Environmental assessment in slum improvement programs: Some evidence from a study on infrastructure projects in two Dhaka slums

Farhat Jahan Chowdhury a,*, A.T.M. Nurul Amin b

a SEA-UEMA Project, Urban Environmental Management, School of Environment, Resources and Development, Asian Institute of Technology, P.O. Box 4, Klong Luang, Pathumthani 12120, Thailand
b Urban Environmental Management, School of Environment, Resources and Development, Asian Institute of Technology, P.O. Box 4, Klong Luang, Pathumthani 12120, Thailand

Received 1 December 2004; received in revised form 1 September 2005; accepted 1 November 2005
Available online 15 February 2006

Abstract

This paper reports findings from a study on slum improvement projects to show the difference that environmental assessment (EA) can make in such interventions and to suggest mechanisms for its integration into such projects. The findings are based on a field survey that was carried out in two slums of Dhaka where infrastructure projects were implemented. In one slum, the EA process was considered in designing and locating infrastructure and in the other it was not. The survey results traced the severe problems that existed in both slums before the implementation of infrastructure improvement projects and reveal that after the intervention the situation has considerably improved in the slum where EA was conducted. In contrast, some problems still persist in the other slum where EA was not considered. To make it worse, the newly built infrastructures have even given rise to a set of new problems. In order to avoid such negative outcomes from development interventions, the paper finally develops the mechanism for integration of EA into slum improvement project.

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Keywords: Environmental assessment; Slum improvement project; Infrastructure; Environmental problems; Project planning and implementation; Environmental monitoring; Participation

* Corresponding author. Tel.: +66 2 524 8339.
E-mail addresses: farhat@ait.ac.th (F.J. Chowdhury), amin@ait.ac.th (A.T.M.N. Amin).
1. Introduction

The growth of cities in developing countries has been accompanied by a rapid growth of urban inhabitants living in the substandard conditions in slums. Slums are underserviced and or with no service parts of cities where living conditions are often appallingly poor. It is widely acknowledged that slum growth is largely a manifestation of poverty, and that it is impossible to prevent slum settlements where poverty levels are high and urban growth rate is rapid. Slums in the cities of developing countries cannot be wished away. The challenge is thus to find realistic and effective ways for addressing this problem. The United Nations Millennium Summit (2000) in Johannesburg has established a target for improving the living condition of slum dwellers. The Millennium Development Goal (MDG) 7, target 11 requires to achieve a significant improvement in the lives of at least 100 million slum dwellers by 2020 by reducing poverty and improving water and sanitation. From the experiences accumulated over the last few decades, it has been acknowledged that in situ slum upgrading is more effective and should be the norm in addressing much of the slum problems (UN-Habitat, 2003; Islam, 2001). According to Okpala (1999), slum upgrading is a realistic option for urban development and management in developing countries.

Similar to many other developing countries, Bangladesh has experienced a rapid increase in urban population in the recent decades (13.5 million in 1981, 22.9 in 1990, 37.3 in 2000, and 46.4 in 2005), especially since independence in 1971 (Rahman, 2002; CUS, 1999; Islam, 1996a). Nearly 47% of the 33 million urban population live below the poverty line (BBS, 2001). These people mostly live in urban slums and cannot meet the basic needs. In any large city of Bangladesh, slums and squatters accommodate nearly one third to one-half of the city population (Islam, 1996a). The situation is particularly bad in Dhaka where a 1996 CUS (Center for Urban Studies) study identified some 3007 slum and squatter settlements in Dhaka Metropolitan Area (CUS, 1996). Many studies, conducted by the Center for Urban Studies (CUS) and the Urban Studies Program (USP), reveal that the rapid urban growth has caused economic and socio-cultural improvements for some people but it has also led to deterioration in the overall urban environment, particularly causing a low or even substandard living for a very large number who constitute the poor (CUS, 1999; Kalam and Karim, 1998; Islam and Nazem, 1996; Islam, 1996b).

Poverty, high density, the absence of utilities, and lack of infrastructure are common features of urban slums (UN-Habitat, 2003; Islam, 1996a; Miah et al., 1988). The urban poor in general and the residents of slums in particular have been affected most negatively by urban service deficiencies. The environment of slums is extremely unhygienic as they are located at sites such as solid waste dumps, open drains and sewers, low land, embankments, and often along the rail lines (UN-Habitat, 2003; BBS, 1988; CUS, 1976). A study, conducted by CUS on urban poor in 1988, showed that the majority of the slums get inundated during floods. About 65% of Dhaka slums have poor drainage condition (CUS, 1988). There is no evidence that suggests any improvement in such situation. A USP study reveals that in the slums and squatter settlements, a single open pit latrine may have to be shared by even up to 20–25 families (Islam, 1996a).

To address the deteriorated socio-economic and physical environmental conditions of the slums, the government of Bangladesh with the support of different donor agencies has initiated different slum improvement programs. Presently, the Local Government Engineering Department (LGED), the Dhaka City Corporation (DCC), and several municipalities are implementing a number of slum improvement and urban development projects funded by
ADB, UNICEF, World Bank and other development partners. Beside, the Department of Public Health Engineering (DPHE), the CARE Bangladesh, the Asian Disaster Preparedness Center (ADPC), the WaterAid and some NGOs are also implementing development program for slum residents. These programs include infrastructure improvements, hygiene and nutrition education, skill-based training, income generating activities, and community mobilization and awareness campaigns. Among these, infrastructure improvement programs seek to directly upgrade the unhygienic and unsanitary conditions of the slums. Infrastructure improvement programs include the construction of drains and sewage lines, footpaths, latrines or community latrines, garbage disposal bins, drinking water supply, improved housing, flood protection, and street lighting. These improvement programs have a direct impact on the environmental condition in the slums. Construction of infrastructure does not always improve the environment of slums. Some evaluations reveal that government, donor agencies and NGOs often implement slum improvement projects in a piecemeal way without proper assessment, staffing and coordination (Sandhu, 1998; Asthana, 1998; Miah et al., 1988). Instead of solving a problem sometimes an intervention creates adverse impact on the environment.

It is in the above context that environmental assessment (EA) assumes significance. Generally, EA is a tool that integrates environmental considerations into project design and execution (Lohani et al., 1997). A perception however is widespread that EA for small-scale project is neither affordable nor essential. As noted by Glasson et al. (1999, p. 3), many developers see EA yet another costly and time-consuming constraint on development. But that EA rather makes the infrastructural development (irrespective of size) sustainable, through identification and assessment of problems, is not always appreciated. Clark (1984) even argues that EA may rather reduce costs and the time required to reach a decision by avoiding duplication of efforts. Events throughout the world substantiate the view that planning and decision-making systems need a better integration of environmental, economic and social considerations (Clark, 1984). This has assumed even greater significance from the need of assessing all developmental infrastructures from the viewpoint of sustainability (Dalal-Clayton and Sadler, 2005).

At the above backdrops, a study (Chowdhury, 2003) was conducted in two Dhaka slums to investigate possible varied outcomes from interventions (with and without EA) for physical improvement of the slums. This paper is based on the key findings of that study. The rest of it is structured as follows: discussions of EA's value and adoption in small-scale projects (Section 2); a brief review of the EA application status in Bangladesh (Section 3); a profile of the two slums studied and methods of data collection (Section 4); the outcomes from project interventions—with and without EA (Section 5); the reasons for persistence of poor living environment (Section 6); new problems arisen from the project built infrastructure (Section 7); the difference that EA seems to have made (Section 8); the suggested mechanisms for integration of EA into slum improvement programs (Section 9); and the concluding remarks (Section 10).

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1 CARE Bangladesh is one of the largest private, nonsectarian, not-for-profit and development agency dedicated to helping the poorest communities solving their most threatening problem.

2 ADPC is a regional resource center working towards disaster reduction for safer communities and sustainable development in Asia and the Pacific.

3 WaterAid is an international NGO dedicated exclusively to the sustainable provision of safe domestic water, sanitation and hygiene education to the world’s poorest people.
2. EA’s value and adoption in small-scale projects

2.1. Definition, role and steps

EA is important for development projects as it refers to the identification and prediction of impact on the environment. As defined by Glasson et al. (1999), EA is a systematic process that examines the environmental consequences. It basically studies probable changes in the various socio-economic and biophysical characteristics of the environment, which may result from a proposed or impending intervention and thus facilitate sustainable development planning (Mitchell, 2002; Canter, 1996; Jain et al., 1993). As identified by EPA (1992), the overall purpose for undertaking an EA is to seek ways to avoid or minimize adverse effects of a proposed project to the extent practicable, and the maintenance, restoration or enhancement of environmental quality as much as possible. Thus, EA helps in achieving the ultimate goal of a project by formulating a suitable environmental management plan that minimizes adverse effects and enhances positive effects (Haque et al., 2000; World Bank, 1991).

Sadler (1996) identifies three main stages (generic steps) of EA process: (1) preliminary assessment, (2) detailed assessment, and (3) the follow up. Preliminary assessment includes ‘screening’ to establish whether detailed environmental assessment is required and ‘scoping’ to identify the key issues and impacts that need to be addressed and prepare the terms of reference for environmental assessment. The detailed assessment includes impact analysis to (a) identify, predict and evaluate the potential significance of effects and consequences, and (b) identify mitigating measures to minimize, prevent or offset the impacts. This stage also includes documentation of environmental assessment results, decision making or approval of the proposal. Finally, the follow up stage includes monitoring to check if interventions comply with the EA terms and conditions.

From the procedural perspective, EA is a multi-step process and the major steps in this process, in general, are: project design and description, baseline description, scoping, identification and prediction of impacts, assessment and evaluation of significance of impacts, analysis of alternatives, environmental management planning (including plan for mitigation, enhancement and monitoring), EA reporting, and monitoring of the impacts (Glasson et al., 1999; Lohani et al., 1997; World Bank, 1991). Consultation with communities is recognized as key to assessing environmental impacts and is suggested to use at most stages of the process (Glasson et al., 1999; Sadler, 1996; FAP, 1992).

2.2. Adoption of EA in small-scale project

There is a commonly held notion that EA entails additional cost burden on development projects and slows down the progress of implementation. With that in view, many government agencies implement project without EA. Outcomes of EA are viewed as neither beneficial nor essential for implementation of development projects. Proper implementation of EA in the developing countries is largely done in donor-funded projects (Momtaz, 2002). Generally, large-scale infrastructure development projects (e.g. embankments, power plants, dams, highways) require EA as a condition of national and international funding. But, many donor agencies do not explicitly suggest or consider EA for project infrastructures when the main purpose of funding is poverty eradication, promoting education, improving child and maternal health, etc.

In contrast to the general notion that EA is for large-scale projects, Spaling (2003) has stressed EA for community based small-scale development projects. He makes the case based on his experience of projects implemented by the Canadian non-government organizations and their
partners in sub-Saharan Africa. Small-scale projects funded by USAID requires EA (CARE, 2001). Conventional EA is simplified and adapted to community based small-scale development projects to maximize the benefit and reduce the adverse impacts. Examples of such projects are: small community wastewater system, safe water supply, community-based sanitation project, small-scale income generation activities (IGA), waste management, resettlement or any kind of construction project (CARE, 2001; CIDA, 1997; Knausenberger et al., 1996). As one of a number of strategies in support of sustainable development, international agencies have increasingly and forcefully advocated the use of EA studies for projects that they sponsor in the Third World (Brown and Jacobs, 1996). In fact, many donors have made the EA mandatory, as their funded projects experienced some adverse impacts on the environment.

The Integrated Food For Works (IFFW), funded by USAID and implemented by CARE International in Bangladesh, is a case in point in this respect. This project had been designed to implement small earthen roads in rural areas of Bangladesh. In support of USAID, CARE conducted an environmental evaluation study of this project in 1990. Evaluation results showed that this project had created increased flooding problem; of course along with a lot of positive impacts. From this experience, USAID has made conducting EA a requirement for development projects in Bangladesh. The CARE Bangladesh has established an Environment Unit to conduct EA and ensure environmental management of project interventions. It has simplified the EA process for small-scale projects (CARE, 1992, 2001). Similar practice is followed in CIDA funded projects. For example, in meeting the requirements of CIDA for its partnership project with AIT, the SEA-UEMA (Southeast Asia Urban Environmental Management Applications) project has simplified the EA procedure and has been conducting the EA process in assessing the impacts of community based small-scale demonstration projects to make the project environmentally viable (UEM/AIT, 2004).4

2.3. Significance of EA in slum improvement projects

Like other development initiatives, slum improvement programs are heavily dependent on foreign assistance and donation from the national and international organizations (Routray and Pradhan, 1998; Asthana, 1998). It is evident from different studies that slum improvement projects create adverse impact on the local environment and are not able to achieve the desired result if they are not designed with proper environmental considerations. For example, Siddique et al. (1998, p. 217) evaluation of a slum improvement project, implemented by LGED, reveals that the project did not respond to the characteristics of the local land terrain. As a result, the improvements could not produce the expected outcome. Instead, the project created waterlogging and overflow of drains and sewers. Their study showed that in designing physical improvements, the varying environmental conditions, peculiarities of individual sites and the local people’s needs were not considered. Another evaluation study, conducted by Hanchett et al. (2001) on the WaterAid Bangladesh’s urban programs, reveals that many constructed drains were clogged and lacked suitable outlets, and the tube-wells lacked water in some seasons. Sewer problems interfered with proper functioning of some program latrines. Dumping of human waste after cleaning pit latrines and septic tanks is the most difficult environmental problem faced by their urban programs. Hoque et al. (1994) found that the design of double alternating pit latrines, provided by an international development agency, was not well accepted by the urban poor due to the de-sludging function. This activity had contaminated the environment of the urban poor.

4 Both authors are heavily involved in this project’s implementation. The first author is particularly involved in the project’s demonstration component for which EA process has been made compulsory.
Different study results also show that slum improvement interventions cannot always achieve their goals; instead they sometime create environmental problems (Werlin, 1999; Siddique et al., 1998; Sandhu, 1998). Okpala (1999) emphasizes that improved advance planning for the development of settlements would lead to a more sustainable and cost-effective urban development. Brown and Jacobs (1996) suggest adoption of environmental assessment to support the community development process in informal settlements. They conclude that proponents of new development, who have the resources to meet environmental standards, should be expected to undertake EA in their respective intervention; because the cost of dealing with the externalities associated with any development are always greater at a later date.

3. EA application status in Bangladesh

In Bangladesh, EA has been made mandatory through enactment of the Environmental Conservation Act (ECA), 1995 and the Environment Conservation Rules (ECR), 1997. Only industries and large-scale projects received full attention in the ECR '97 with stipulations of full-scale environmental assessment to reduce plausible adverse effects on the environment. The ECR '97 contains a list of projects and industries and classifies them into four categories: Red, Amber A, Amber B and Green according to the significance of impact (GoB, 1995, 1997). Only the ‘Green’ category projects do not require any environmental assessment. Besides this basic legislative base on EA, several government departments and non-government organizations in Bangladesh have prepared guidelines for conducting EA on specific sector or intervention. The Department of Environment (DoE) has prepared EIA guidelines only for industries (DoE, 1997). The LGED prepared a guideline on environmental issues related to physical planning for its rural infrastructure development activities (LGED, 1992). The CARE Bangladesh has prepared environmental guidelines in different period for its various projects as well as interventions. Under the Integrated Food for Development Project (IFFD), CARE prepared EA guidelines for the rural road improvement projects (Khan and Fitzcharles, 1998). Later in 2001, under the Integrated Food Security Program (IFSP), CARE has prepared three separate EA guidelines for its slum improvement project (SHAHAR), paved road intervention (BUILD project), and the small-scale community based ‘Flood Proofing Project’ (CARE, 2001). The Water Resources Planning Organization (WARPO) prepared guidelines for environmental assessment of Flood Control, Drainage, and Irrigation Project (WARPO, 2001).

Among the slum improvement interventions (e.g. drainage network, community latrine, refuse bin, tube-well, pathway), the public or community latrines are the only ones, which have been considered as Amber B category intervention in the ECR '97 (GoB, 1997). Implementing agencies, however, have often overlooked this legal provision. There is no legal provision of EA for slum improvement intervention particularly, for drainage network, though it creates enormous adverse impact on environment if not planned and designed properly. A recent evaluation study on EA procedures and practices in Bangladesh reveal that the list of projects and industries requiring EA is not adequate and the criteria for preparation of list of industries and projects requiring EA are not well defined (Ahammed and Harvey, 2004).

4. Profile of the two studied slums and methods of data collection

The two slums, which were beneficiaries of two different programs (one with EA and other without), have been selected to (a) compare the improvement and changes associated with the
interventions and thereby (b) bring out the difference in the outcomes that EA may have had made. These are:

(1) The Bank-Maath slum upgraded by SHAHAR (Supporting Household Activities for Health, Assets and Revenue) Project, where EA was adopted for planning and implementation of infrastructures, and

(2) The City-Polly slum upgraded by SIP (Slum Improvement Project), where EA was not adopted (see Fig. 1).

The main reason for selection of SIP and SHAHAR for this study was that both programs implemented similar types of infrastructural intervention (viz., pathway, drainage network, tube-well, community toilet, and refuse bin or waste management) for improvement of slum environment. Criteria followed in selecting the two slums are: (a) no physical infrastructure building intervention before the implementation of SIP or SHAHAR and (b) other than the SIP

![Fig. 1. Location of the two slums.](image-url)
or SHAHAR intervention, no physical infrastructure building intervention implemented by any other agency.

4.1. Brief profile of the two slums

4.1.1. The Bank-Maath slum

This slum has been upgraded under the SHAHAR project and implemented by CARE-Bangladesh and the Tongi Municipality. CARE conceptualized and designed the SHAHAR project with the financial support of USAID. Bank-Maath is located in Tongi Municipality, just 25 km north of Dhaka city (see Table 1 and Fig. 1). According to a census survey conducted by the SHAHAR, the total number of households (HH) of this slum is 588 with a total population of 2940. Most of the people living in this slum are engaged in small businesses. Many of its inhabitants work in the neighboring mills and factories. Some men work as day laborers or as rickshaw and van pullers. Women residents of this slum generally work in garment factories and are involved in the separation of cotton from discarded cloth. Some of them also work as day laborers. The land terrain of the Bank-Maath site is comparatively flat. One privately owned pond and three derelict small ditches exist in this slum.

The SHAHAR project followed a brief environmental assessment process, which was called: Site Specific Initial Environmental Examination (SSIEE) before the implementation of interventions in the Bank-Maath slum. Using this process, CARE and the municipality assessed the slum site, identified possible impacts (i.e. positive and negative) associated with intervention and suggested mitigation measures (CARE, 2001). The design and location of the interventions were thus finalized based on the recommendations of SSIEE.

4.1.2. The City-Polly slum

Under its SIP program, the LGED and DCC upgraded this slum with the financial support of UNICEF. The SIP has been a community-based effort designed to improve the quality of life of slum dwellers, who are the target beneficiaries of the project (LGED, 1997). This slum is located in Demra Thana of Dhaka metropolitan area (See Table 1 and Fig. 1). It was established by DCC for its waste collection screw in 1987. The total number of households is 445 with a total number of 2220.

<table>
<thead>
<tr>
<th>Features</th>
<th>Bank-Maath</th>
<th>City-Polly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Tongi Pourashava, Dhaka</td>
<td>Demra Thana, Dhaka</td>
</tr>
<tr>
<td>Year of establishment</td>
<td>1971</td>
<td>1987</td>
</tr>
<tr>
<td>Project implementer</td>
<td>CARE Bangladesh, Tongi Municipality</td>
<td>Local Government Engineering Department (LGED), Dhaka City Corporation (DCC)</td>
</tr>
<tr>
<td>Funding agency</td>
<td>USAID</td>
<td>UNICEF</td>
</tr>
<tr>
<td>Total households</td>
<td>588</td>
<td>445</td>
</tr>
<tr>
<td>Land terrain</td>
<td>Flat land</td>
<td>Flat land</td>
</tr>
<tr>
<td>Ownership of the land</td>
<td>Dhaka Improvement Trust (DIT), District council, Cooperative bank</td>
<td>Dhaka City Corporation (DCC)</td>
</tr>
<tr>
<td>Project interventions</td>
<td>Drainage system, construction of pathways, community toilet complex with tube-well, community collection system of refuses</td>
<td>Drainage system, construction of pathways, community toilet complex with tube-well, refuse bin</td>
</tr>
<tr>
<td>EA status</td>
<td>Conducted, intervention design and location was finalized through EA</td>
<td>EA was not considered, interventions implemented using the project’s manual</td>
</tr>
</tbody>
</table>
population of 2225. The land terrain is flat. There was no physical infrastructure before implementation of this project.

It was confirmed from the initial interview with the project personnel of SIP and review of project’s relevant documents that LGED and DCC did not require or carryout any environmental assessment for this slum or any other slum improvement in Bangladesh under the SIP.

4.2. Data collection method

Data collection methods included on-site observations; conducting standardized questionnaire survey of slum residents; and holding in-depth discussions with the project stakeholders (e.g. LGED, DCC, CARE and the municipality officials); and conducting interviews with the experts and professionals. A purposive sampling technique was used for the questionnaire survey. Slum dwellers, who had been living at the selected site for a long time and had observed the changes associated with the interventions, formed the sample ‘population’ (i.e. sample frame) for this survey. Usually slum residents move from one place to another and try to live close to the work place. From the initial field visits of the two slums, it was gathered that many residents did not experience the environmental changes occurred in those slums. About 10% of households in both slums however are appeared to be relatively long-term residents (more than 8 years). They observed the implementation process of the program in their respective community. With this in view, the actual ‘sample frame’ of the survey was taken as a sub-set of the total HH of 588 in Bank-Maath and 445 in City-Polly; i.e. 58 and 44, respectively (see Table 2). From these two sample frames, 30 HH were taken as samples from each slums.\(^5\) Head of the households–men or women depending on their respective status in the household–were interviewed in April 2003.

Professionals and experts working on slum issues and environmental assessment were also interviewed to explore and identify potential mechanisms for the integration of EA into slum improvement programs. Whereas these ‘experts’ are from different academic and research institutions, the ‘professionals’ are drawn from the government department/agencies, donor organizations and NGOs. Donor organizations selected are the ones which provided funding for the implementation of different slum improvement projects. The selected experts and professionals had some role in the planning and implementation of these programs.

5. Outcomes from project interventions with and without EA

Prior to the implementation of the two projects (SHAHAR and SIP), there were no major infrastructures either in the Bank-Maath or City-Polly slum. In both slums, the

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\(^5\) A sample size of 30 was set as target for ensuring a minimum sample size required for statistical tests. To be precise, 30 HH from Bank-Maath and 31 from City-Polly, were selected for the survey.
physical environments had deteriorated seriously. According to the slum dwellers surveyed, the major physical environmental problems that prevailed in both slums were:

- Lack of drainage
- Overflow of wastewater
- Muddy conditions
- Scattered disposal of refuse
- Unsanitary condition.

Experts and professionals interviewed during the field survey also observed that drainage and sanitation are the two major environmental problems in urban slums of Bangladesh. Drainage related problems include backflow of wastewater, overflow of drains. Sanitation related problems include overflow of excreta, seepage of wastewater or water pollution from the latrine, degradation of surrounding area, visibility of human excreta in the open space and spread of diseases. Scattered disposal of refuse in and around the slum and odor from the refuse bins are also widespread.

Both projects built infrastructures, which included drains, pathways, waste disposal systems, community latrine complexes with tube-wells, for environmental improvements. The findings presented below show, after the changes the physical environment of the City-Polly and the Bank-Maath slum have improved differently. The survey results show that the newly implemented infrastructures could not mitigate all the pre-existing problems. The improvements were particularly insignificant in the City-Polly compared to those in the Bank-Maath slum. The following sections presents the survey results on drainage, wastewater, pathways, waste disposal, and the sanitary condition and thereby trace the difference that undertaking of EA seems to have made in the two slums.

5.1. Lack of drainage

Insufficient and unsanitary drainage condition is one of the major reasons for drainage congestion problem in slums all over. Drainage system removes unwanted water from the neighborhood in a controlled and hygienic manner in order to minimize public health hazards, inconvenience and the deterioration of other infrastructure (Ahmed and Rahman, 2000).

The construction of an efficient sewer and drainage system is very complex. Factors that are to be taken care of in building such systems include rainfall and seasonality, run-off from inside slum and surroundings, household water use, topography, final discharge point, sediment loads, and land ownership. Drains may create new environmental problems if they are constructed without considering these issues. They cannot be implemented as a single isolated infrastructure, even if they are for slums. A proper environmental assessment allows identification of environmental problems associated with new infrastructure provisions.

Both the SHAHAR and SIP designed and implemented open surface drainage system. The SHAHAR project did not try to solve the drainage problem of the Bank-Maath slum in isolation. Through a proper assessment of the slum site and its surrounding area, it tried to make a drainage network and ensured final outlet. The project constructed 1163.86 m of drain to solve drainage-related problems from the area. Unfortunately, the SIP did not assess the slum and its surroundings in designing the drain and did not even ensure an outlet.
Before the implementation of the SHAHAR and SIP, drainage situation was very poor in both slums. During the field survey, all respondents from both slums acknowledged the existence of poor drainage condition in both slums before implementation of the projects (Table 2). The situation used to become worse during the rainy season. After implementation, drainage has improved in both slums. But the situation seems to have improved greatly in the Bank-Maath slum. Responses of residents of this slum suggest near non-existence of the drainage problem after implementation of this project. The situation however did not improve as much in the City-Polly (Fig. 2). Indeed, 74% of the respondents from this slum noted the persistence of this problem even after the implementation of the project (Table 2). Without assessing the physical condition of the slum, the volume and sources of wastewater, and the required length of the drains, the SIP constructed only 198.12 m drain which basically covered the front side of the slum. During the field survey, it has been observed that there is no drainage facility at the backyard and fringe area of this slum. The final outlet of the drainage system was not ensured. The SIP authority discharged wastewater to nearby low land in an unplanned manner instead of identifying a proper outlet location for wastewater.

In the Bank-Maath slum, this problem had been solved through a complete and well-designed drainage network. It was successful because the environmental team, in addition to the engineering team, assessed the internal and external environment of the slum through an EA process and recommended new drains inside the slum and 320 m of outlet drain to solve the problem permanently. \( \chi^2 \) test result (\( p \) value=0.000 and \( \alpha=0.01 \)) confirms that the number of households experiencing this problem in the City-Polly are significantly higher than those in the Bank-Maath slum.

5.2. Overflow of wastewater

Overflow of wastewater is another environmental problem related to drainage system. This problem occurs when the existing drainage system cannot carry or drain out full volume of wastewater from the slum or the capacity of the drain is exceeded. In the Bank-Maath slum, the sources of wastewater were: household wastewater, rainfall, surface run-off from surrounding

![Fig. 2. Drainage congestion scenario in City-Polly.](image-url)
industrial area, and industrial toxic wastewater. In the City-Polly slum, the sources of wastewater include the household wastewater, rainfall, surface run-off from catchments of residential and commercial establishments, run-off from a solid waste disposal site located at Dhalpur, and the wastewater with human excreta.

Survey results reveal that the drainage intervention did not improve the wastewater overflow problem in City-Polly. Most of the respondents (83.9%) noted the continuation of the problem after the implementation of drainage system (see Table 3 and Fig. 3). During the field survey, it was observed that depth of the drains were not adequate and the project did not construct adequate length of drains for the whole area. The problem has been solved only in a small portion of the slum. In the way of stating the reason of persistence of wastewater overflow problem, the survey respondents reported that the implementing agency did neither assess the internal and external environment of the slum nor consult the local people. They seemed to have tried to stick to the project manual, which had been prepared to guide the construction work of all slums to be improved throughout the country under SIP. Slum residents informed that layout

<table>
<thead>
<tr>
<th>Persistence of environmental problem</th>
<th>Bank-Maath (the slum with project requiring EA)</th>
<th>City-Polly (the slum with project not requiring EA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Persist</td>
<td>Does not persist</td>
</tr>
<tr>
<td>Lack of drainage</td>
<td>0 (0.0)</td>
<td>30 (100.0)</td>
</tr>
<tr>
<td>Overflow of wastewater</td>
<td>3 (10.0)</td>
<td>29 (90.0)</td>
</tr>
<tr>
<td>Muddy conditions</td>
<td>2 (6.7)</td>
<td>28 (93.3)</td>
</tr>
<tr>
<td>Scattered disposal of refuse</td>
<td>13 (43.3)</td>
<td>17 (56.7)</td>
</tr>
<tr>
<td>Unsanitary condition for overflow of excreta</td>
<td>0 (0.0)</td>
<td>30 (100.0)</td>
</tr>
</tbody>
</table>

Figures in parentheses denote percentage.

of the drains often followed the residences of some powerful households of the slum. The instructions given in the SIP project document are:

Each slum or whole area of the slum may not require drains; the total amount of drains of each slum should be determined by the number of beneficiary households; only two meters of drains will be constructed for each beneficiary household (LGED, 1997).

Beneficiary households of SIP are few whose monthly income is very low. This, coupled with the above instructions, create a built-in rigidity and a partial approach in addressing the drainage problem of a slum. The interviewing of DCC and LGED staff and checking of project documents and evaluation reports suggest that the construction guidelines provided in the SIP reference manual is very shortsighted which dissuades the field staff to consider the problem holistically. This manual has also been misinterpreted by the project staff. Allocations are planned based on the number of the beneficiary families rather than on the slum’s geographic characteristics. The provision of drains in the City-Polly has thus turned to be inadequate and incomplete. Also, the drains are too narrow for the drainage in the area and these have not been connected to the main drainage channels of the area. The drain ends in the slum have abruptly created pools of dirty water at different spots and back of the slum.

The provision of drainage system in the Bank-Maath slum has largely solved the wastewater overflow problem. About 90% of respondents confirm non-persistence of this problem (Table 3). During the field survey, the researcher observed that the depth of the drain was adequate. It was learned that the implementing organization carefully identified the sources of wastewater through the EA process and calculated the volume of wastewater generated from the slum and its surrounding environment and succeeded to drain out through the newly constructed outlet. Public consultation is one of the important steps of the EA process. Consultation with the slum dwellers in this slum helped proper identification of wastewater sources and its drainage.

A small portion—about 7% of Bank-Maath and 19% of City-Polly—expressed a negative opinion (Table 3). During the field survey, it was observed that the built pathways in the City-Polly could not completely solve the slippery and muddy condition, as the project did not pave the five sub lanes. Survey respondents reported that the implementing agency was very much rigid to the manual and did not address the problem identified by the local people. This rigidity, again, arose from the guideline provision of improving pathways of approximately 3 m per beneficiary household (LGED, 1997). This resulted to non-paving of five sub-lanes and limiting the total length of paved pathway to 320 m. This contrasts with the total length of pathways built in the Bank-Maath slum to 1018.29 m. Although this large difference in the length of the paved pathways all cannot be attributed to the rigidity provision alone, undertaking
of an EA would have led to anticipation of the problem and resulted adoption of mitigating measures.

5.4. Scattered disposal of refuse

Scattered disposal of refuse in and around the settlement was common in both slums before the implementation of the project. The SIP constructed two refuse bins to solve the solid waste management problem in the City-Polly slum. However, the SHAHAR project did not construct any refuse bin in the Bank-Maath slum; instead, they initiated a community collection system. It is widely observed that people throw the household refuses in and around the bin, which also never gets collected by the municipality in time. Heap of waste lies for days creating an unhygienic environment. In appreciation of such widespread problem in the city, the SHAHAR employed a poor man from the community to collect wastes from houses and dispose those to the municipal bin. This seems to have resulted on the overall a clean environment free from household waste. About 43.3% respondents, however, reported that waste problem persists at one spot of the slum (Table 3). It appears the person engaged for the waste collection did not collect wastes from some residents who live backside of the slum. These residents dispose refuses at the slum backyard and virtually transformed the spot to a dumping site (Fig. 4).

Although the waste-related intervention is relatively successful compared to other interventions in the City-Polly, about one-third of its respondents still reported persistence of the problem in their slum (Table 3). This relatively better outcome can be explained by the fact that the residents of this slum are mostly waste collection staff of the city corporation. The slum’s location near to the city corporation’s zonal office also contributed to the regular collection and transportation of wastes in this slum. Thus, it is not a surprise that the $\chi^2$ test (p value = 0.372 and $\alpha = 0.01$) result shows that there is no significant difference between the two slums in terms of improvement of waste disposal.

5.5. Unsanitary condition

Before project implementation, unsanitary condition was prevailing severely in both slums. The reasons for prevailing unsanitary condition were: overflow of excreta from pit latrine, lying of excreta on drains and open ground, and stagnation of wastewater. Poor design, improper
location and insufficient number of latrines and absence of drainage system were responsible for this problem in both slums.

The SHAHAR and SIP implemented ‘on-plot’ sanitation system where disposal of excreta takes place on or near the housing plot. Under this system, both projects constructed community latrine complex. The reason for choosing community latrine was lack of open space and congested housing. The design of community latrine complex implemented by the SHAHAR includes latrine, bathing place and tube-well for both males and females. In the Bank-Maath slum, the SHAHAR project constructed six community latrine complexes. The SIP implemented five community latrines in different locations of the City-Polly slum. The design of community latrine complex implemented by the SIP includes latrine and tube-well.

Significant improvement took place in Bank-Maath slum after the implementation (Table 3). However, the situation did not improve in City-Polly. In the latter, 81% of respondents reported continuation of the problem. Unsanitary hanging latrines existed in this slum even after the project implementation (Fig. 5). During the field survey, it was observed that community latrine pits were located adjacent to the kitchen, some of which were broken with possibility of transmission of germs to the food. It was evident from the survey that excreta were overflowing from the filled up pits. This problem has been exacerbated overflow of wastewater and lack of drainage. $\chi^2$ test result ($p$ value=0.000 and $\alpha=0.01$) confirms this problem in City-Polly is significantly higher than that in the Bank-Maath slum.

6. Reasons for persistence of poor living environment

The evidence presented in the preceding section makes it clear that the living environment, overall, improved significantly in the Bank-Maath after the implementation of the interventions. However, it is much worse in the City-Polly. The implemented program could not solve the environmental problems in the latter. On pursuing the issue further as to the reasons for persistence of environmental problems, the respondents in the City-Polly identified six reasons, whereas their counterparts in the Bank-Maath slum identified four different reasons. The latter has to do with the persistence of muddy condition and disposal of waste in the backyard because other problems are more or less solved in the Bank-Maath (see Table 4). In the City-Polly case, the reasons for the persistence of the problem apply to all four areas of interventions.
Reasons for persistence of problems in the City-Polly can be categorized in three major categories: one, residents’ non-participation in the planning process (items 1, 4, and 6 in Table 4); two, non-assessment of external and internal environment of slum (items 3, 4, and 5, in Table 4); and three, non-monitoring (item 2 in Table 4) of the results from the interventions. Non-flexibility of the authority (item 4 in Table 4) in addressing the problems of the slums has emerged as second important reason: 83% of respondents in the City-Polly have raised this as a reason for persistence of problems. In fact, the persistence of the problems is reported nearly by all respondents in this slum. In contrast, only a few respondents of the Bank-Maath slum reported persistence of problems or cited reasons thereof. The authority in the City-Polly slum installed a facility with a single mind focus on the service need of the project beneficiaries which led to ignoring the impacts on those who were not the beneficiary targets but inevitably lived close to them essentially in the same neighborhood. During the field survey, the respondents also confirmed that implementing agency did not assess the problems of the whole slum. Instead they installed facilities in the premises of the selected few slum residents who were the immediate targets of the project. This has led to persistence of many problems.

Largely in line with the slum residents’ responses, experts and professionals observed that persistence of environmental problems in slums has to do with:

a. Non-consideration of EA during planning and implementation phases of the program
b. Lack of post installation follow up or monitoring
c. Non-flexibility of the proponent in designing and implementing the intervention as per site situation.
7. **New problems arising from the project built infrastructures**

The survey results reveal that not only the old problems were persisting, the project implementation has also created a host of new problems in the City-Polly slum. This became evident from the opinion of the survey respondents as well as researcher’s observation during the fieldwork. Waterlogging is one such problem that has emerged because the authority did not construct any permanent outlet drain and did not connect it with the local drainage system. They made an arrangement to discharge the wastewater into the adjacent low-lying area. However, due to the huge population pressure in the city, some poor people had started to move to that low land and built a new slum. With the help of local political leaders, they constructed dike on the outlet drain to keep their slum free from wastewater intrusion problem. Eventually, this resulted waterlogging problem in the City-Polly. The situation persisted even in the dry season when the field survey was conducted (Fig. 6). An EA could have anticipated or even locate this problem, which would have in turn allowed taking necessary mitigating or even preventive measures.

Design and location of the community latrines were not environmentally sound in this slum. During the field survey, it was observed that latrine pits are located beside the kitchen and overflow of excreta was also observed. Flies from the pits are going on to the food. Another design related problem is: tube-wells in the latrine complex are located in-between 10 m of the defecation pit which is highly unhygienic. To protect microbial contamination, a horizontal distance of 10.0 m between a drinking water well and a latrine is essential (Ahmed and Rahman, 2000).

8. **Difference that EA has made**

Our investigation has shown that the problem background and the type of intervention in the SIP and SHAHAR projects were quite similar. Physiography of the two slums are also not much different. The basic difference between the two projects was: the SHAHAR had considered EA during the planning and implementation phases and the SIP did not. Thus, it is no surprise that the environmental problems related to drainage, wastewater overflow and sanitation have been persisting in the City-Polly slum where SIP was implemented without undertaking an EA. In addition, the newly built drainage infrastructures have created additional problem of waterlogging in this slum. Location of toilet facilities and tube-well was not environmentally benign and exposed to health risk of the slum dwellers in the City-Polly. Compared to this

![Fig. 6. Waterlogging problem in City-Polly.](image-url)
situation, there was no such problem in this regard in the Bank-Maath slum as the location and design of infrastructures were finalized through an EA process. As a result of the EA procedure, the SHAHAR constructed additional 320 m drain in the Bank-Maath slum and mitigated the drainage and wastewater related problems. Overall, the environmental problems in the Bank-Maath slum are much less than those in the City-Polly where SIP did not undertake EA.

An evaluation of the WaterAid program (Hanchett et al., 2001, p. 6) also supports this indication from our study. Their evaluation recommends that providing water and sanitation service to the very poor living in and outside slums require entirely new program strategies and there should be a goal to ensure that all program structures will last at least 5 years. The program is advised to consider modifying the total concept away from committee-based ownership and use to a move toward an area based approach. In fact, the water and sanitation services in and around the slum can be better provisioned through undertaking of EA which ensures proper identification and assessment of problems and potential repercussion from any new provisions in and around the slum. Undertaking of an EA will ultimately help in finalizing the design, location and overall sustainability of any project intervention. As observed by Spaling (2003), EA is also one way of evaluating the sustainability of projects.

9. Mechanism for Integration of EA into slum improvement infrastructures

In view of the favorable difference that undertaking of an EA makes (as shown in Sections 5 and 7), the study (Chowdhury, 2003) took an additional task of developing a mechanism for integration of EA into slum improvement programs. This mechanism, based on considered opinion of experts and professionals, field observation, researchers’ experience, and by drawing on from the related literature, is briefly presented below.

In outlining the mechanism, importance is given to the legislative compulsion, comprehension of EA benefit by the implementers, and its overall incorporation in the project cycle (see Fig. 7). Keeping these points in mind, the study reviewed the EA legislation for tracing any EA requirement on slum improvement interventions (as discussed in Section 3). This investigation reveals that slum improvement interventions are not explicitly incorporated in the ECR ’97 list of the development projects. Experts and professionals have also pointed out this lapse and emphasized incorporation of slum improvement interventions in the ECR ’97 list. During the interview, experts and professionals, however cautioned that making the EA mandatory by legislation for slum improvement projects is a necessary condition but not sufficient. The legislative step is to be followed up with institutional requirements and incorporation of EA in the project cycle. Three interrelated components for integration of EA into slum improvement programs are seen as:

(a) Enshrining of EA requirements by legislation
(b) Institutionalization
(c) Incorporation of EA in project cycle.

Fig. 7 illustrates the hierarchical components of the EA mechanism. Incorporation of EA in slum improvement programs, at the backdrop of the two-Dhaka slum study, is outlined below:

(a) *Enshrining of EA requirements by legislation*: Essential legislation requiring an EA is the key and foremost component for integration of EA into slum improvement program. Review of the environmental legislation in Bangladesh reveals that community toilet is the
only intervention which requires EA. This is included under Amber-B category of Environment Conservation Rules 1997. Field investigation underlying this study shows that construction of drainage system turns to a hazard if the environment of the slum is not assessed properly. Thus, drainage system is proposed to be enlisted under the Amber-B category of the Environment Conservation Rules. It is important to note that slum improvement program in general should be included, not limited to any single infrastructure provision.

(b) Institutionalization: For institutionalization, it is proposed that an environment department be established in each organization executing the slum improvement programs. Environmental policy and guidelines for assessment of the surrounding environment of slum are to be made a requirement. Organizations can simplify the EA as per the nature and scale of a project. Recruitment of environmental staff and continuation of environmental monitoring of the programs are also proposed. As suggested by experts and professionals, separate fund is to be allocated to service the EA implementation process (Fig. 7).

(c) Incorporation of EA in project cycle: For incorporation of the EA in project cycle, a ‘two-tier’ environmental assessment system is proposed (Fig. 8). The first tier of EA is to be Rapid Environmental Screening, which allow identification and selection of an intervention. The second tier of EA is ‘Programmatic Rapid Environmental Assessment’, which is to serve finalization of location and design of the interventions.
For planning and implementation of slum improvement interventions, immediate surroundings of the slums need to be assessed carefully along with the slum’s inside environment. Ensuring participation of the slum dwellers for properly designing and siting of the project intervention is to be an integral part in this process. Based on EA, an Environmental Management Plan (EMP) is also to be prepared and shared with slum dwellers and other stakeholders. Environmental monitoring during and post infrastructure construction period is to be routine in the project cycle.

10. Conclusion

It is important to realize that slum improvement programs involve interventions in a highly populated and deteriorated local environment. Therefore, in planning and designing of the interventions, the inside and outside environment of the slum are needed to be assessed with utmost care. As argued and empirically made the case in this paper, the siting and design of the interventions are to be finalized based on an EA. The survey results and field observations, based on which this paper has been prepared, show that slum improvement program could not mitigate the problems in the City-Polly slum due to non-assessment of the internal and external environment prior to the implementation of the project. Similar program has produced better result in the Bank-Maath slum where EA was undertaken. Slum dwellers surveyed for this study cited reasons for persistence of problems after the implementation of the interventions, which in all likelihood could have been avoided if an EA was undertaken before installation of the infrastructures. Lack of public participation and non-consideration of internal and external environment appear as key reasons for emergence of new problems in the slum after the implementation of the interventions. Integration of environmental assessment into slum improvement program is thus seen an essential part of the infrastructure installation to maximize the benefit of a program and minimize any potential negative impact. Having made the case both

Fig. 8. Incorporation of EA in project cycle (adapted from UNEP, 1988; Lohani et al., 1997, and CARE, 2001).
on an a priori reasoning basis and on its empirical verification through studies of two Dhaka slums, this paper has also outlined a mechanism of integrating EA in the slum improvement program.

Acknowledgements

The research grant of Asian Institute of Technology (AIT), logistical support of CARE Bangladesh (Uttara field office) and access to information of LGED, UNICEF and DCC for the fieldwork are thankfully acknowledged. The comments of anonymous reviewer are also gratefully acknowledged.

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Ms. Farhat Jahan Chowdhury obtained her master’s in Urban Environmental Management (UEM) from the Asian Institute of Technology (AIT), Thailand, in 2003. Prior to that, she got her B.Sc. (Hons.) and M.Sc. in Geography from the University of Dhaka, Bangladesh. Farhat is currently working as a Research Associate in a CIDA-AIT partnership program, Southeast Asia Urban Environmental Applications (SEA-UEMA) Project, at AIT. She is responsible for planning and management of environmental demonstration projects in cities of Southeast Asia. Farhat has 5 years of professional experience in environmental management with the CARE Bangladesh. She conducted and reviewed several EA (Environmental Assessment) of small-scale infrastructure projects in Bangladesh.

A.T.M. Nurul Amin, PhD, is a Professor of Urban Environmental Management (UEM) Field of Study in the School of Environment, Resources and Development (SERD) at the Asian Institute of Technology (AIT), Thailand. Professor Amin has been with AIT since 1987. His research interests include urban poverty reduction policies and designing use of economic instruments for environmental protection and management. He has published widely on the urban informal sector and environmental management issues. He has served in several administrative positions at AIT, including the Chairperson of Human Settlements Division (HSD), Coordinator of Urban Environmental Management Field of Study and Director of CIDA-AIT Southeast Asia Urban Environmental Management Applications Project.