

# Valuing Benefits of Environmental Improvement: The Case of the Buriganga River in Bangladesh

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**Abstract:** *The paper examines the application of the contingency valuation method (CVM) for estimating the benefits of the cleanup of polluted and degraded areas in developing countries. The traditional method, which is based on the Western concept of "willingness to pay", is being questioned in terms of its applicability for societies where the market mechanism is not fully developed. An alternative approach, based on "willingness to contribute" (in non-monetary terms) is being suggested. The new concept is tested with empirical information collected in 2001 through a survey of 400 households living around the dying river Buriganga in Dhaka, Bangladesh. The people surveyed were given a scenario for the improvement of the ecological health of the river using a variety of technological solutions and were asked what their willingness to contribute was. The major finding of testing this approach is that it gives a much better picture of the real value of environmental improvement.*

**Keywords:** Contingent valuation; passive use value; willingness to pay, willingness to contribute, Buriganga river.

## 1. Introduction

The contingent valuation method (CVM) has long been used to model the value of non-market goods and services, such as the cleanup of polluted land sites or preservation of natural parks and endangered species. Traditionally, the CVM is based on the market thinking in order to estimate benefits (direct, indirect or passive) which have no market value.

It uses survey techniques to elicit monetary values. For example, in the case of an environmental improvement respondents are asked the maximum amount of money they are willing to pay (WTP) for the work to be carried on or the maximum amount they are willing to accept in compensation to forgo the expected benefits. Although originated in the West, over the years such modelling of environmental benefits has also been used unchanged in the developing countries where the market economy and associated market mechanisms are not fully developed.

The paper elaborates the CVM to make it more suitable for developing countries and reports results from its application for estimating the benefits from the cleanup of the Buriganga River in Bangladesh. The concept of environmental improvement is defined from a holistic perspective and includes: (i) improving the water quality to such an extent that swimming, fishing and boating can be possible; (ii) adopting regulatory and non-regulatory measures to minimise sources of pollution; and (iii) removing illegal structure to ensure free flow of the river water.

The rest of the paper is organised as follows. The next section outlines the theoretical approach, which is followed by a description of the case study and the survey design. The results from the application of the model are reported in section four and the last section draws the conclusions.

## **2. Theoretical approach**

The economic concept of value is broadly defined as any net change in the welfare of society. This concept does not restrict environmental values to benefits from the direct use of a resource. It rather broadens the horizon to include, for example, benefits from satisfying altruistic desires arising from moral beliefs of individuals or groups. This concept of valuing the environment is being interpreted by economists (Carson and Mitchell, 1989; Munasinghe, 1993 and Turner, 1999) as 'total economic value' (TEV). It distinguishes between use values (e.g. use of resources) and non-use values (e.g. aesthetic beauty). The concept of economic value can therefore be summarised as follows:

Total economic value = use values + non-use values

Use values = direct use value + indirect use value

Non-use values = existence value + option value + bequest value

As an example, table 1 specifies the TEV from the cleanup activities of the Buriganga river (Alam, 2002). The typology illustrates the possible benefits from such environmental improvements (which in the case of Bangladesh could only be achieved through the provision of public funds). Previous research had focussed on one particular aspect rather than adopting a holistic perspective. For example, environmental improvement, cleanup measure or water quality improvement have been perceived as maintaining certain level of flow in the river (Garrod and Wills, 1999), upgrading water quality to a level for 'boatable, fishable and swimmable' (Carson and Mitchell, 1993) or controlling water pollution (Feenberg and Mills, 1980 and Choe, Whittington and Lauria, 1996). The adopted approach in this study is an attempt to cover the total economic value.

A traditional application of the CVM in order to estimate the monetary values of the environmental improvement of the Buriganga river requires residents and members of the public to be asked about their willingness to pay, e.g.: "How much are you prepared to pay to be able to swim safely without any health hazards in the Buriganga water?". Although even a Western respondent may not be at ease in answering such a question, a resident from a developed country will have enormous difficulties in putting a monetary value for something which is either taken for granted or is considered to be somebody else's fault and responsibility. Moreover, a large proportion of the population exists under the poverty line with extremely low levels of pecuniary income. It is therefore not uncommon to get a zero value for the WTP.

In addition, developing countries have not yet adopted full-blown market systems and mechanism such as barter exchange or volunteering services to friends and relatives in need are quite common. There is an obvious deficiency of the CVM, which asks only for monetary values, while money is not the only and dominant exchange mechanism in the everyday life of countries such as Bangladesh. A more appropriate approach is to go back to the basic meaning of money as a measure of the societal usefulness of time (Marx, 1965) and focus on

### **Direct Use Value**

- Water transport (navigation)
- Increased fish production
- Increased food production
- Irrigation
- Educational, scientific and cultural
- Tourism and recreation
- Improved health benefit
- Increased property value

### **Indirect Use Value**

- Riverbank erosion prevention
- Flood control
- Reduced damage to downstream irrigation system
- Ecological function (watershed protection)

### **Option Value**

- Biodiversity

### **Existence Value**

- Clean water from pollution and encroachment
- Aesthetic value

### **Bequest Value**

- Value arising from the knowledge that the river remains healthy and viable and will persist.

**Table 1: Components of the total economic value in the case of the cleanup of the Buriganda river in Bangladesh**

the time Bangladeshi residents are prepared to dedicate for improving their environment. Consequently, the “willingness to pay” model can easily be complemented or substituted by a

“willingness to contribute” (WTC) model (which also includes non-monetary contribution in terms of time). An example of a survey question will then be: “How much time are you willing to contribute to make the Buriganga river safe for swimming?”.

This new approach to the environmental benefits’ evaluation model was tested in 2001 through a survey of 400 households living in the area of the Buriganga river in Dhaka, Bangladesh.

### **3. The case study**

After presenting the site of the study (namely the Buriganga river) we explain the survey designed for the application of the environmental benefits’ evaluation model.

#### **3.1 The site of the case study**

Dhaka, the capital city of Bangladesh, was established on the left bank of the river Buriganga in 1610 and is surrounded by a peripheral river system comprising Buriganga, Balu, Turag, Tongi Khal and Lakhya. A number of water channels (locally known as khals) crossed through and around the city in the past and were of hydrographic importance linking the peripheral rivers mainly with Buriganga. The majority of these khals do not exist any more as they have been filled in due to unplanned development and environmental degradation.

The Buriganga river branches off from Dhaleswari short after Savar, comes through the western and southern sides of the city, then curves rightward to meet again Dhaleswari beyond Fatullah. In fact, Buriganga forms the southern and western boundary of the city.

The river receives a large quantity of waste (both solid waste and wastewater), surface runoff, untreated industrial effluents and treated sewage effluents directly or indirectly from the city. These wastes contaminate the river water affecting its aquatic life. Analysis of long term data from some of the major rivers in Bangladesh shows that Buriganga is more polluted than any other river in the country (DOE, 1993). Most importantly, the quality of the Buriganga river water has been deteriorating. Water quality parameters, such as pH, dissolve oxygen, biological oxygen demand and chloride, hardly satisfy the standards set out by the

Bangladeshi Department of Environment (Alam, 2002). In addition to the pollution problems, Buriganga is also under threat of becoming a 'dead' river in the future. Influential people are grabbing the riverbanks resulting in narrowing of the channel.

Notwithstanding this, Buriganga is extremely important for the city of Dhaka. It provides drainage for its internal waters, it is a source of drinking water, a place of recreation and a number of other human activities. The elaborated CVM was applied to estimate the benefits of a cleanup program which could restore and rehabilitate the river.

### **3.2 Survey design**

A hypothetical cleanup program with non-market benefits was used in a face-to-face survey. The questionnaire included attitude, knowledge and behavioural questions. The hypothetical environmental improvement was outlined to the respondents by a scenario specifying the technologies to be used, the goods and services to be affected, the actual or likely change in provision of the amenity, the organisation providing the amenity and the method of payment. Respondents were then asked for their valuation in monetary and time terms, contingent on the scenario described to them.

A random sample of 400 households was drawn from the approximately 1,107,474 households within Dhaka City (BBS, 2001). A stratified simple random sampling procedure was adopted to select the random sample from a population of 5.38 million (BBS, 2001). The 15 districts (thanas) of Dhaka were divided into two constituents: 'Buriganga River area' (i.e. boarding on the river) and 'outside Buriganga River'. This division was required to make the sampling more representative and to examine any difference of opinion between the two regions. The sample of 400 households was then allocated to the seven randomly selected thanas in proportion to each thana's population (resulting in 42-75 households being assigned to each thana). Two wards from each thana and two mohallas from each ward were selected, resulting in 14 wards, 28 mohallas and 400 household from the seven thanas. In cases where several families were living in one sampled house, we randomly choose only one household. The survey was conducted between March and June 2001. The overall response rate was 95.45%. The results of the survey are discussed in the section to follow and the funds which could be potentially available for the project are calculated on this basis.

## **4. Survey results and analysis**

The survey results are discussed in relation to the WTP, WTC and the estimated total funds for the cleanup of Buriganga environmental project.

### **4.1 Willingness to pay**

From the sample of 400 respondents, 25.5% (or 102 households) are willing to pay for the cleanup program to save the Buriganga river from becoming dead. The difference of opinion in the sample reflects a true difference in the parent population ( $\chi^2 = 96.04$  which is greater than the critical value of 3.84 for one degree of freedom at the 5% level of significance).

The actual amounts of monthly monetary contributions are listed in Table 2. It contains information from 99 households as 3 of the willing to pay households were not in a position to select an actual amount.

In the survey sample, the median<sup>1</sup> monthly amount of the WTP is Tk 51.91 which is a relatively small sum. It should also be noted that 49% of the respondents indicated the lowest category as the amount they were willing to pay for the cleanup program.

### **4.2 Willingness to contribute**

The survey found that many respondents were willing to support the environmental improvement project, but when the question about their WTP was asked, a substantial portion of them (about 75.25%) were unwilling to commit any monetary contribution because of their financial inability. This outcome was anticipated. The inclusion of the willingness to participate question (respondents were asked whether they were willing to contribute their

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<sup>1</sup> There has been considerable debate as to whether the mean or median WTP should be chosen as the appropriate welfare measure. Imber, Stevenson and Wilks (1993:83) argue that “(w)hile the mean may be logically correct for use in benefit estimation for benefit-cost analysis, the median is the preferred measure in practice”. Nevertheless, we decided to use the median because of the following two reasons: (1) it is closer in value to the majority of the observations and resistant to both outliers and skewness; (2) one of the class intervals for the amount of monetary contribution is open-ended; i.e, it does not have a finite upper limit.

own time for the environmental improvement) helped reveal more information about the non-monetary value of the project.

Monthly amount	Midpoint (Tk)	Frequency	Cumulative frequency
> TK 2000	3000	3	3
TK 1001-2000	1500.5	0	3
TK 501-1000	750.5	2	5
TK 201-500	250.5	10	15
TK101-200	150.5	8	23
TK 51-100	75.5	27	50
TK 1-50	26	49	99
		n=99	

Tk – taka, national currency of Bangladesh

**Table-2: Distribution of the willingness to pay responses**

The proportion of respondents willing to contribute their own time was 32.75%. They were also asked how much hours they were prepared to dedicate to the cleanup of the Buriganga river. This information together with data on monthly household income was used to transform the WTC into monetary terms. Respondents' mean value of WTC was estimated to be Tk 62.04 per month. It is interesting to note that this amount is higher than the direct monetary contribution. It was also observed that households with lower income were more likely to reject the WTP and propose the WTC. In other words, the estimated WTC amount could in real terms be of a much higher value.

### 4.3 Total estimated project funds

The estimated monthly amounts for monetary (Tk 51.91) and time (Tk 62.04) contribution for the cleanup of the Buriganga river by the surveyed residents of Dhaka can be extrapolated for the whole population of the city. Table 3 does this for one year. The estimated total annual funds to be available for the cleanup project is Tk. 445.93 million (US\$ 7.96 million). This is a considerable amount on money, particularly taken into consideration that the 2000

annual per capita income in Bangladesh was only US\$387. Such an information could be extremely valuable for the Bangladeshi government or any decision making body. The application of the developed model allowed for the residents of Dhaka to voice the importance of saving the river and to accommodate its non-market value into a monetary economic framework.

<b>Category</b>	<b>Amount in Tk</b>
Household's WTP per month (mean) (Proportion of households WTP)	51.91 25.50%)
Total number of households in Dhaka City	1,107,474
Annual value of monetary contribution by Dhaka residents	175.91 million
Household's WTC per month (mean) (Proportion of households WTC)	62.04 32.75%)
Annual value of time contribution by Dhaka residents	270.02 million
<b>Total estimated annual value of project funds</b>	<b>445.93 million</b>

**Table-3. Estimated annual value of the cleanup project for the Buriganga river**

## **5. Conclusion**

The paper examined the plausibility of the application of CVM in Bangladesh. The results from the face-to-face survey showed some revealing outcomes which are not only contrary to the conventional wisdom, but also add a new dimension to the application of the CVM in the developing countries.

The major findings of this investigation are that not only a significant proportion of the respondents are willing to pay for environmental improvements, but an even larger share are also willing to contribute in non-monetary ways. When this contribution is monetised, it is estimated that the residents of Dhaka are willing to invest around Tk 450 million annually to improve the environmental health of their main river. A failure to consider the value of such

benefits to the community in the decision-making calculus could lead to gross under-estimation of the importance of undertaking environmental improvement activities.

## 6. References

- Alam, M.K. 2002. "A Framework for the Cleanup of the Buriganga River in Bangladesh" *Development Review* (forthcoming).
- Bangladesh Bureau of Statistics (BBS). 2001. *Population Census 2001*, Preliminary Report, August, Dhaka.
- Carson, R.T., and R.C. Mitchell. 1993. "The Value of Clean Water: The Public's Willingness-to-pay for Boatable, Fishable and Swimmable Quality Water" *Water Resource Research* 29(7): 2445-2454.
- Choe, K.A., D. Whittington, and D.T. Lauria. 1996. "The Economic Benefits of Surface Water Quality Improvements in Developing Countries: A Case Study of Davao, Philippines" *Land Economics* 72(4): 519-527.
- Department of the Environment (DOE). 1993. *Water Quality Data of Rivers Buriganga, Medhna, Balu, Sitalakhya and Gamuna (1981-90)*. Dhaka: Government of Bangladesh.
- Feenberg, D., and E.S. Mills. 1980. *Measuring the Benefits of Water Pollution Abatement*. New York: Academic Press.
- Garrod, G., and K.G. Willis. 1999. *Economic Valuation of the Environment: Methods and Case Studies*. Cheltenham: Edward Elgar.
- Imber, D., G. Stevenson, and L. Wilks. 1993. *A Contingent Valuation Survey of the Kakadu Conservation Zone*, RAC Research Paper No. 3. Canberra: Resource Assessment Commission.
- Marx, K. 1965. *Capital: A Critique of Political Economy. The Process of Capitalist Production*. London: Lawrence and Wishart.
- Munasinghe, M. 1993. "Environmental Issues and Economic Decisions in Developing Countries" *World Development* 21(11): 1729-1748.
- Turner, R.K. 1999. "The Place of Economic Value in Environmental Valuation". In I.J. Bateman, and K.G. Willis (eds) *Valuing Environmental Preferences: Theory and Practice of the Contingent Valuation Method in the USA, EC, and Developing Countries*. New York: Oxford University Press.