Smart City – Good Practice

Waste, Social Inclusion

Organic Solid Waste Management

Dhaka, Bangladesh

Dhaka's model for converting solid waste into resource through Public-Private-Community Partnerships (PPCP)

Dhaka has envisioned a strategy for zone-wise waste management through a network of decentralised composting plants and the establishment of successful partnerships with the government, private sector and residents. Through facilitating innovative partnership arrangements, a community-based solid waste management model for Dhaka has been developed, raising the attention of many other cities in Bangladesh and in developing countries, who sought to replicate it. With its emphasis on recycling and resource recovery, this model has improved the urban environment and the quality of lives of poor people living in slums [5].

Country/ City Profile

Country		City	
Population (2014)	159.1 million [1]	**Population (2014)**	16,982,363 (urban area) [1]
Land area (km²)	130,170	**Land area (km²)**	360 [3]
GDP per capita (2014, current international $, *at purchasing power parity*)	3,124 [1]	**GDP per capita[1] (2008, US$, *at purchasing power parity*)**	5,777 [2]
Region	South Asia	**Region**	Central, close to the coast

City's physical geography	**Location**	✓ Central Bangladesh, on the lower reaches of the Gange-Brahmaputra Delta ✓ Positioned in a low-lying flood plain, the city has a low elevation and it faces recurring urban flooding and waterlogging due to intense rainfall [4]
	Climate	✓ Tropical monsoon climate (due to climate change, rainfall is heavier and more erratic) ✓ 2,000mm average annual rainfall (mostly during the summer monsoon) ✓ The frequency of heavy-rainfall events is increasing, while light-rainfall events are decreasing [4]

Initiating context

Dhaka, the capital of Bangladesh and a highly densely inhabited city with a population of over 16 million in an area of only 360km^2, has been facing severe environmental problems. Rural migrants have been moving into the city, placing an added burden on an already burdened system [5]. By 2006, 40% of the urban population was below the poverty line and 50% of the poor urban population lived in slums. While these people played an important role in reducing the city's waste by at least 15%, the economic potential of the organic waste remained untapped [7].

The Dhaka City Corporation (DCC), responsible for urban solid waste management, estimated in 1999 that of the total 3,500t of solid waste daily generation, 1,800t were collected and dumped by the DCC, 900t went to land filling, 400t went to road sides and open spaces, 300t were recycled by street children and 100t were recycled at the generation point [15]. Rapid urban population growth and rising incomes (creating a middle and affluent class) have accelerated waste production, exceeding the government's capacity to adequately manage the waste [8].

In 2006 alone, the city was generating around 5,800t of solid waste daily, at least 80% of which was organic, and therefore suitable for composting. Nevertheless, half of this garbage was not collected by the city corporations due

[1] PricewaterhouseCoopers GDP estimates drawing on data from UN, World Bank, OECD and national sources.

to lack of funding, and was left to decay in the city's open spaces [5]. The stench that resulted, along with contamination of water and food, rodents and clogged drains posed a serious health risk to Dhaka's residents and deteriorated the quality of urban life [6]. The waste sector in Bangladesh is also a significant contributor to greenhouse gas emissions because it generates methane. Excluding carbon dioxide, this sector produced 17 million metric tons of CO_2-equivalent in 2005, or 27% of the nation's total non-CO_2 emissions.[2] By 2020, waste related emissions were projected to increase by 22%, to 20 million metric tons [10].

A secondary environmental problem encountered in Bangladesh was the organic depletion in the soil of the countryside. Excessive use of chemical fertilizer and pesticide had led to loss of topsoil fertility. Decomposed organic wastage, initially used for nourishing the soil but later being burnt for fuel, started being replaced by chemical fertilizers, which contaminated rivers and canals, killing off several local species of fish [6]. By 2006, 83% of cultivable land in Bangladesh had less than 3.5% organic matter [7].

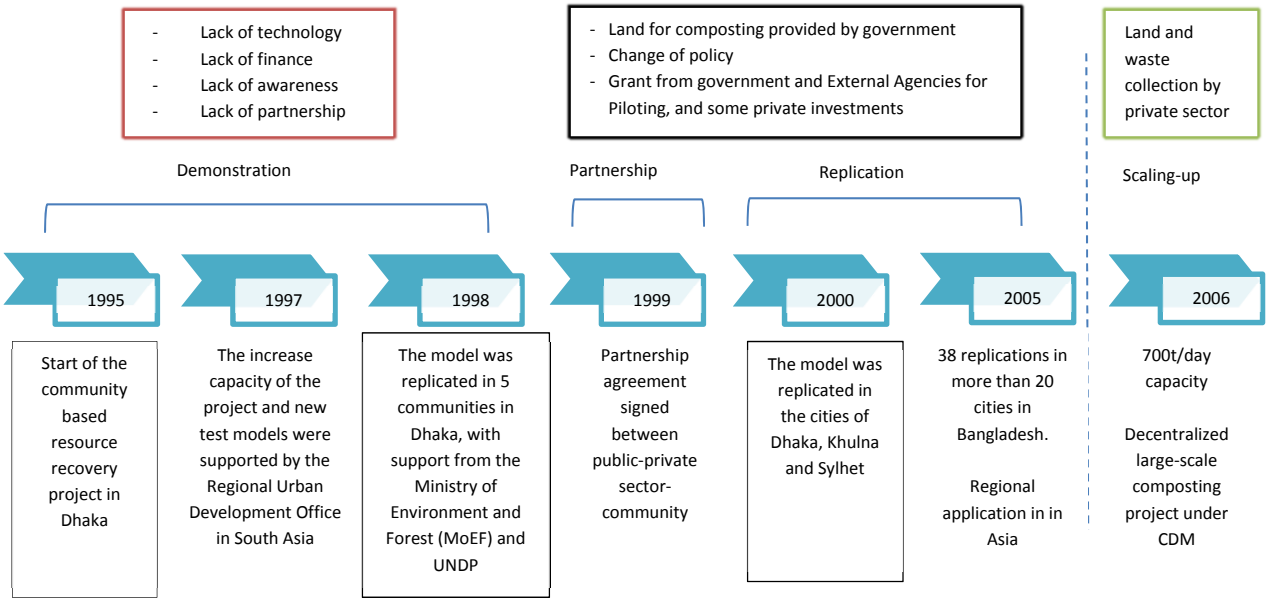
Project description

A grassroots initiative of two urban planners, Iftekhar Enayetullah and Maqsood Sinha, started to provide a solution to these two main environmental concerns. In 1995 they established "Waste Concern", a national research organization dealing specifically with solid waste management, and later in 2005 Waste Concern Group was formed as a Social Business Enterprise [7]. Their solution was theoretically simple (transporting organic matter from surplus areas to where it could be an environmental benefit), but operationally complex, since it relied on engaging private citizens, governments and businesses in order to work, while using affordable innovative technology [6].

The challenge was to make city dwellers shift their perception from 'waste seen as a problem' to 'waste seen as a resource'. The project aimed to improve urban environmental sanitation through a model for solid waste management with an emphasis on recycling, resource recovery, and public-private-community partnerships. Waste Concern promoted the concept of the 4 R's: *Reduction, Reuse, Recycling, and Recovery*. The fundamental principle of the strategy was to establish a network of community-based composting plants, which would convert household organic waste into bio-fertilizer. These plants would create job opportunities for the neglected poor, particularly women, by involving them in recycling activities. In order for the project to gain ownership and acceptance from the slum dwellers, an integrated monetary system was put into place [5]. One barrel for organic waste was provided for a group of 5-6 households for waste segregation. The organic waste was collected from house-to-house by employed slum dwellers and was then transported on bicycle-driven collection carts to community processing centres and transformed into compost [5]. The generation of income took place through charges applied for house-to-house waste collection (30% of project income) and sale proceeds of compost (70% of project income). The households would then share the income from sale proceeds of the compost [7].

Implementation process

Projects implementation details



Growth over time and barrier faced, © Waste Concern 2006, Source: based on [7]

[2] Excludes emissions from land-use, land-use change and forestry

In 1995, Waste Concern started a pilot composting plant in Mirpur, Dhaka, on land donated by the Lions Club, a service club organization. In Mirpur they were able to demonstrate that each family could turn its kitchen scraps into a nutrient rich product, which they could then sell to Waste Concern. Making use of the existing network of waste pickers and of simple technology, Waste Concern was able to demonstrate the benefits of a community-based approach [5].

The success of the Mirpur pilot project convinced all stakeholders (among whom the DCC and the Public Work Department PWD), including the government, that the model was feasible. The Ministry of the Environment and Forestry (MoEF), under the Sustainable Environmental Management Programme (SEMP), requested that the project be replicated in other neighbourhoods. With the support of UNDP in 1998, four other poor communities from Dhaka adopted the model. Access to land was still a barrier to the project and it took five more years to convince government agencies to back their community-based projects and to enter into the first ever municipal-private partnership in waste management in Dhaka. Key to this success was not only the technology used but also the innovative arrangements put in place to ease the city's worries over land use [5].

To generate revenue for the community-based composting plants, Waste Concern arranged for fertilizer companies and small nurseries to purchase compost-based bio-fertilizer produced by the plant. An agreement between Waste Concern, two private companies, and a leading NGO has enabled the marketing and sale of organic nutrient-enriched compost throughout Bangladesh. [7] As of 2006, one of the companies, Alpha Agro, was selling 200t of compost a year and earlier estimates predicted 15,000t of demand increase over the following years [5].

Project components

Technology [6, 7]

Composting Methods used by Waste Concern:

- ✓ Barrel type composting
- ✓ Aerator type composting
- ✓ Box type composting

Advantages for using these technological methods:

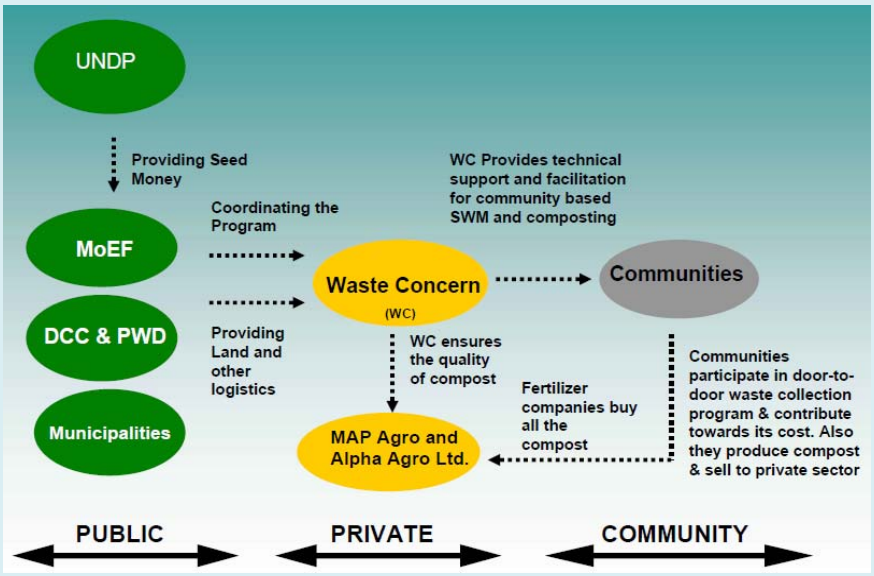
- ✓ Simple, affordable, labor intensive and low cost
- ✓ Suitable for the socio-economic and climatic conditions of Bangladesh

Cost recovery (as of 2006) [7]

- The project is financially viable
- Fixed cost of 3t capacity plant was USD 8,800
- Operational cost per year was USD 10,200
- Yearly income from the project was USD 14,800

Sustainability [7]

- ✓ Selling compost through a marketing network
- ✓ 70% was the income from sale proceeds of compost
- ✓ 30% was the income from charges for house-to-house waste collection
- ✓ Pay-back period of the investment was 23 months



*Parthership Model of Community Based Composting, © Waste Concern 2006, **Source**: [7]*

Initial Funding [5]

The initial donation of land for the pilot project (1995) was from the Lions Club. In 2000, Waste Concern formed the first private municipal partnership in waste management in Dhaka. It also established a community-based recovery project and the land was provided by DCC, along with the necessary infrastructure. Funding came through UNDP's Sustainable Environment Management Programme of Government (SEMP).

Results

The community-based approach to waste collection engaged residents to expand and improve services and the working conditions of service providers, thus reducing occupational health hazards. Increased rates of collection and disposal have improved water and air quality, and expansion of the solid waste management system created opportunities for employment. The integrated solid waste management plan has stimulated the development of a waste-related regulatory framework, inspired replication across the country, and led to innovative measures of managing waste [8].

Waste Concern's initiative has enabled the creation of a Master Plan to manage municipal solid waste throughout its lifecycle, ultimately leading towards a national "3R" Waste Reduction Strategy (Reduce, Reuse, Recycle), which was

passed in 2010. The Plan had also institutionalized community-based primary collection services, which also included educating residents about the new solid waste management system and engaging them to adopt the collection program [8]. In terms of waste disposal, Dhaka created a city Landfill Management Unit, closed an old open landfill (Berri Band), built a new sanitary dumpsite (Amin Bazar) and expanded the capacity of the Matuail landfill, upgrading the site with leachate collection, treatment facilites, gas venitng system and other technologies. The Matuail landfill ultimetely received Clean Development Mechanism approval in 2012 [9]. The city's composting facility received CDM approval in 2005[3], making it the globally first registered composting based CDM project [11].

Project impact [7]	
Local Impact	✓ Reducing GHGs ✓ Promoting Public-Private-Community Partenrships ✓ Reducing Solid Waste Management costs of municipalities ✓ Enhancing food security and promoting organic farming ✓ By 2006, the project was replicated 38 times in 20 towns in Bangaldesh ✓ Communities are participating and have ownership of the project ✓ Improving the quality of life of the city ✓ Reducing health hazards and improving the environment ✓ The models is included in national policy ✓ Raising pulbic awareness on Solid Waste Management and recycling ✓ Reducing poverty by creating jobs for the neglected poor ✓ Promoting sustainable farming
Global impact	✓ Attracting Foreign Direct Investment ✓ International replication ✓ Reducing GHGs ✓ Complying with the MDGs

Benefits of Decentralized Composting [12]
✓ Simple technology and labour intensive ✓ Low capital cost and locally available materials ✓ Less maintenance costs (compared to large centralized systems) ✓ Low-level skills required ✓ Having the residents separate their own waste reduces the volume of solid waste earmarked for disposal, increses the value of recyclables, and enhances the environmental awareness of the community ✓ Reduces the costs of transportation ✓ Quality compost is good since waste is efficiently separated twice and risks for contamination are minimized.

Benefits of Composting [12]
✓ Lightens heavy solis. Allowing better infiltration of both air and water ✓ Enhances and improves the soil's structure, so that becomes less subject to erosion by either water or wind ✓ Adds nutrients and trace materials to the soil, stimulating biological activity and encouraging vigorous plant rooting systems ✓ Enables soil to retain nutrients and moisture, preventing them from being leached out of soil and into the ground water.

Lessons learned

The massive scale of urbanization in South Asia is expected to create a growth in demand for solid waste services. An enormous opportunity exists to improve upon the "business-as-usual" approach of uncollected waste and open dumping encountered throughout the region and to convert this waste into value-added resources, such as alternative fuels and agricultural fertilizers [14]. About 60 to 80% of municipal solid waste in Asia's developing countries is made up of organic material [13]. By introducing composting, cities can mitigate the waste problem. Up to 80% of the waste can be diverted from the landfill to compost plants, thus reducing the amount of waste that goes to the dumpsite, reducing disposal costs for city administration and mitigating climate change [12].

Waste Concern's successful pilot project demonstrated how creative partnership ventures, in which non-government and private sector organisations supporting the work of waste disposal authorities, can tackle the serious problems of waste management and generate revenue for all those involved. These forms of public-private-community partnerships have the potential to provide innovative, efficient and sustainable solutions for tackling environmental problems [6]. The model has been replicated in more than 20 countries in the Asia Pacific region and Africa.

References

[1] World Bank (2014), Data Bangladesh, data.worldbank.org/country/Bangladesh
[2] PricewaterhouseCoopers, Global City GDP Rankings 2008, pwc.blogs.com/files/global-city-gdp-rankings-2008-2025.pdf
[3] Demographia World urban Areas, 11th Annual Edition 2015, demographia.com/db-worldua.pdf
[4] Susmita Dasgupta et. all., *Urban Flooding of Greater Dhaka in a Changing Climate: Building Local Resilience to Disaster Risk*, World Bank Publications, 2015
[5] Ashoka Innovators for the public, *Cash for Trash: Solving Dhaka's Waste Problem*, 2006, www.ashoka.org
[6] Iftekhar Enayetullah, Ashoka Fellow, 2001, www.ashoka.org/fellow/iftekhar-enayetullah
[7] Iftekhar Enayetullah, Q.S.I. Hasmi, *Community Based Solid Waste Management Through Public-Private-Community Partnerships: Experience of Waste Concern in Bangladesh*,3R Asia Conference, 2006, wasteconcern.org

[3] The CDM-approved facilities are only the decentralized large-scale composting projects that are dealing with secondary waste collection.

[8] Center for Clean Air Policy (CCAP), *Dhaka's Integrated Municipal Solid Waste Program, Bangladesh*, 2012, ccap.org
[9] The Government of Bangladesh, 2004, *CDM Project Design Document: Landfill Gas Extraction and Utilization at the Matuail landfill site Dhaka, Bangladesh*, cdm.unfccc.int/Projects/projsearch.html
[10] U.S. Environmental Protection Agency, 2011, *Emissions and Projections of Non-CO2Greenhouse Gases from Developing Countries: 1990-2030*, www.epa.gov/climatechange/EPAactivities/economics/nonco2projections.html
[11] The Government of Bangladesh, 2004, *CDM Project Design Document: Composting of Organic Waste in Dhaka*, cdm.unfccc.int/Projects/projsearch.html
[12] Waste Concern, United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), *Decentralized composting*, 2010, wasteconcern.org
[13] *ESCAP and Waste Concern Project*, Sustainable Urban Development Section, Environment and Development Division ESCAP, 2010
[14] The Asian Development Bank, The Australian Agency for International Development, *Toward Sustainable Municipal Organic Waste Management in South Asia*, 2011
[15] Faisal Ibney Hai, M. Ashraf Ali, *A Study on Solid Waste Management System of Dhaka City Corporation: Effect of Composting and Landfill Location*, UAP Journal of Civil and Environmental Engineering, Vol. 1, No. 1, 2005

Author/ Contact

© CEPS – Centre for European Policy Studies

Place du Congres 1
1000 Brussel, BELGIUM
Tel. +32 2 229 39 11
info@ceps.eu
http://www.ceps.eu/