# Government – community – private partnerships for maintaining ecological health

M. Khorshed Alam* and Dora Marinova

Institute for Sustainability and Technology Policy (ISTP), Murdoch University

Address: South Street, Murdoch,
WA 6150, Australia
* fon: (61 8) 9286 1504 (H),
(61 8) 9360 6293
* fax: (61 8) 9360 6421
e-mail: khorshed@murdoch.edu.au
marinova@murdoch.edu.au

## Abstract

*Many cities and towns throughout the world are established and developed on the banks of rivers. People have long relied on rivers for trade, transportation, fishing and recreation as well as for cleaning and waste removal and decomposition. Historically, the Buriganga River has helped create the conditions for urbanisation in Dhaka, the capital of Bangladesh. As its physical nature is being constantly changed by human intervention, it has become a dying river both hydrologically and biologically. Being a developing country, the Bangladesh government and the city authorities are finding it difficult to provide the funds for cleaning up the river and prevent further pollution. Based on an extended contingency valuation approach, the paper argues that there are resources available within the community which can be mobilised to deal with this paramount problem. It also proposes government-community-private sector partnerships for restoring the ecological health of the river as well as eliminating or abating the potential sources of pollution. Part of this model is a decentralised system for waste collection, processing and management.*

## Introduction

Many cities and towns throughout the world are established and developed on the banks of one or more rivers mainly because of easy riverine communication. Rivers have provided humans with food, water, recreation and sites for settlement for thousands of years. In addition to facilitating livelihood, sustenance and transportation, rivers are also used for cleaning and disposal of the waste created by humans. The location of industries and factories on riverine sites has treated the rivers as a "natural sink" – for both solid waste and industrial effluents. They are also used as municipal waste dumps. The carrying capacity of the rivers and their ability to regenerate have not been considered until significant damaged had been done to many river systems. Industrialisation, population growth in the catchments as well as human-made intervention in the natural riverine environment have contributed to the destruction of the ecological systems of many rivers. For example, alterations of the river systems include among others canalisation, construction of concrete walls and dams on river routes, control and regulation of the water flow (Maddock 1999, Karr and Chu 2000), which have consequently caused loss of habitat and hydrological problems. In developing countries, such as Bangladesh, the use of rivers as sewer drains and tanks, compartmentalisation of catchment areas, construction of unplanned embankments and other flood control structures, encroachment of the river banks have become an issue with a major negative environmental impact.

In the last fifty years or so, national and local governments throughout the world have attempted to restore many degraded rivers and alleviate some of the ecological damaged being caused to their environment. This is traditionally perceived as a public responsibility with very limited contribution from the private sector. The issue is particularly difficult to tackle in developing countries where environmental restoration

activities compete with other priorities such as poverty alleviation, education or health. The scarcity of financial resources in these countries, including in the public domain, is often an unsurmountable barrier to the establishment of projects aimed at improving the ecological health of rivers. One particular problem the authorities often encounter is to evaluate the desirability of public funding for such restoration programmes. There is hardly any information about the desirability and benefits, particularly non-market benefits, that such activities can generate. This makes it difficult to assess the viability of undertaking any river restoration programme.

The rest of the paper focuses on one particular case of environmental restoration, namely the Buriganga River which passes through Dhaka City, the capital of Bangladesh. Firstly, it argues that there are potential resources available within the community that can be mobilised to fund the cleanup of the river. Then it adopts a holistic approach to its ecological restoration and provides a cost-benefit analysis based on the valuation of market and non-market benefits. Finally, it proposes government-community-private sector partnerships for restoring the ecological health of the river as well as eliminating or abating the potential sources of pollution. Part of this model is a decentralised system for waste collection, processing and management.

## The Buriganga River

The Mughul ruler established Dhaka City on the bank of the Buriganga River as a provincial capital not only because of its strategic location in the then Bengal, but also because of its importance for riverine communication, water supply, flood control and drainage capabilities. It forms part of the riverine network which supports the livelihood of present-day Bangladesh. The Buriganga River is an important part of Dhaka City's urban landscape, ecology and economy. It has influenced the location of early settlements, been sources of water and served as a major transportation route. Until the 1960s, the development of Dhaka City was concentrated only on the north-eastern banks of the river but in the 1970s, after the country's independence, it started to expand towards the north due to heavy population pressure on the periphery of the river.

The river was once a natural free-flowing stream which provided many beneficial uses, such as water supply, groundwater recharge, recreation and fisheries. It was used for agricultural, sanitary and industrial purposes. Always a threat through periodic floods, the river remained an intrinsic part of the city until the early 1980s. However, since the 1980s, intensive human interventions have greatly influenced its flow and function. Once determining factor for urbanisation, trade and source of industrial growth (predominantly small and medium scale enterprises), it was later degraded by industrial and residential developments along its banks and in its catchment.

The situation deteriorated further because of the lack of proper solid waste management and sewerage disposal system in the city, particularly in the vicinity of the river. Furthermore, a group of unscrupulous people started to grab the off-shore land since the early 1980s building illegal encroachments without any waste disposal and sanitation facilities. The indiscriminate dumping of domestic and industrial wastes, the failure on the part of the authorities to enforce rules and regulations pertaining to the ecological health of the river further aggravated the situation. As a result of all these actions and non-actions, the Buriganga River is dying biologically and hydrologically.

There is a large public outcry as well as pressure to cleanup the river. Its deteriorating condition has received enormous media coverage in the last few years. Since 2000, a group of civil society, titled *Buriganga Bachao Andolon* (Save the Buriganga) has been very active to generate pressure on the regulatory authority to take steps to

cleanup the river. Owing to this public demand, the authorities have taken steps to demolish some of the illegal structures. However, this process lacks political commitment. Furthermore, many believe that demolition of illegal structures alone will not solve the overall problems the river is facing. The list of required remedial measures includes: demarcation of the offshore land, introduction of improved solid waste management, waste water treatment, riverbed dredging, construction of access roads and expansion of sewer lines for residents along the river. The public authorities lack financial and other resources to carry out all these activities. The pertinent questions here are: first, can such resources be generated, and second, whether investing in the cleanup of the dying river is socially desirable and economically viable.

The restoration of the river environment will bring the opportunity not only to improve the ecological health of the river but also to redevelop the whole city around a living resource. The areas of Dhaka located around the river are currently the worst parts of the city – they are old, industrial, worn out, highly polluted and lack sanitation facilities. If the health of the riverine environment is improved, there is the potential to turn the city around and make the river an asset, instead of a sewer. This will rejuvenate and stimulate the redevelopment of all adjacent areas, including residential, industrial and public spaces.

Having this in mind, a household survey based on the extended contingent valuation technique (Alam and Marinova 2002) was conducted in 2001 in Dhaka to estimate the importance to city residents of the ecological restoration of the Buriganga River and their preparedness to contribute to its potential cleanup. Starting from a willingness-to-pay framework, the survey asked 400 respondents about their direct monetary contribution for a 10-year programme to clean up the river (hereafter the Burriganga River Cleanup Programme). Considering the fact that many of the respondents (representing Dhaka dwellers) are extremely poor and that a large section of the economic activities in Bangladesh are still non-monetised, the survey also asked about willingness-to-contribute time to the cleanup programme. This new approach was able to provide a voice and solicit contribution from the extremely poor and unemployed residents of Dhaka for whom the value of any environmental improvement may even be of higher importance than that of affluent people. Both contributions, i.e. in terms of money and time, were then monetised which generated a considerable amount of untapped resources within the community (Tk 5046 million) for improvement of the ecological health of the river.

## Financial Viability of the Buriganga River Cleanup Programme

The purpose of this analysis is to examine the desirability of the public funding for the cleanup of the ecologically endangered river under the conditions of a developing country's economy where in general investment for intangible benefits (such as clean water or aesthetical amelioration) are considered to be non-economic. It has three components: 1) benefit flow – constructed on the basis of the household survey and secondary data using market information and the benefit transfer approach; 2) cost flow – constructed using market information; and 3) extended cost-benefit analysis to bring together all the information into an economic cash flow.

### Benefit Components

The potential benefits from the Buriganga River Cleanup Programme are both direct and indirect. Residents derive direct benefits through market transactions and they include (i) increased housing and land values; (ii) improved health benefits; (ii) cost saving for domestic and industrial water uses; (iv) increased navigation; (v) increased value of

recreation and tourism activities; and (vi) increased fish production. The estimated benefit components are shown in Table 1 for a period of 10 years (each component shows the aggregate figure for the ten year period in 2001 prices). The indirect benefits do not pass through any market and therefore do not bear any price tag and were estimated using the extended contingent valuation technique (as already explained). The time contribution was converted into money unit using current wage and salary information in Bangladesh. The indirect (or non-market benefits) are also presented in Table 1 together with potential revenue that the programme can generate. The latter includes a levy collected from the tannery industries located along the river (for services of a waste water treatment plant) and sales from solid waste services.

*Table 1: Total benefit of the Buriganga River cleanup programme (Million Tk)*

| Components of benefit | Price | % of column total |
|---|---|---|
| *Market benefits:* | | |
| Increased housing and land value | 4366.01 | 28.97 |
| Improved health | 127.33 | 0.85 |
| Cost saving for domestic and industrial water uses | 1078.70 | 7.16 |
| Increased navigation | 23.60 | 0.16 |
| Increased value of recreation and tourism activities | 17.00 | 0.11 |
| Increased fish production | 6.05 | 0.04 |
| Total market benefit: | 5618.70 | 37.29 |
| *Non-market benefits:* | | |
| Willingness to contribute money | 2289.62 | 15.19 |
| Willingness to contribute time | 2756.37 | 18.29 |
| Total non-market benefit: | 5045.99 | 33.49 |
| *Other revenue:* | | |
| Net sales revenue from solid waste service | 4359.28 | 28.93 |
| Levy collected from tannery industries | 44.40 | 0.29 |
| Total benefit | 15068.36 | 100.00 |

Because of the magnitude of its importance and long-lasting difficulties in its management, the solid waste collection and treatment (with the potential revenue) will be addressed separately in the last section of the paper addressing the implementation of the cleanup programme.

The total benefit of the BRCP is estimated as Tk 15068.36 million for a period of ten years. The share of non-market benefit is 33.49 percent compared with 37.29 percent of market benefit for the period of the programme. The extended contingent valuation study reveals that despite the fact that the study area is an extremely poor economy and many of the respondents are illiterate, a large sum of investable funds can be generate from the community. In other words, there is a potential for partnerships between the community and the government for addressing the issues of the environmental health of the Buriganga River.

## Cost Components

Most prices of the cost components of the cleanup programme are expected to be available in the market. However, as such research is in its infancy in Bangladesh, information on some costs is difficult to obtain. For the purpose of this analysis, information was collected from recently published or available documents prepared by government departments in Bangladesh. In cases where appropriate proxies had to be used (because of information scarcity), some adjustments were made after consultation with departmental experts. The main cost components for the Buriganga River Cleanup Programme include (i) removal of illegal structures from the river and construction of an access road; (ii) solid waste management; (iii) wastewater treatment; (iv) improved sewerage service; and (v) river-bed dredging and construction of landing facilities. The estimated cost components (in 2001 prices) are presented in Table 2 for a period of ten years.

*Table 2: Total cost of the Buriganga River cleanup programme (Million Tk)*

| Components of cost | Total cost | % of column total |
|---|---|---|
| Removal of illegal structures and construction of an access road | 957.69 | 23.48 |
| Establishment of wastewater treatment plant | 2323.35 | 56.96 |
| Improvement of sewerage facilities | 283.20 | 6.94 |
| River-bed dredging and construction of landing facilities | 514.56 | 12.62 |
| Total cost | 4078.80 | 100.00 |

The total cost (financial) is estimated at Tk 4078.80 million in 2001 constant price which is significantly lower than the estimated benefit (just above a quarter of the benefit).

## Cash Flow

Both, estimates of benefit and cost are in market price. However, market prices do not reflect the 'opportunity cost of capital' because of the existence of the market imperfections and policy distortions in the economy (developing countries are particularly susceptible to this). This required appropriate adjustments to convert financial prices into economic values. Also, the total cost of each component is divided into two broad categories: investment cost and operation and maintenance cost. Investment costs are the costs incurred in establishing the cleanup programme, and include costs of equipment, construction, manpower and land. Operation and maintenance costs are those incurred in running and maintaining the programme, and include raw materials, manpower, utilities, equipment hiring, and repair and maintenance. All items of the cost components are divided into tradable and non-tradable categories as tradable and non-tradable goods and services are required to be valued in different ways. Non-tradable goods are valued at shadow prices while tradable goods are valued at border prices (Abelson 1996). Table 3 represents the economic cash flow of the cleanup programme.

The summary statistics of the economic analysis of the Buriganga River cleanup programme are the net present value (NPV), internal rate of return (IRR) and benefit cost ratio (BCR). These are also presented in Table 3. The discount rate is 15 percent as determined by the Bangladesh Planning Commission and an inflation-adjusted real rate is estimated at 10.11 percent per annum.

Therefore, the BRCP will be acceptable if the IRR is above 10.11 percent, or if the NPV is positive, using a 10.11 percent discount rate as a measure of the social opportunity cost of capital. The NPV at 10.11 percent discount rate is Tk 6100.89 million ($107.03 million). The IRR is 822 percent, which is well above the opportunity cost of capital of 10.11 percent. The BCR is 4.24 at 10.11 discount rate. All three criteria of the ECBA are satisfied. Therefore, it can be concluded that the Buriganga River Cleanup Programme is economically viable.

*Table 3: Economic cash flow of the Buriganga River cleanup programme (Million Tk)*

| **Items** | **Figures in Millin Tk** |
|---|---|
| Investment items: | |
| Skilled labour | 26.24 |
| Unskilled labour | 29.38 |
| Tradables | 849.45 |
| Non-tradables | 850.18 |
| Total investment cost: | 1755.25 |
| Operation and maintenance items: | |
| Skilled labour | 57.04 |
| Unskilled labour | 88.29 |
| Tradables | 179.20 |
| Non-tradables | 351.60 |
| Total operation and maintenance cost: | 676.13 |
| Contingency: | |
| Tradables | 28.66 |
| Non-tradables | 104.46 |
| Total contingency cost: | 133.13 |
| Grand total (cost) | 2564.50 |
| Total benefit | 15068.36 |
| Net benefit | 12503.86 |
| NPV @ 10.11% = Tk 6100.89 Million<br>IRR @ 10.11 discount rate = 822<br>BCR = 4.35 | |

## Implementation of the Buriganga River Cleanup Programme

The extended cost-benefit analysis above indicates that the benefits of the environmental restoration of the river outweigh by far the costs. Nevertheless, the implementation of the various components of such a programme will require partnerships between the government (to provide the initial funds for starting off the programme, collect the funds from the community and to oversee its implementation), the community (to contribute its time) and the private sector (to take on board the business opportunities created by the programme). Without establishing such a partnership it will prove difficult if not impossible to mobilise the available resources.

Almost each area of potential benefits and costs requires such partnerships, however we will only provide an example in relation to the waste collection, treatment and management. The Dhaka City Corporation (DCC) is currently responsible for solid waste collection and disposal in Dhaka City. The DCC also has to arrange the sweeping of about 2395 km of roads, streets and footpaths and cleaning of about 2463 km of open drains every day. It has failed to provide these services properly. A number of studies have been conducted over the last few years (e.g. Enayetullah 1995, Hamid and Huq 1999) and almost all conclude that (i) it is not possible on the part of the DCC to provide a solid waste management service for a population of about 10 million within an area of 360 sq km; and (ii) private sector participation and decentralisation are inevitable.

Taking these findings into account, a government-community-private sector partnership is proposed for the solid waste management in Dhaka City. In the private sector some local initiatives have emerged to be innovative, locally appropriate, sustainable and viable both from

institutional and financial point of view. Two pertinent initiatives are described below.

- **Community-based Organisation (CBO):** Over the last few years, local community-based initiatives of house-to-house collection of solid wastes have taken place in many parts of the city. These emerged due to the failure of the DCC to deliver the service. These initiatives are taken mainly by community-based organizations (CBOs), in some cases instigated by the local ward commissioners because of high public demand. These CBOs provide door-to-door collection of waste and then dump it in the community bins to be finally collected by the DCC for disposal into landfill areas. The CBOs charge between Tk 10 to Tk 100 monthly to every household as a service charge. From the perspective of the resident, this system is exceptionally valuable as the neighbourhood is cleaned. However, these initiatives do not match the design of the DCC's communal bins and their timing of waste collection from community bins. In effect, the waste is transferred to a secondary collection point, such as dustbins provided by the DCC or litters the streets. As a result, more waste remains uncollected inside and near community bins. Also, CBO's initiative focuses totally on house-to-house collection of waste, and does not encourage the sustainable use of resources including the 4R's concept (i.e. reduce, reuse, recycle and recover). In effect, Dhaka City needs to reuse wastes as much as possible as the waste causes problems, such as landfill management and waste collection.
- **Government-Private Sector Partnership:** *Waste Concern*, a private sector organisation, has recently initiated a pilot experiment designed to convert organic waste into compost with high economic value. In an attempt to search for an alternative low-cost and sustainable solid waste management, *Waste Concern (WC)*, for the first time in 1995, initiated a pilot barrel-type composting project in two slum areas in Dhaka City (see Box 1). The conventional approach of solid waste management is based on the concept of 'collection-transport-dumping of waste'. By comparison, the WC's approach is based on the concept of 'resource recovery, minimisation and recycling'.

The Buriganga River Cleanup Programme can adopt and replicate the WC model for the whole of the DCC which will be a significant move towards an efficient and sustainable solid waste management for Dhaka City. The role of DCC will be to supervise and monitor the work of the WC, carry waste from community bins to landfill areas and manage landfills. The community will also need to continue with its contribution for waste collection in the respective neighbourhoods. The partnerships will be able to generate revenue through the sales of compost. They will also provide additional employment opportunities, develop local knowledge and skills and increase social and environmental responsibility of the residents of Dhaka.

**Box 1:**

**Waste Concern (WC) – a success story of waste management at the local level**

More than 80 percent of the solid waste in Dhaka City is organic (bio-degradable) and contains high moisture levels. Therefore, there is enormous potential to convert the organic portion of the waste into compost, an organic fertilizer which can be used to improve the ability of soil to retain water and resist soil erosion. In the past, the Dhaka City Corporation has not conducted any research to investigate the potential for converting this useful solid waste into resources. Processing of waste in order to produce compost is also important for decreasing the amount of space it occupies at its disposal. This has enormous economic and social importance in an agrarian society as the organic compost of waste can be converted into organic fertiliser and can create significant employment opportunities.

This is what the WC has been doing on a pilot scale. The WC is using an aerobic composting technique. In this process, organic waste is heaped into piles which allows the beneficial microorganisms to decompose the organic waste efficiently. This process takes 45 days, subject to maintaining the temperature and moisture at a given level. At the end, quality fertilizer compost is made from trash. This pilot experiment has been proven to be technically sound and is commercially viable.

A replication of the WC experience throughout Dhaka City would provide significant improvement of solid waste management and reduction of air and water pollution, health risks and waste-volume requiring disposal at the final dumping sites. Thus, composting of solid wastes appears to be a promising way of turning waste into treasure.

## Conclusions

The total benefits of the cleanup programme of the Buriganga River outweigh total costs. From the society's point of view, such river restoration programme is found to be worth undertaking. Thus, the proper valuation of non-market environmental goods and integration of the total value within the economic analysis has significant policy implications insofar as it takes into account the unpriced or underpriced outcomes of a proposed policy decision. This study also shows that investable funds can be generated within community, despite many believe restoration of rivers in developing countries is "predominantly a matter of luxury" (Nienhuis and Leuven 2001: 91). They can afford to put significant sum of money in restoring rivers, because humans could not live without rivers. The successful implementation of such a holistic environmental programme, however, will require commitment from all sectors of society and a useful model to achieve this are government-community-private partnerships.

Although the focus of the analysis of this paper was on the ecological health of a river in a developing country, the approach taken can be extended to any environmental problem in any country. The market rationalist assessment of the importance of ecological health is not adequate as it hides the values community assigns to the natural environment and the potential power it has to contribute for its restoration and preservation.

# References

Abelson, P. (1996), Project Appraisal and Valuation of the Environment: General Principles and Six Case-studies in Developing Countries, London: Macmillan.

Alam, K., Marinova, D. (2002) Valuing Benefits of Environmental Improvement: The Case of the Buriganga River in Bangladesh, in S. Karner and B. Wieser (eds) Proceedings of the International Summer Academy on Technology Studies: Technology and the Public, Deutschlandsberg, Austria, pp. 169-176

Enayetullah, I., (1995), "A Study of Solid Waste Management for Environmental Improvement of Dhaka City", Unpublished Masters Thesis, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology, Dhaka.

Hamid, N. and Huq, S., (1999), "Introduction", in N. Hamid and S. Huq (eds), Reforming Dhaka City Management, Vol. III, Dhaka: Asian Development Bank, pp: 1-12.

Karr, J. R. and Chu, E. W. (2000), "Sustaining Living Rivers", Hydrobiologia, 422/423: 1-14.

Maddock, I. (1999), "The Importance of Physical Habitat Assessment for Evaluating River Health", Freshwater Biology, 41(2): 373-391.

Nienhuis, P. H. and Leuven, R. S. E. W. (2001), "River Restoration and Flood Protection: Controversy and Synergism?", Hydrobiologia, 444: 85-99.