But this trend of attitude has been extended to the majority of the families mandatorily to rely on bottled water due to poor quality water supply.

Bottled water markets : Tamilnadu accounts for 50 percent of the total bottled water business in India. There are more than 400 registered units in this state of which more than 250 are located in and around Chennai. The water sales figures

The increasing threat posed to human health as a consequence of deteriorating water quality in Chennai has become burning issue in recent years. This research paper has attempted to introduce referendum user fee for water in order to improve water quality by the way of WTP. The results of the WTP indicate that health cost and preventive cost per household has increased drastically due to contaminated water. The survey result shows that the respondents are well aware of present water quality and the necessity of their participation to restore the same. The study results also give a positive scope for charging user fee. Most of the WTP studies carried out in developing countries in the past have been mainly limited to the estimation of user's mean WTP and sometimes been controversial.

quoted by the South India Packaged Water Association as follows:

Unfortunately 25 years after the promulgation of this Act, Chennai's water problems have grown worse. To fill the growing gap between supply and demand the Board

resorted to tapping groundwater from the peri-urban villages of the Chennai city. So rapacious was the Chennai Metro Water Board that with a view to protecting the long-term water supply to Chennai City, the Chennai Metropolitan Area Ground Water (Regulation) Act was enacted in 1987, prohibiting groundwater extraction in 229 notified villages around the Chennai city for any purpose other than domestic use. Since then, the Act has been amended twice to increase the number of protected villages to 243 and then to 302. Even though the main purpose was to control groundwater extraction and illegal transportation of water from these areas into the city, the Act is apparently grossly violated not only by private individuals but by the government itself.

Metro Water board is very much a party to the over-exploitation of ground water in these villages, contributing to a serious threat to livelihoods. Furthermore, in many villages groundwater quality has turned brackish or even saline due to seawater intrusion. Thousands of truck operators are still involved in commercial transaction in water in these villages and, worse, in some villages water companies have even been established. The Tamilnadu Groundwater (Development and Management) act of 2003 has been enacted and received the assent of the President, with a view to protecting groundwater from hazards

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Drinking Water Manufacturers Association are stunning

Type of Packaging	Price per Unit per day	No of units sold of sale (Rs)	Total daily valued
250 ml polythene sachet	Rs. 1	5 million	5.0 million
One litre bottle	Rs. 10 to 12	75,000	0.75 to 0.9 million
12 litre cans	Rs. 20 to 30	100,000	2.0 to 3.0 million
25 litre bubble top containers	Rs. 25 to 40	20,000	0.625 to 1.0 million
Water tankers carrying 10,000 to 12,000 litres	Rs. 600 to 1000*	10,000	6.0 to 10.0 million

Note: * The price variation is due to factors such as water quality, distance transported and season (summer or monsoon months).

The total spent on bottled water or water from tankers is therefore:

Rs. 14.3 million to 19.9 million/day (US\$ 0.3 to 0.4 million)

Rs. 429 million to 597 million/month (US\$9.5 to 13.3 million)

Rs. 5.15 billion to 7.16 billion/year (US\$110.4 to 159.1 million)

This would be enough money for 2.82 million to 3.92 million people to buy 500 grams of rice a day each (at Rs.10 per kilo of rice) for a whole year (\$15,000 to 716,000 tons of rice in a year).

Source: Jenakagan S., (2007)

of over-exploitation and to ensure its planned development and proper management.

Due to increasing awareness of potential health problems, packaged drinking water and water dispensers have become quite popular in India. With around 1,600 brands, the Indian packaged drinking water sector is estimated to have a size of US\$ 247 million. About 5 billion litres of bottled water are sold in India today, making the country the tenth largest consumer of bottled water globally. It is estimated that this market is growing at a rate of about 25 per cent annually. Although these are big numbers, the per capita consumption of bottled water in India is only around 0.6 litres per year. There is

no single brand that dominates the Indian market by volume. Of the 1,600 certified manufacturers, three famous brands jointly hold a market share of 30 per cent: Bioton (Paris), Aquafina (PepsiCo) and Kinley (Hindustan Coca Cola). These players primarily market smaller containers of 300 and 500 millilitres or 1 and 2 litres. Local brands made by regional players, who sometimes belong to the unorganised sector, account for the remaining 70 per cent of the market.

A large proportion of these companies' business comes from bulk packs of 20 or 25 litres. These packs are usually supplied at the doorstep of consumers by local distributors. Many Indian cities lack

sufficient water supplies. Urban growth is making it difficult and expensive to build the dams, pipelines and canals used in the modern era to supply cities with water. Among other cities, Bangalore introduced a rule requiring all new buildings to have water harvesting systems.

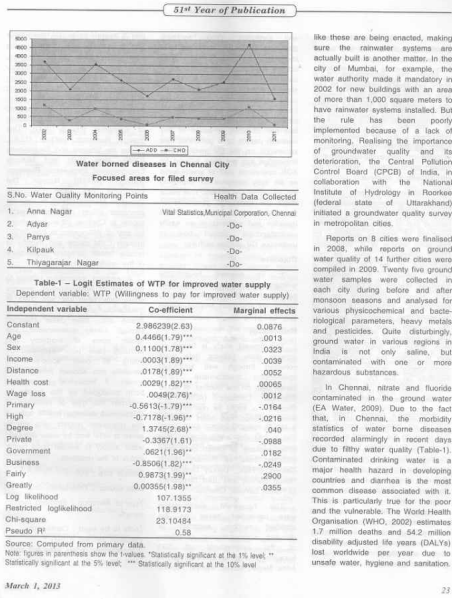
According to calculations by the municipal administration of Bangalore, rainwater would cover the city's water needs for six months every year. The rule will be extended to all cities in the federal state of Karnataka in 2011. The state government is also considering a water bill rebate for citizens who install such systems in their houses. However, even though regulations

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Almost all of these deaths are in developing countries and nine out of ten deaths occur in children.

Under this circumstance, it is every individual's preference to use safe drinking water for their domestic use. This study has been carrying out to estimate the household's willingness to pay for domestic water supply by the Municipal Corporation in order to reduce the incidence of water borne diseases among the residents in Chennai.

The scope of this paper does not permit a comprehensive review of the vast and growing literature on CV method and its application. From the viewpoint of practical guidance for estimating reliable WTP, Whittington (1988) pioneered work on the application of the CV method in water services in developing countries. Mitchell and Carson (1989) also provided guidelines for CV practitioners, including a list of questions that should be asked by any decision maker who wishes to use the findings of a CV study. Since then, within the WSS sector alone (not to mention the broader field of environmental economics), much research on the CV method has been carried out, improving the knowledge base overall.

Whittington's papers (1988 and 2000b) are noteworthy contributions that focus on the practical aspects of conducting CV surveys in developing countries. They also provide valuable insights as to why so many CV studies conducted in developing countries are unreliable. This paper draws heavily on the above mentioned papers on practical guidelines for conducting CV surveys. Gunatillake et al. (2008) illustrates that a good practice CV study can help in estimating household demand for water supply and sanitation (WSS) services, designing tariffs and subsidies, and improving performance of WSS utilities. Using the same source of data, van den Berg et al. (2006) show how a CV study finding can be used to assess the validity of the basic assumptions of public-private partnership in water supply. Over the last two decades, a series of key research papers have generated new knowledge on the CV method. This knowledge has not been tailored for ADB operations staff or practitioners as an easy reference for improving the quality of CV studies. This paper details the knowledge generated on the CV method in the last two decades and presents in an easy understandable manner how to undertake CV studies safely.

Objective

1. To estimate household's willingness to pay for domestic water supply in Chennai city using Contingent Valuation Method (CVM) survey.

Methodology

The present study is based on primary data. Primary data were collected through well structured open-ended questionnaire. Time-series data on the number of Acute Diarrheal Diseases (ADD) and Cholera that might be due to urban water pollution has been collected from the Vital statistics department, Chennai Municipal Corporation. The other sections of health data were collected from all Primary Health Centers (PHCs), Deputy Director of Health Service and Joint Directorate of Health Service, Chennai.

The household questionnaire were conducted based on the stratified random sampling of different socio-economic conditions of the respondents of 500 households from different areas of Anna Nagar, Adyar, Parys, Kilpauk and T. Nagar. Each area consists of 100 households (i.e. 100 samples from each area) were collected. Other part of the relevant secondary literature has been collected from various libraries like Madras School of Economics (MSE), Chennai; India Institute of Management (IIM), Bangalore; Energy Research Institute (TERI), Centre for Science and Environment (CSE), New Delhi and National Environmental Engineering Research Institute (NEERI), Nagpur. The researcher has used Contingent Valuation Method (CVM) to estimate economic values of domestic water supply to Chennai urban households by way of Willingness to Pay (WTP) through CVM model and thereby to reduce health foregone expenditure of the residents.

In addition, information relating to the cost of hospitalization, average wage loss, days lost and costs of medication, expenditure to prevent illness etc., have been collected through survey questionnaire. The health costs of morbidity and mortality have been estimated by taking all other socio-economic variables into account through field survey. A household survey has been conducted for five months to ascertain the type of incidence of illness and average health cost. A few regression models were run to arrive at WTP level for water domestic water supply to sustain good health status of the residents.

Sample size : 500

Data source : Time-series data

Type of Sampling : Stratified random sample

Tools to be used : Contingent Valuation Method (CVM) (Economic models like Logit and Tobit are used)

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Contingent Valuation Method (CVM)

The researcher used regression models in which the dependent variable or response variable itself can be dichotomous in nature. Basically, it is a 'Yes' or 'No' type answer received from the respondents with regard to improvement of the urban domestic water supply. We use 1 or 0 value to measure this. In this question, some of the respondents are willing to pay and some are not. To estimate and infer problems, we use Logit model. We have to classify all categories according to their actual contribution in terms of rupees to improve domestic water supply. To measure the actual contribution for the respondent's domestic water service for better quality improvement we use Tobit model.

The specification of the Logit equation is,

$$WTP_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 X_{it} + \beta_3 X_{it} + \beta_4 X_{it} + \beta_5 X_{it} + \beta_6 X_{it} + \beta_7 X_{it} + \beta_8 X_{it} + \beta_9 X_{it} + \beta_{10} X_{it} + \beta_{11} X_{it} + \beta_{12} X_{it} + \beta_{13} X_{it} + \beta_{14} X_{it} + \beta_{15} X_{it} + \beta_{16} X_{it} + \beta_{17} X_{it} + \beta_{18} X_{it} + \beta_{19} X_{it} + \beta_{20} X_{it} + \beta_{21} X_{it} + \beta_{22} X_{it} + \beta_{23} X_{it} + \beta_{24} X_{it} + \beta_{25} X_{it} + \beta_{26} X_{it} + \beta_{27} X_{it} + \beta_{28} X_{it} + \beta_{29} X_{it} + \beta_{30} X_{it} + \beta_{31} X_{it} + \beta_{32} X_{it} + \beta_{33} X_{it} + \beta_{34} X_{it} + \beta_{35} X_{it} + \beta_{36} X_{it} + \beta_{37} X_{it} + \beta_{38} X_{it} + \beta_{39} X_{it} + \beta_{40} X_{it} + \beta_{41} X_{it} + \beta_{42} X_{it} + \beta_{43} X_{it} + \beta_{44} X_{it} + \beta_{45} X_{it} + \beta_{46} X_{it} + \beta_{47} X_{it} + \beta_{48} X_{it} + \beta_{49} X_{it} + \beta_{50} X_{it} + 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has to be done to improve the water quality in order to improve their healthy life. The variable Education at Primary and High school level has the negative sign and significance. Thus, education may also be interpreted as a proxy for the quality drinking water consciousness among the respondents. As the education level goes up the probability of WTP for water quality improvement rises up. This is very evident at Degree level education.

Conclusion

The increasing threat posed to human health as a consequence of deteriorating water quality in Chennai has become burning issue in recent years. This research paper has attempted to introduce referendum user fee for water in order to improve water quality by the way of WTP. The results of the WTP indicate that health cost and preventive cost per household has increased drastically due to contaminated water. The survey result shows that the respondents are well aware of present water quality and the necessity of their participation to restore the same. The study results also give a positive scope for charging user fee. Most of the WTP studies carried out in developing countries in the past have been mainly limited to the estimation of user's mean WTP and sometimes been controversial.

This research has attempted to extend the use of WTP survey results indicating that charging for improving the water quality for Chennai may not have negative impact amongst the public. In this case of observed behaviour method, the assumptions made about the use of WTP for water

quality improvement services may be far from true in the developing Countries. The paucity of adequate data on the degree of water pollution and its effects on people's health cannot screen the fact. Generally, the community and nature in general can only be speculated but the fast deteriorating trend of the water quality of the city can never be denied. If the present trend of quality water shortage continues to exist in future without taking preventive steps to control it, the society's cost of health expenditure may give huge burden among the people.

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