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SUSTAINABLE ENVIRONMENTAL SANITATION AND WATER SERVICES

## Community based solid waste management

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MANAGEMENT OF SOLID waste is a major concerning issue in the urban centers of developing countries in general and Bangladesh in particular. Waste generation during the last decade of previous century has increased enormously at an average annual rate of 8.96% per capita per year (Choudhury et al, 2002) while the solid waste management and their proper disposal is miserably lagging behind in most of the urban centers in Bangladesh. With the very high density of population and continued inward migration of more people, task of managing the solid waste has become an enormous challenge for Dhaka City, the capital of Bangladesh. Especially with the scant resources in terms of money, skilled manpower and logistics, it is very difficult to handle the bulk volume of solid waste of about 5,500 tons per day generated by 10 million people living in Greater Dhaka City. In spite of extensive unplanned recycling mostly by 'scavengers' for their own economic interest, the Dhaka City Corporation (DCC) can not collect and dispose of more than 50-60% of the total generated solid waste. There is a very low coverage of solid waste collection services, particularly for the poor who receive minimal services, and as a result they often dispose of their solid waste into low-lying areas and storm drains.

Therefore, acting on their own concerns, some individuals have started to organize community groups to deal with the burgeoning problems of solid waste management in Dhaka City. This study presents case study from such initiatives. This community-based initiative provides door-to-door services to the community for a nominal fee and after organized recycling the final disposal of waste is done by that organization.

The solid waste generated in developing countries has very high densities and higher percentage of organic matters compared with the solid waste generated in developed countries. So the management of organic fraction of solid waste is becoming a very important strategic option to minimize severe environmental pollution in many urban centers. The second case study includes the experience of a community-based organization, initiated by a non-government organization (NGO) with support from a donor agency, which introduced pilot barrel type composting plants to manage organic fraction of solid waste in two slums of Dhaka City. This is aimed to bring sustainable solid waste management service with economic benefits within the reach of the slum dwellers.

### Quantity of solid waste

The solid waste in urban areas of Bangladesh is generated by domestic sources, street sweeping, hospitals, commercial and industrial activities. The rate of generation of solid waste in Dhaka City is in the range of about 0.45 kg/capita/day and 0.63 kg/capita/day in the dry and wet seasons respectively. This per capita per day generation of solid waste in Dhaka City is comparable with that of 0.51 kg in Kolkata (Rahman, 1993), but much lower than that of 2.0 kg (Warmer, 1999), US national average. Extensive recycling of solid waste in Bangladesh has contributed most to the reduction of quantity of waste that require collection and final disposal.

### Composition of solid waste

Table 1 shows the typical physical composition of solid waste in Dhaka City collected from bins of residential and commercial areas. It is apparent from Table 1 that the major components these municipal solid waste include organic waste. The organic fractions of solid waste generally comprise of putrescible and non-putrescible material. The putrescible material is generally comprised of food waste (materials emanating from the preparation and consumption of foods), papers, paperboard, yard trimmings and the like, they decompose rapidly, particularly in warm weather, and unless carefully controlled, develop objectionable odours. This organic decomposed waste serves as breeding grounds of disease vectors and is aesthetically unpleasant.

### Collection and disposal of solid waste

With the scanty resources in terms of money, waste collection vehicles, skilled manpower and other logistics, DCC can not practise door to door collection of solid waste.

**Table 1. Composition of solid waste in Dhaka City**

Constituent	% by dry weight	
	Residential area	Commercial area
Food waste	84.5	79.5
Paper	5.5	7.2
Plastics, rubber	1.7	1.5
Textiles	1.8	1.6
Glass, metals, ceramic, grass, other construction materials	6.5	10.2

DCC has about 2,000 concrete bins and about 2,500 corrugated iron sheet bins as stationary containers, and about 410 drop boxes located in the selected areas. The total numbers of waste collection vehicles include about 85 covered and uncovered trucks for emptying stationary containers and also to collect waste from selected waste accumulation points, and about 104 drop box carrying trucks. Households and management of different institutions, commercial and industrial establishments are expected to carry their waste to those above bins/ drop boxes or to the selected communal waste collection points, but are sometimes observed to be deposited into storm drains, low-lying areas and on roadside. There is always lack of maintenance of these bins and drop boxes that often causes dispersion of waste from these containers, resulting in aesthetic problems and odour nuisance. However, there are about 130 community based voluntary organisations working in Dhaka City who provide door to door waste collection services and dispose of their collected waste into the nearest city corporation communal solid waste collection bins/ drop boxes (containers). This minimises the cost of street cleaning and indiscriminate disposal of waste from the households, but the households have to pay taka<sup>4</sup>(Tk.) 10 to Tk. 20 per month depending on the locality they reside. The waste that reaches the city corporation containers or designated waste accumulation places are collected and transported to open dumping sites or low-lying areas for final disposal. The coverage of such service includes only 40% – 50% of total generated waste in Dhaka City. Similar situation exists in most of the urban centres in developing countries. It is apparent from Thapa and Devkota (1999) that developing countries generated about 160 million tons of municipal waste in 1970, which doubled to 322 tons in 1990 and about 30% - 50% of these generated waste left unmanaged. The low coverage mostly includes the slum areas and shanty neighbourhoods. Such uncontrolled disposal of solid waste with high organic materials, in tropical humid climate, is an ideal environment for the survival of pathogens and disease vectors. This poses a serious threat to the public health, the environment and the local economy.

Therefore, acting on their own concerns, some individuals have started to organize community groups to deal with the burgeoning problems of solid waste in Dhaka City. The following section describes two such case studies.

**Case study -I**

The idea of forming a community group for neighborhood cleaning up date backs to late 1995, when Ms. Shanti Ribaru, a sewing instructor by occupation, participated in a motivational training program. Immediately after her training experience, she decided to mobilize the people of a locality, Rayer bazer area, in Dhaka City to launch a community-based solid waste management initiative. During 1996 and the first six months of 1997, she approached many of her neighbors including the elected Commissioner

responsible for the locality with the idea. With persistent effort for long 18 months, she was able to enroll eight other individuals (six businessmen, one office worker and one student/ political activist) as her partners for this initiative. They contributed 1Tk. 31,500 for the proposed initiative. They organize workshops with the resident of the local community emphasizing community role and responsibility to keep the neighborhood clean and environmentally safe. They used a leaflet that gave the details of the initiative including their working plans. Initially 1,300 residents signed up for the services and agreed to pay fees ranging from 1Tk. 5 to Tk. 20 depending on the amount of waste they generate. This community-based initiative provides door-to-door services to the community and after organized recycling the final disposal of waste is done by that organization. It steadily increased the number of subscribers to the initiative. As of the end of March 2001, a total 6,000 household (which is about 75% of the total resident population of that locality) signed up for this service.

To assess the impact of the initiative, 100 randomly selected residents of the locality, who are subscribers to this service, were surveyed (see Table 2). It is apparent from Table 2 that 100% subscriber are satisfied with the services but 5% want more improvement, particularly collection of waste twice a day, disappointed with their once in a while irregularities and/or are offended with the attitude of some waste collectors. 80% respondents feel that their neighborhood has become cleaner and 15% subscribers are not satisfied with the present level of cleanliness, however, 100% of them are willing to continue to pay for the services and feel that the initiative will be sustainable. Clearly, this initiative provides a well-appreciated service to the resident of the Rayer bazer community and improves the aesthetic of the neighborhood. It also generates significant economic activities. Revenue collected from subscribers increased over the life of the project. It increased from Tk. 15,000 (from 1,300 subscribers) in August 1997 to Tk. 22,595 (from 2,300 subscribers) in February 1998. And therefore, created employment for 16 people with a significant amount of surplus fund ranging from Tk. 9,800 in August 1997 to Tk. 12,895 in February 1998. In addition to these subscription fees, they also recover recyclable, which is an organized recycling activity where workers use protective clothing, to acquire additional income.

This is clear from this case study that this initiative is a quite successful venture. It minimizes overall environmen-

**Table 2. Views of the residents**

Question	Answer		
	yes	Yes, but ..	no
Are satisfied with the services?	95	5	0
Is the environment clean?	80	15	5
Are willing to pay?	100	0	0
Will it sustain?	100	0	0

tal degradation and the initiative is economically sustainable.

**Case study –II**

The population of Dhaka City has increased significantly due to huge inward migration of poor people. The deplorable condition of these poor migrants and severe shortage of adequate housing have led to the mushrooming growth of slum and squatter settlement in Dhaka City. More than one-third of Dhaka City’s population lives in slum and squatter settlement. The physical facilities to most of these slums are very poor. The slums in Dhaka City can be divided into two types, namely authorized and unauthorized slums. The unauthorized slums are developed in Government or organizations’ land illegally and therefore, they have no access to any urban facilities. Most of the authorized slums are built in private low-lying or deprived areas. The physical facilities to most of these authorized slums are also very poor. In most cases, there are no roads inside the slum areas. It has already discussed that the city corporation services, particularly solid waste collection service is over burdened, and therefore, simply can not provide services to the slum dwellers, resulting in unhygienic and filthy living condition. Consequently, the development of a strategy is urgently needed to minimize such environmental degradation.

The characteristics of solid waste presented in Table 1 indicate that they contain a huge percentage of organic waste, and hence the low-cost technology for their safe disposal would be production of biogas and/or compost. The composting process involves the microbial decomposition of biodegradable solid waste under anaerobic condition, where microorganism converts the organic fraction of solid waste into a stable end product, called compost. The main objectives of composting are to decompose organic fraction of solid waste to: reduce its volume, weight and moisture content; minimize potential odor; decrease pathogens; and, increase potential nutrients for agricultural application. The composting system can be operated either manually or mechanically, in open pits and windows or in enclosed containers, rotating drums, tunnel and enclosed halls.

The second case study includes the experience of a community-based organization, initiated by a non-government organization (NGO) with support from a donor agency, which introduced pilot barrel type composting plants in two slums of Dhaka City. A specially designed 200 liter capacity bottomless perforated barrel with lid is used as composting plant. The cost of such barrel including the cost of raised constructed base is about Tk. 1,500. In this particular initiative, six households use one barrel to dispose their organic portion of solid waste. Generally solid waste decomposes aerobically into the compost in three months time. Presently the organizing NGO, who supplied the barrel, purchase the compost at Tk. 2 per kg (on wet basis), and thus the cost of the barrel can be recovered

within one year. This NGO is planning to link the compost dealer directly with the slum dwellers in future.

To assess the impact of the initiative, 200 randomly selected residents of the above two slums were surveyed (see Table 3). These survey results revealed that 100% subscriber are satisfied with the services. 98% respondents feel that their neighborhood has become cleaner and 2% subscribers are not satisfied with the present level of cleanliness, however, 100% of them are willing to pay for the reimbursement of the cost of composting barrels and feel that the initiative will be sustainable. It is evident from field survey in a limited experimental area that this initiative appears to be successful both environmentally and economically. However, this technology requires further long-term field verification for their wider application and commercial use in Bangladesh.

The main problems faced to implement this initiative were the lack of adequate access and also the space to place composting barrel in the slum areas. In this initiative, the slum dwellers were motivated by the NGO to realign some of their dwellings for better access and also for the space for placement of barrel. As the slum has no drainage facilities, during monsoon period, water logging was observed, and water percolating into the barrel creates odor nuisance. Raising the constructed bases, for placing the barrels, minimized this problem.

**Conclusion**

This action research evaluates the cost-effectiveness and performance of the community based solid waste management services as practiced in Dhaka City. This also highlights the scope, potentials and problems encountered in these initiatives.

Accelerate unplanned growth of Dhaka City with extreme shortage of capital outstrips the capacity of City Corporation to provide basic services in general and solid waste management services in particular.

This study presents a community-based initiative (case study–I), which provides door-to-door waste collection services to the community for a nominal fee, and after organized recycling (which protect the health of workers involved) the final disposal of the collected waste is done by that organization.

An important policy implication can be drawn particularly from the success of the case study-I that the transfer of

**Table 3. Views of the residents**

Question	Answer		
	yes	Yes, but ..	no
Are satisfied with the services?	100	0	0
Is the locality/ environment clean?	98	2	0
Are willing to reimburse the cost of composting barrel?	100	0	0

proper knowledge and training can play a vital role to motivate some individuals in the community to solve many problems by mobilizing community, even without any support from external resources or donors.

The solid waste in Dhaka City contains a huge percentage of organic waste, and hence the low-cost technology for their safe disposal could be production of compost (case study-II). However, the application of composting technology requires further long-term experimental verification for their wider application and commercial use in Bangladesh.

The community survey results revealed that most of the subscribers (80% in case study-I and 100% in case study-II) are satisfied with the services. And 100% of them are willing to continue to pay: for the services (in case study-I) or to reimburse the cost of composting barrels (in case study-II).

This study reveals that the above two initiatives are sustainable and successful both environmentally and economically. It is also evident from field studies that these initiatives are well accepted by the local community.

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## Note

<sup>1</sup> 1 US dollar (\$) = 58 Bangladesh taka (Tk.)

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