

Strategies for the Replication of Urban Environmental Innovations – A Case of Community-based Decentralized Composting in Dhaka

Sudhakar Yedla



Indira Gandhi Institute of Development Research, Mumbai
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Associate Professor
Indira Gandhi Institute of Development Research (IGIDR)
General Arun Kumar Vaidya Marg
Goregaon (E), Mumbai- 400065, INDIA
Email (corresponding author): sudhakar@igidr.ac.in

Abstract

Traditionally sanitary services are provided by the State or State owned bodies. However, with the ever increasing population and waste generation rates coupled with lack of financial resources and infrastructure, poor community participation the municipalities are unable to provide a good service. As a result major fraction of waste remains uncollected on streets and sewer systems. Many bigger cities in Asia, South and Southeast-Asia in particular, are facing this situation. Hence, to bring the much needed additional resources and also to improve the efficiency of the system, involvement of private sector in providing these civic services has become a necessity.

Waste Concern (WC), a non-government organization in Dhaka had initiated community based composting by partnering with Public Works Department (PWD), Dhaka City Corporation (DCC) and fertilizer manufacturing industry. With improved community participation, they have successfully demonstrated the marketing of compost generated from solid waste and increasing demand for the same in the market testimonies the fact that the whole process is a success with all partners sharing various benefits. As this attempt by WC has been identified as an “innovative urban practice” by many international agencies, other cities from the developing countries are showing interest in this useful practice. In this paper attempts are made to understand the process of Dhaka’s Community-based Decentralized Composting (DCDC) model, its socio-economic impacts, long term intra-sectoral implications, necessary conditions, and to identify strategies/measures to replicate DCDC in the other developing cities of Asia.

DCDC is more labour intensive and less capital intensive option with promising employment generation. From the analysis it was found that this method of waste management is suitable for cities with poor waste management efficiency, considerable activity of rag picking by informal sector and existence of urban poor deriving livelihood on scavenging activity. There should also be enough demand for the compost generated and also the acceptability among partners. Based on the socio-economic analysis and personal interviews with all actors involved in DCDC, the following strategies/measures are identified as requirement for its replication and long term sustainability in the other developing cities in Asia – selection of appropriate technology; utilization of local human resources; public-private-community partnership and appropriate risk sharing; community participation; need for champion organization (Ambassador); entrepreneurship in the approach; product quality control; sustainable benefits sharing; regulatory framework to promote partnerships; interfacing the other complementing sectors; analyzing the demand-supply dynamics; pricing policies to regulate compost price; assessment of macro-economic impacts.

Key words: Community Participation, Decentralized Composting, Dhaka, Replication Strategies, Solid Waste Management

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1. Introduction

Economic development and increasing production levels result in environmental deterioration. Severity of degradation depends on the level of economic activity and also the characteristics of the city under consideration. Most of the environmental concerns viz. air pollution, industrial pollution tends to come under control after attaining certain level of economic development and this concept has been explained in the literature by means of Environmental Kuznets Curves (EKC) (Stern, 2004). Unlike the other pollutants, solid waste generation rates keep increasing with the economic development. Hence, the best suited strategies could be to reduce waste generation and manage solid waste generated at local level instead of shifting it to a common facility for its final disposal. Especially among the developing cities of Asia where the solid waste management units face severe resource crunch, the most feasible way to handle waste is to adopt community based decentralized approach.

Further, as solid waste is non-point source pollution, involvement of community is essential for its better management. Especially in developing cities of Asia where the waste is not segregated at source, the involvement of community is essential to achieve any betterment in waste management.

Such effort of decentralized approach to municipal solid waste management by involving local people, local technology and also multi-stakeholder partnerships was successfully demonstrated in Dhaka city, Bangladesh by an NGO named *Waste Concern* (WC). Innovative practice of introducing entrepreneurship in solid waste management brought significant success to those efforts. Many national and international institutions have identified it as a “good and innovative practice” in solid waste management and as a potential practice for application in other cities. However, complete and comprehensive insights are required to the whole process, its socio-economic impacts and barriers to its implementation so as to replicate it in other cities. Such insights are grossly missing at present. Hence, efforts are made in this study to present complete details of this innovative and successful process

and also identify and analyze important elements for its successful replication in other developing cities in Asia.

2. Waste Management in Dhaka

2.1 Socio-Economic conditions

Dhaka, the capital of Bangladesh and one of the fast growing cities in the world, is a mega city covering an area of about 1353 square kilometers. This city covers Dhaka City Corporation (DCC) and 5 municipalities neighboring DCC along with the adjoining urban areas. Slightly deviating from the regular mega city characteristics, Dhaka has 39% of its land under urban use while the remaining 61% is non-urban, semi-rural or agriculture land (JICA, 1991). Dhaka mega city is estimated to have a population of 11.3 million where DCC accounts for 5.94 million in the year 2004 (UNESCAP, 2004). Density of Dhaka city is 16,500 persons/sq.km and with limited availability of flood-free land, it may experience further rise in population density. Dhaka is the center of economic and commercial activities with more than 90% of the manufacturing units of the whole Bangladesh located in Dhaka. It has very high rate of poverty with its national per capita GDP recoded at US\$ 387 in 2000-01 (World Bank, 2000). Urban poor is dominant in this city with approximately 55% of the Dhaka population being rated as poor (GOB-ADB, 1996). Urban poor are particularly at a higher level of health risk with about half of urban poor (1.1 - 1.3 million) living in about 3000 slums and squatter settlements. Access to water supply, sanitation, solid waste management, and other civic services is extremely limited in these settlements and that leads to such a grave situation as shown in figure 1. With poor conditions prevailing in Dhaka urban poor and also considerable portion of them living in slums, solid waste problem has been the top priority issue in Dhaka City. Being flood prone state, Dhaka's municipal solid waste problem is further aggravated. The following section presents the details of solid waste management in Dhaka city.

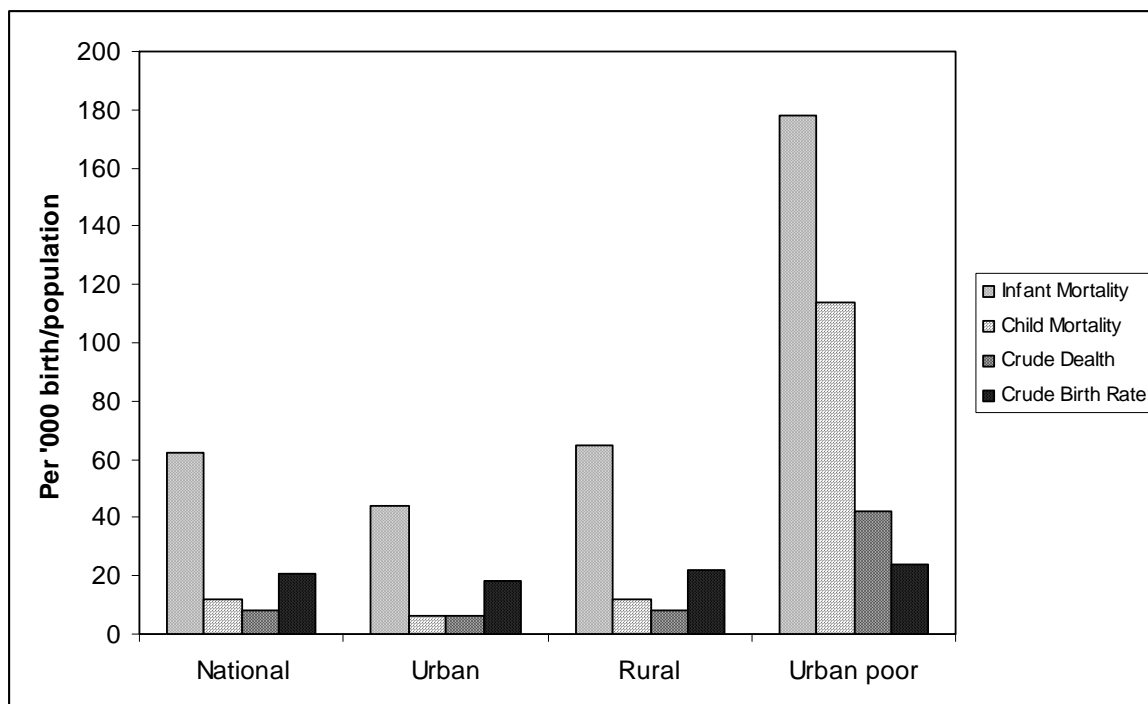


Figure1: Indicators for the poor conditions of urban poor in Dhaka (Source: UNESCAP, 2004)

Informal sector dominates the employment pattern in Dhaka with almost 63% of the total employed labour force working in the informal sector. It is interesting to observe that 10% of the employed under informal sector work on waste recycling and related activities with almost 120,000 people working on recycling related occupation in Dhaka. This is a distinct character observed in Dhaka that could provide an ideal platform for decentralized and community participation approach to solid waste management.

2.2 Solid waste management

Dhaka city, generating 3000-3500 tons of solid waste every day, has been facing one of the worst solid waste management problems among the other cities in developing countries of Asia. Only 42% of the waste is collected by the Conservancy Department of DCC leaving the rest on roadside, drains and low lying areas. The fact that only 22% of the urban poor have access to municipal waste collection bins signifies the severity of the problem, particularly for the urban poor (GOB-ADB, 1996).

Table 1 presents average composition of solid waste in Dhaka. Compostable fraction dominates Dhaka's municipal solid waste (MSW) with almost 68% of its residential waste is compostable. Plastic and polyethylene bags remaining in the waste poses a serious problem in Dhaka, a city which is geographically prone to frequent flooding. Plastic bags present in the

waste that is dumped in sewage, dangerously interfere with the sewer system by clogging the drainages and result in floodwater standing in for days together.

Table 1: Composition of Solid Waste in Residential and Industrial Areas

Component (Percentage by dry wt.)	Mixed waste	Industrial waste	Residential waste	Commercial waste
Food and veg. waste	70.12	26.37	59.91	62.05
Paper products	4.29	7.59	11.21	6.28
Plastic, rubber & leather	4.71	6.01	17.67	4.62
Metals	0.13	-	0.15	0.28
Glass & Ceramics	0.25	-	-	0.37
Wood	0.16	-	-	-
Garden wastes, tree trimmings ,& straw	10.76	4.32	8.76	2.86
Cloths	4.57	46.2	-	18.93
Rock, dirt & Misc.	5.01	9.49	2.30	4.62
Moisture Content(per cent)	65		50	54

Source: GOB and World Bank, 1998

Dhaka has no formal conceptualization of resource recovery, waste minimization and recycling. DCC, the formal sector, collects “mixed” waste from community bins and transport it in uncovered trucks and dumber trucks of capacity varying between 1.5 to 5 tons and disposes in an open area (Kazi, 1999). DCC due to the financial limitations cannot afford to go for a proper disposal by means of sanitary landfilling or incineration. DCC spends as high as Tk. 2045 to dispose of a ton of waste every day (Enayetullah, 1995). However, due to lack of proper coordination and poor stakeholder participation and partnerships the solid waste management problem is at its worst needing an immediate attention from various actors involved.

Apart from the formal collection and disposal by DCC, there are 120,000 rag pickers involved in recycling of waste in the city retrieving about 15% of the waste generated (Sinha, 1993). It was reported that the value of such retrieving is around 2.63 million USD every year which indicates the important role of the informal sector in waste management in Dhaka. However, these rag pickers - mostly women and children - retrieve only inorganic material which has a direct economic value leaving behind the organic and degradable garbage which has no direct market value. Adding another dimension to the complication, the land availability in DCC is very scarce and the existing dump sites are close to their capacity putting DCC waste management system on high alert.

2.3 Institutional and regulatory issues

Conservancy Department of DCC is responsible for solid waste management including cleaning of streets and drains. Due to lack of ordinance for proper waste management and also lack of resources, waste management in Dhaka remained a failure for long time. The Dhaka City Corporation Ordinance 1983 is the only local law that has a provision for the removal of refuse from all public streets, public latrines, urinal drains, and dustbins and for collection and disposal of such refuse. The National Policy For Safe Water Supply & Sanitation 1998 refers to the empowerment of setting tariffs, by-laws & other needs concerning waste management and places emphasis on organic waste recycling such as compost, bio-gas. The policy also suggests the transfer of the collection, removal and management of solid waste to the private sector subjected to its feasibility. The poor implementation of regulations and weak institutional support resulted in insignificant stakeholder participation and multi-stakeholder partnerships, which play a key role in waste management.

2.4 Conditions lead to innovation

Poor waste management in Dhaka leaves the city clueless and frequent floods and soil conditions add to the already worst situation. The city with extreme levels of poverty is further buckled with the spread of diseases and ground water contamination due to the poor waste collection and disposal. Another important problem that Dhaka and other areas of Bangladesh face is the depletion of soil organic content and the resulting fall in the productivity of the soil. This has potential to contribute to the waste management problem in terms of increased migration to Dhaka due to the falling agriculture practice. However, solid waste has potential to complement the rural economy by contributing the organic fertilizer which enriches the soil fertility. For a sustainable future of Bangladesh, efforts are needed to generate self-reinforcing cycle of urban-rural ecology. With these objectives, and conditions of high organic content in waste, poverty, dominant informal sector and scope for organic farming in Bangladesh soils, *Waste Concern* had started community-based decentralized composting in Dhaka city in the year 1995. They have adopted decentralized composting for the following reasons:

- Decentralized composting offers an economical mode of waste disposal
- Suits well with the economic, social and climatic conditions and waste composition
- Scope to use local material and man power with very little technology requirements

- Offers much scope for active community participation and source separation and reduction of waste generation at source itself
- Improvement of waste collection efficiency
- Reduction in costs of waste collection and transportation
- Income and employment generation for urban poor, specifically for women
- Increasing the life of the existing landfill (dump) sites

3. Dhaka's Community-based Decentralized Composting (DCDC)

Countering the common myth that waste is an “unwanted material and needs to be handled by the state only” *Waste Concern (WC)*, for the first time in Dhaka, had initiated a Community-based Decentralised Composting Project at Section-2, Mirpur, Dhaka. As a beginning step in 1995, *WC* has started composting on experimental basis in a small area of 1000m², lent by Lion's Club for a period of 3 months. Objective of this demonstration project was to explore the technical and commercial feasibility of the “labour intensive aerobic composting technique” in Bangladesh. This initiative by *WC* is an integration of various important elements like house-to-house collection of waste, decentralized composting of the waste collected using aerobic composting method, marketing of compost and recyclable material retrieved from the waste. This was achieved by involving partnership with civil societies, informal sector, private sector and other NGOs. Figure 2 presents the multi-faceted approach taken up by *WC*.

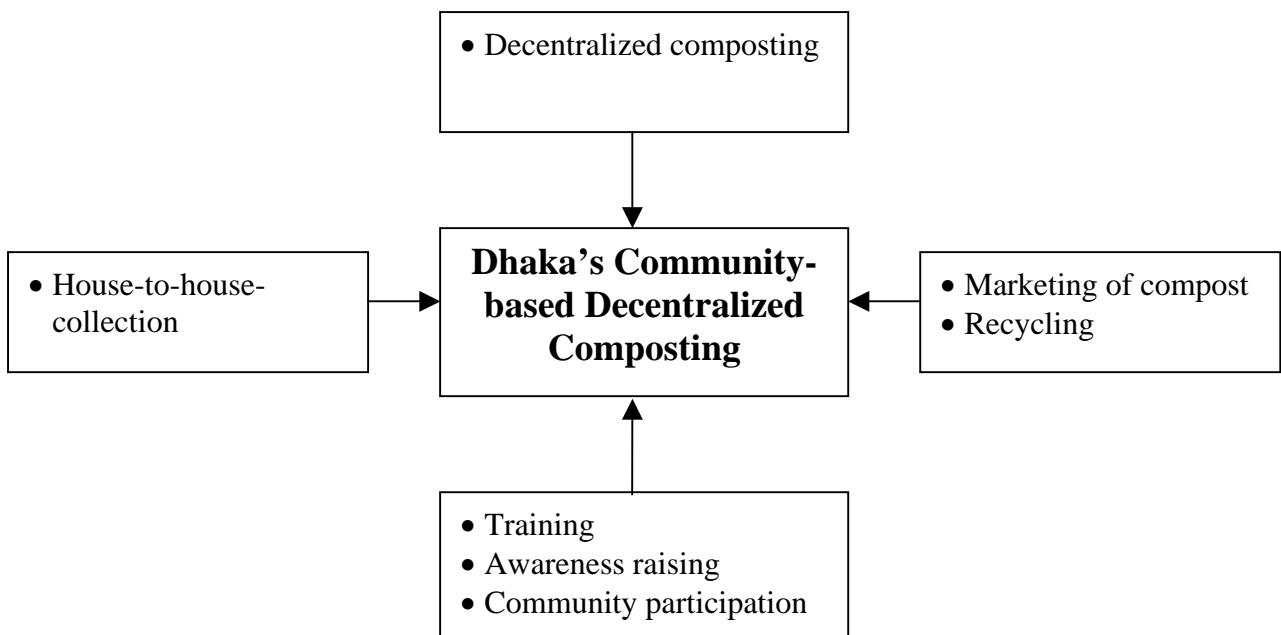


Figure 2: Approach of WC in DCDC

Initial establishment of the plant took substantial efforts from the founders of WC. Odour which is a major problem with the composting activity in the neighbourhood and lack of community participation were two major issues came between the proposal and implementation of this composting project. Before starting the project, a survey was conducted by *Waste Concern* on the target residents of Section-2, Mirpur with the help of Environmental Task Force of the Gothe Institute, Dhaka. Additionally, a survey of the farmers who are the potential users of the compost was also conducted to check the acceptability of the compost generated. Upon successful demonstration, now the Mirpur plant acts as a major demonstration plan for entrepreneurs and municipalities interested in implementing the DCDC. Following sections present in detail various steps undertaken by WC to make a successful demonstration of this *innovative urban environmental practice* (UNESCAP, 2004; Sinha and Enayetullah, 2000):

3.1 Community mobilization for waste collection

Community participation is an essential element in this practice and WC rightly gave a special attention to the assessment of the needs and aspirations of the beneficiaries and also to the community involvement. To achieve this WC, before initiating the project, had conducted a survey in the neighborhood of the Mirpur site to determine the opinion of people on the

problems of waste management and their willingness to participate and contribute (WTP) in any development program related to the waste management in Dhaka. Majority of the respondents (>80%) have indicated displeasure on the existing waste management run by DCC and showed willingness to contribute (Tk 15-16 per month) towards door-to-door collection. Though, some fraction of the respondents declined to any such proposal of service with additional payment, it was at a very insignificant level. This assessment had provided the much needed encouragement and support for the WC to start up the activity. WC, since the inception of the project, has been working, on a regular basis, to increase the awareness among the community and to segregate waste into organic (wet) and inorganic (dry).

3.2 Assessment of potential users of compost

Before setting up the project in 1995, WC had conducted a detailed survey of farmers in the vicinity of Dhaka who could be the potential users of compost generated from waste. It was revealed from the survey that 94% of the farmers in Savar, Hemayatpur in the vicinity of Dhaka are interested in buying compost for their crops. From the survey it was noticed that the soil fertility in Bangladesh has been declining due to the excess usage of inorganic fertilizers and lack of availability of organic fertilizer is one of the reasons for it (DoE, 1990; Enayetullah and Sinha, 1999). The conventional organic fertilizers used in agriculture viz. agriculture residue, animal dung etc. have been prioritized as cooking fuel in rural Bangladesh and this has resulted in lack of organic fertilizer for agriculture applications in Bangladesh.

Hence, the farmers of Bangladesh welcomed the idea of compost generation from waste and showed their willingness to buy the compost from WC (Enayetullah and Sinha, 1999). This along with community willingness to participate had encouraged WC to initiate the “Community-based Decentralized Composting” on an experimental basis.

3.3 Collection of solid waste

There are many recorded cases of composting of municipal solid waste in different cities like Mumbai, Chennai, Bangalore (India), Matale city in Sri Lanka and so on. However, most of them have failed due to the fact (among other reasons) that waste collected by the municipality was used for the composting. Un-segregated waste collected by the municipalities along with hazardous and toxic waste results in poor quality compost which is not acceptable to farmers for obvious reasons. To come over this problem, WC had adopted door-to-door collection of waste with the help of rag-pickers by providing them with rikshaw

vans² (manually pulled three-wheeler). This activity was started covering 100 households in section-2 of Mirpur housing estate, which is subsequently increased to 600 households. By the year 2004 the service has been extended to 1400 households by partnering with other CBOs (Community based organizations). WTP derived from the survey was used to design collection fee from the residents. In the initial phase, Tk 10 per month was collected from each household which has been increased to Tk 15 per month (UNESCAP, 2004). This revenue is used as salaries for the waste collectors and rikshaw drivers. Selling the inorganic recyclable materials retrieved from the waste gave the workers an additional income.

Waste Concern had adopted “sharing of benefits” as a mechanism to create more involvement of all actors and their active participation. As the residents pay for the waste collection, they became more vigilant and participated with increased involvement and the informal workers, who otherwise live in poor conditions, could make a comfortable living in this whole process. Other benefits of this process are explained in the sections to follow.

3.4 Identification of appropriate technology

Being a community-based approach, this process need to produce less odour and should not attract birds and other stray animals. And the technology applied should be simple without much of machinery and space requirements. Moreover, intensive mechanized techniques would not provide a cost-effective process for a small scale operation as in the case of community-based decentralized composting. Therefore, *Waste Concern* had conducted experimental runs to identify a suitable method of composting by trying out composting by “Chinese Covered Pile System” and “Indonesian Windrow Technique”. It was found that odour control is effective in the case of Indonesian method and also it produces quality compost compared to the Chinese method. Hence, *WC* had adopted Indonesian Windrow Technique in their demonstration plant at Mirpur.³ Flow line of the composting process in DCDC and various steps involved starting from the collection to its marketing (DCDC model) are presented in Figure 3.

² Each rikshaw van can carry 1.18 cubic meters of garbage

³ Details on the composting process, its technicality and composition of the compost under these two methods can be found at Enayetullah and Sinha (1999)

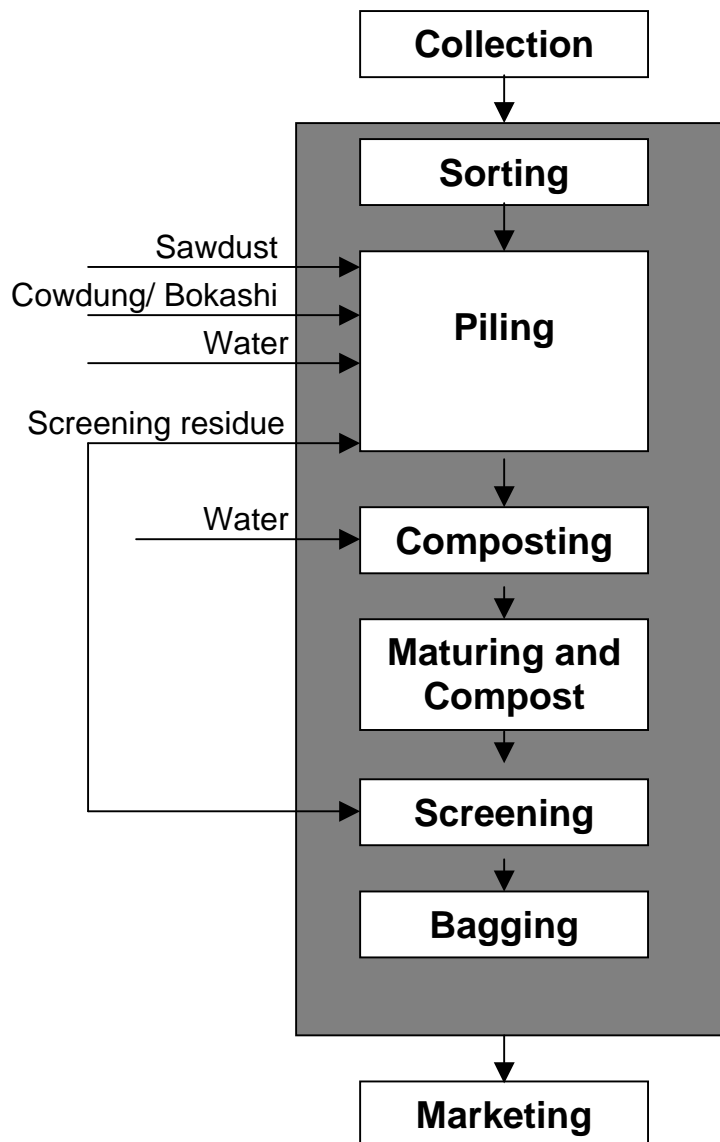


Figure 3: Description of DCDC Model (adopted from UNESCAP, 2004)

Three tons of solid waste is composted every day at Mirpur demonstration site. It requires the services of 11 workers, 6 waste collectors and 3 van drivers and one plant manager. Five rikshaw vans are in service.

Waste Concern, encouraged by the success of this process had identified/developed three distinct methods of composting for varying conditions. This waste composting process has been extended to slum areas, where DCC fails to reach and collect waste, to improve their living conditions and generate additional income from waste composting. In slums where there is lack of space and system to operate, “Barrel type composting” was adopted where a cylindrical shape container with an option of opening at different depths was used to compost

the waste dumped by the dwellers⁴. WC had adopted 3 types of composting techniques for varying conditions as shown below:

- Barrel type composting : Lack of land and also a system to maintain the complete composting process
- Aerator type composting : When the waste could be transported to an available common land and Mirpur demonstration plant is an example for this method of composting.
- Box type composting : When the waste can be transported but the space is limited

Box type process is more hygienic among all three methods. All three methods have been doing well and producing comparable quality of compost in Dhaka.

3.5 Marketing strategies for compost

Marketability of compost play the key in DCDC and compost quality is crucial. WC had their compost tested by the Laboratories of Soil Science Department of Dhaka University and Environmental Engineering Laboratory of Bangladesh University of Engineering and Technology (BUET). The quality of compost produced by WC was better than that of the organic compost available in international market (Enayetullah and Sinha, 1999). This has been the main reason for high acceptability of the WC product among the farmers of Bangladesh. Hence, there exists a good market for this compost in Bangladesh and particularly in and around Dhaka. Many other efforts of compost generation from solid waste (for instance Excel industries in Mumbai) failed due to poor acceptability of the compost (Sarika, 2004).

This small scale approach cannot get into bigger scale unless the entrepreneurship quality becomes a part of the strategy. *Waste Concern* had tapped this point to the perfection by trying to penetrate the market by means of the already existing network of dealers who are close to the farmers in the traditional chain of agriculture. *Waste Concern* had signed partnership agreement with Pam Agro Industries - a fertilizer marketing company - to sell all the compost produced in different community based composting plants in Dhaka. This company purchases bulk of the compost produced by WC, enriches it to the nutritional needs of different crops and markets the product. Map Agro has established a nutrient enrichment

⁴ these observations presented here are based on author's field visit and interaction with the WC directors and other actors involved.

manure production plant near Gazipur, Dhaka where they enrich the compost produced by WC.

Waste Concern sells its compost to Map Agro Ltd. at Tk 2.5per Kilogram. Map Agro in turn enriches it to sell at a price of Tk 5 per Kilogram. With the help of their existing network of fertilizer and pesticide dealers this enriched compost could be sold as far as 400-500 kilometers away from the enrichment plant. Unlike in many other attempts of converting waste into compost, this innovative marketing strategy has done wonders in the case of DCDC.

3.6 Partnerships among actors

Since the beginning of the project in 1995 the approach of WC has been the partnership among number of actors involved in solid waste management. The partnerships have been in different clusters linking public sector, private sector and the community. Following are the major actors and partnerships involved:

Donor Agencies and Public Sector

Subsequent to the successful demonstration in 1998, Ministry of Environment and Forests (MoEF) of the Government of Bangladesh had selected WC as a sub-implementing agency for their project “Community based urban waste management in Dhaka” which is funded by UNDP.

UNDP under community based solid waste management program in Dhaka city provides seed grant/startup fund for the establishment of community based composting units integrated with house-to-house collection of waste. Ministry of Environment and Forests (MoEF) is the responsible body to coordinate this program and provides strategic support.

Dhaka City Corporation (DCC), Public Works Department (PWD) and Lion’s club plays an important role by permitting the private/NGO establishments to use their land for the establishment of composting units and also by waiving water and electricity charges. *Waste Concern* had signed a partnership agreement with DCC in these lines.

NGOs and Private Sector

In sociological terms any new practice involving public participation needs champions and champion organization. Usually NGOs or CBOs play such role and in the present case of innovative practice *Waste Concern* had effectively played that role of “Champion organization” putting consistent efforts and follow-ups. The responsibility of WC was to

mediate with the city corporation and other public agencies as well as private sector to provide land and other supports for the implementation of the program and marketing of recyclables and compost. *Waste Concern* had conceptualized the “green force⁵” and provided them with much needed assistance and guidance. Technical assistance given by *WC* encouraged the communities to participate in community based decentralized composting. *WC* also provides help for the communities to establish their own composting plants (run by CBOs) and provides them with training on the operation and maintenance of these plants. *WC* helps the community owned and operated plants in marketing of their compost through the partnership that *WC* has with the fertilizer company.

Marketing companies are very important partners in this project of waste composting and rightly *Waste Concern* had signed a partnership agreement with Map Agro Ltd. on marketing of compost generated in the waste composting plants of *WC* through Map Agro’s country wide network of dealers in rural areas of Bangladesh. Demonstration farming was adopted by Alpha Agro, a sister concern for Map Agro Ltd. to convince the dealers and the farmer about the usefulness of the compost. Multi-stakeholder partnerships adopted in DCDC are shown in Figure 4.

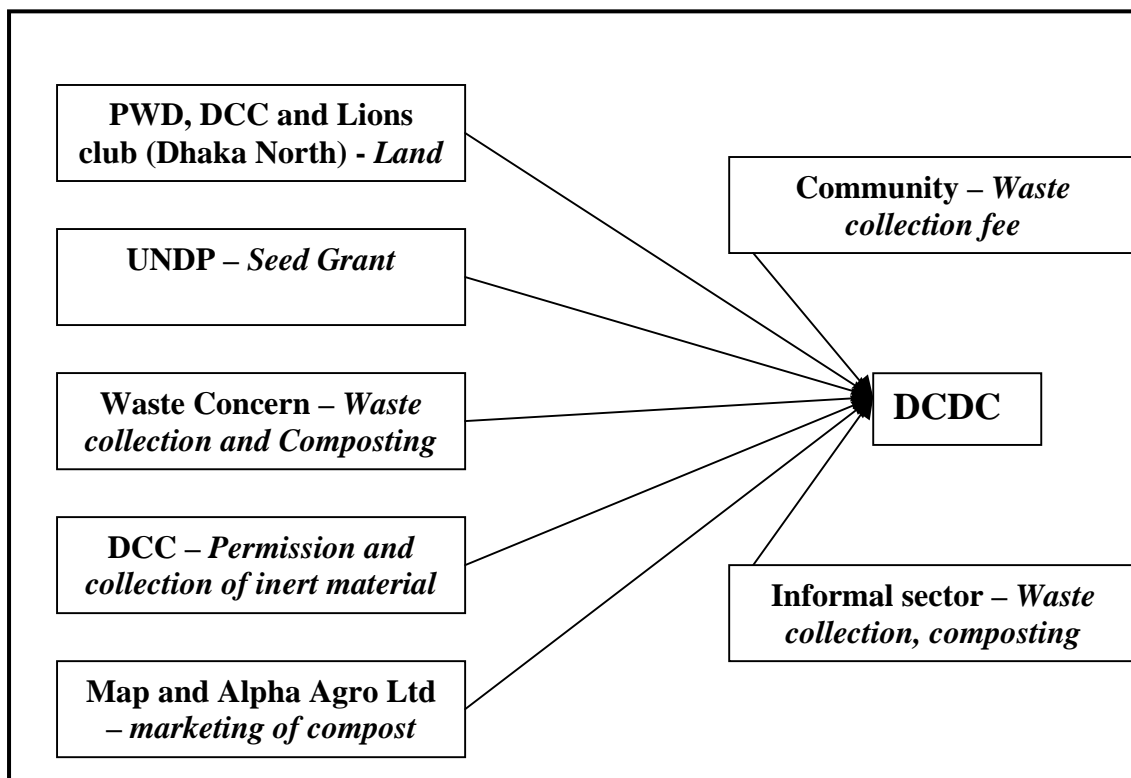


Figure 4: Multi-stakeholder partnerships in DCDC

⁵ Green force is the group of enthusiastic youth members of the community who are aware of environmental problems related to the waste management and willing to educate the remaining community on voluntary basis

3.7 Benefits sharing across actors

Equitable benefit sharing is one among many important factors behind the success of this innovative urban practice. DCC by providing land for the composting plants get benefited by the reduced volume of waste to be handled by them. DCC waste collection trucks could avoid going to certain localities where DCDC is operative. With DCDC spreading wide, it was estimated that DCC enjoys substantial savings in waste collection budget.

Community gets a better management of their waste and clean surroundings and streets. House-house waste collection charges by WC make them more watchful of the services, which is a driver for improvement of systemic efficiency. Increasing demand for the enriched compost provides the fertilizer company a huge market advantage. List of actors involved and their actions and benefits shared are given in Table 2.

Table 2: Details of actors involved and their actions and benefits in DCDC process

Actors	Actions	Benefits
Community	<ul style="list-style-type: none"> • Handover the waste to WC waste collector and pay collection fee 	<ul style="list-style-type: none"> • Proper waste management • Clean surroundings and environment
Waste operators		
<i>Waste Concern</i>	<ul style="list-style-type: none"> • Collects solid waste from households, sort it into fractions and convert the organic matter into compost 	<ul style="list-style-type: none"> • Waste collection charge from households • Revenue from Compost sold to Map Agro Industry
City Corporation	<ul style="list-style-type: none"> • Collects the inert material from the composting plant and transport it to the dump site 	<ul style="list-style-type: none"> • Reduced waste to be handled
Informal sector	<ul style="list-style-type: none"> • Participation on waste collection and composting 	<ul style="list-style-type: none"> • Decent salaries and additional income from recyclable material
Compost buyers and Users		
Map Agro Industry	<ul style="list-style-type: none"> • Buy the raw compost from WC, enrich and sell it to farmers through their dealers • Demonstration of organic farming 	<ul style="list-style-type: none"> • Profits on the enriched compost • Increased demand for the compost
Farmers	<ul style="list-style-type: none"> • Application of enriched compost 	<ul style="list-style-type: none"> • Increased yield • Improved soil fertility

4. Socio-Economic Impact Assessment

Assessment of socio-economic impacts is a mandatory requirement for any development activity. For its long term applicability, DCDC has to be financially viable and show less negative impact on allied sectors. This section addresses socio-economic impacts of this innovative development practice in urban waste management.

4.1 Financial viability of DCDC

Community based decentralized composting in Dhaka was found to be financially viable both on short and long terms application. Production of compost involves two types of costs - fixed cost (establishing composting plant), and operational cost (for running the plant). And it also involves two types of benefits viz. direct and indirect. Table 3 and 4 presents the fixed and operational costs involved in a three tons capacity composting plant at Mirpur (demonstration plant) in Dhaka⁶.

Table 3: Fixed costs involved in a 3-ton capacity compost plant⁷

Item	USD ⁸
Construction costs	6485.92
Purchase of 5 rikshaw vans	1388.88
Water and electricity connection	925.92
<i>Total fixed cost</i>	<i>8801</i>

Table 4: Annual operational costs involved in a 3-ton capacity compost plant

Item	USD
Salaries	6500
Electricity and water	1930
Raw material for compost	1777.77
<i>Total annual operational cost</i>	<i>10207.77</i>

With annual earning of 14,805.55 USD (from compost and house-to-house waste collection charges), the net annual earning from the project was found to be 4597.78 USD with a payback period of 23 months (UNESCAP, 2004). In this analysis the land cost was excluded. This presents a very favorable situation for new ventures into community based decentralized composting with partnerships. It is to be noted that this assessment did not consider any seed money grants from international development agencies.

⁶ More details on this can be obtained from UNESCAP, 2004

⁷ details can be found in Enayetullah and Sinha (1999)

⁸ 1 USD = Tk 54

Apart from the financial issues this project has demonstrated other major benefits which are listed below:

4.2 Land savings and reduced waste disposal cost for the City Corporation

For every ton of waste handled by DCDC, the city corporation has to transport only 15% of the waste. This not only reduces the transportation burden on the City Corporation but also decreases the land required for its disposal. At present, DCC requires 1.1m³ of land for the disposal of one ton of waste and USD 15.16 for its collection and transportation (World Bank, 1998). According to the DCC sources, cost of land is USD 22.68 per square meter. Thus the annual savings for DCC from landfill area and cost of solid waste management against one ton per day composting unit in Dhaka are around 85%⁹.

4.3 Empowerment of women, urban poor and employment generation and improved community participation

Community based decentralized composting is a labour intensive practice. According to the experience of WC, one three-ton composting plan needs 20 workers. And given the nature of the work, 11 out of 20 workers can be women leaving out 9 workers for collection of waste. As this additional opportunity taps the rag picker community, which is the most disadvantaged group typically from the urban poor, this practice exhibits great potential to empower the poor. This significantly contributes towards the empowerment of women among urban poor. Fast spreading in the vicinity of Dhaka, DCDC shows great potential for employment generation. It was estimated that DCDC can generate up to 16,000 jobs for the urban poor in Dhaka city and 90,000 at national scale. Though this is a rough estimate based on the waste generation rate in Dhaka and the number of workers needed in a 3-ton DCDC plant, it presents the indicative employment generation potential of this innovative urban practice.

Community mobilization and capacity building of communities to manage their waste at local level is a long term and time consuming process. However, with proper interventions and persistent mobilization and demonstration, the behavioral pattern of community towards waste can be changed. *Waste Concern* had achieved this successfully in four localities of Dhaka City namely Baily Road, Green Road, Kallaynpur and Dholpur. Household's contribution towards house-to-house waste collection is an indicator for the behavioral

⁹ More details can be obtained from Enayetullah and Sinha (1999) and UNESCAP, 2004

change in communities due to these interventions in terms of community based decentralized composting.

4.4 Increased crop yield and soil quality

Bangladesh is an agriculture based economy. Due to the intensification of agriculture increased dose of inorganic chemical fertilizer and abandoned practice of applying the conventional organic manure has resulted in depletion of organic carbon content of soils in Bangladesh. Organic content of the soil in Bangladesh is found to be as low as 3%. The conventional manure viz. agriculture residue and animal dung are used as cooking fuel in rural Bangladesh resulting in its shortage for agricultural applications. Hence there is a dire need of organic compost and the compost derived from waste worked out to a good substitute. It was reported that the application of WC compost could increase the yield by 25-30% per hectare when compared with the crops where inorganic chemical fertilizers are applied (UNESCAP, 2004). Organic fertilizer improved the carbon holding capacity of soil and that provides a long term benefit to farmers. Thus, community based decentralized composting practice has potential to influence the rural economy as well.

Implementation process

In future, with this encouraging result in Dhaka, *Waste Concern* aims to replicate the pilot project, in phases, in all the towns and cities of Bangladesh. An implementation process of DCDC was prepared for this purpose, which includes nine steps as shown below. Cities interested in adopting DCDC are advised to follow these steps:

- Step 1: Work permission/agreement with public/private agency
- Step 2: Base line survey of the selected community
- Step 3: Community mobilization
- Step 4: Capacity building of the community group as “Green Force”
- Step 5: Setup of composting plant
- Step 6: House-to-house collection of waste
- Step 7: Start of composting process
- Step 8: Marketing of the compost
- Step 9: Handing over the plant to community after training and demonstration

5. Issues of long term sustainability of DCDC and its replication

As explained in the previous sections community-based decentralized composting interacts with multiple sectors and hence it possesses potential to have both inter-sector and intra-sector impacts. In the previous sections the intra-sector issues were examined. However, assessment of inter-sector issues, long term and macro economic issues is very essential for this process to sustain on long run. Such issues include:

5.1 Policies to formalize and supplement recycling sector

Community based composting process, if implemented at national level, would result in increased recovery of recyclable material from waste and subsequently an increased supply to the recycling industries. Hence, measures are needed to stream line the recycling activity, which has been an informal sector so far, so as to manage the additional supply of retrieved raw material. Formalizing this sector and encourage it by providing economic incentives would act as a catalyst to further improve the waste management/recycling efficiency. No such integrated measures are attempted in Dhaka so far. During the field trip interactions with various important actors, it was noticed that no such measures have been attempted so far as the activity is still limited to Dhaka. However, it is also noticed that DCDC has been spreading to adjoining areas and hence, it is necessary to devise new and integrated approach. Measures are needed to improve the recycling efficiency, acceptability of recycled products and also its value in light with the improved recycling efficiency. Development of trans-boundary market for recyclable waste is another dimension one can explore to optimize the system at a macro level.

5.2 Impact on agriculture enterprise

In light with the green revolution to meet the ever increasing need for food grains, application of chemical fertilizers is inevitable. However, as a measure to achieve more sustainable agriculture it is argued that agriculture should be practiced as a self reinforcing enterprise (IGIDR, 2003). There are evidences in the literature to say that an enterprise approach yields better net output compared to that of conventional approach to agriculture. Application of compost derived from waste has potential to interfere with such enterprising concept since, in the enterprising approach, enrichment of soils is taken care by the complimenting activities as a part of the enterprise. Availability of waste-based organic compost might interfere with the

changing trends of agriculture practice towards sustainable agriculture. Hence, such possible impacts need to be assessed as DCDC interacts closely with agriculture sector.

5.3 Impact on agriculture policies and trade policies

Application of organic compost derived from solid waste could be a welcoming step towards the implementation of organic farming. Thus it could provide an edge for those goods cultivated under this practice in the international market. However, it is also possible that the international standards on importing agriculture products may become a bottleneck in the case if the compost generated from waste fails to meet certain standards. Hence, it is necessary to regulate the quality of the compost generated from waste and such measures need to be taken by the national government to protect the interests on a longer time frame.

5.4 Impact on fertilizer industries and need for pricing regulation

Due to higher yields, organic compost derived from solid waste (in its enriched form) is gaining popularity among the farmers and hence its demand is increasing. This is partly due to the fact that organic compost is cheaper than the commercially available chemical fertilizers. It further adds to the fact that application rate (dose) is less in the case of organic composting compared to chemical fertilizers. However, it is estimated that even if the total waste generated in Bangladesh is converted into compost it can meet only 17% of the total fertilizer demand of Bangladesh. Given these conditions, there is a high likeliness for the market monopoly on the organic fertilizer making it available only to rich farmers. Hence, to maintain the equitability, there is a need for pricing regulation on organic fertilizers. Though it is unlikely that such situation would arise in the near future, it is an essential element for the long term sustainability of DCDC.

5.5 Impact of fuel pricing policies

Due to the extreme poverty prevailing in rural Bangladesh, agriculture residue and cattle dung which are natural soil conditioners have been used as cooking fuel. This leads to considerable indoor air pollution. With more development, national governments would be compelled to provide subsidy on essential commodities such as cleaner cooking fuels like kerosene and cooking gas and such a policy development would make those natural soil conditioners available again for agriculture practice. In such a case the demand for waste derived organic compost may reduce as the chemical fertilizers would get an edge over the

organic fertilizer derived from solid waste. This would result in non-utilization of compost and its disposal would become a liability.

This process of Community-based Decentralized Composting involves many actors and multiple sectors. Hence, presence of good environmental governance is a necessity for its successful implementation. Detailed assessment of the above issues would provide a basis to make DCDC more sustainable in longer term applications and also for its replication in other similar cities.

6. What made DCDC a successful story and how to replicate it to other cities in Asia?

DCDC has been spreading all over Bangladesh. It has potential to serve cities in the other Asian countries as well. However, one has to identify what are the guiding parameters in this process and the success determining conditions to assess the potential of this method to be replicated in other cities. What are the key factors contributing to its success and what are the criteria based on which this method needs to be assessed for its replication in other cities?

6.1 Key factors/strategies contributing to its success

The following factors/strategies have been identified, based on the analysis presented in the previous section and also the personnel interviews carried out with major actors in DCDC, as factors contributing to its success.

- 1) Selection of appropriate technology and its adaptation to the local needs
- 2) Utilization of local human resources for its operation and maintenance (O&M)
- 3) Public-private-community partnership and appropriate risk sharing
- 4) Community participation and appropriate utilization of social capital
- 5) Continuous efforts to increase awareness among the residents
- 6) Posters and training manuals
- 7) Links with the resident organizations
- 8) Champion organization and brand Ambassadors
- 9) Embedded business plan with entrepreneurship in the holistic approach
- 10) Innovative marketing strategy
- 11) Product quality control by continuous monitoring of the process
- 12) Benefits sharing across actors which creates more involvements and ownership especially for the community
- 13) Support from the state and other NGOs

14) Proper scaling up of activities

As a major and influencing factor, *WC* had adopted a gradual scaling up approach which is demonstrated in the form of different phases of DCDC with their time frame as shown below:

1995: *Waste Concern* had started a pilot community based resource recovery project in Dhaka

1997: Regional Urban Development Office (RUDO) – South Asia had supported to increase the capacity of the project and to further test the DCDC model

1998: With support from MoEF and UNDP, *WC* under SEMP has replicated the model in (five) communities in Dhaka

1999: Partnership agreement signed between public-private sector-community to implement the project

2000: Replication of the model in Dhaka, Khulna and Sylhet cities

2004: Replication of the model in 14 cities of Bangladesh by the Department of Public Health Engineering (DPHE) and UNICEF. City scale landfill gas extraction and composting project under CDM for Dhaka.

Replication of DCDC is planned in Qui Nhon City of Vietnam and Matale City of Sri Lanka

15) Selection of appropriate waste management method suiting well with the local conditions.

Community based decentralized composting of solid waste is considered as one of the best alternative for Dhaka due to the fact that informal sector is very dominant in total employment and 10% of the employed under informal sector works on waste recycling and related activities with almost 120,000 people working on recycling related occupation in Dhaka. This is a distinct character observed in Dhaka which supports decentralized and community participation approach to solid waste management.

These are the factors made DCDC a success story in Dhaka so far. However, for a successful replication of DCDC in other cities and also to attain long term sustainability the issues addressed in the Section 5 needs to be considered along with the above listed factors/strategies.

6.2 Strategies/Measures needed for its replication in other Developing Cities in Asian

Based on the analysis presented in the previous section and also personal interview conducted with various actors involved in the whole process of DCDC the following strategies/measures have been identified as key measures for the replication of DCDC in the other developing cities of Asia.

- Appropriate technology and its adaptation to the local needs (M1)
- Utilization of local human resources for O&M (M2)
- Public-private-community partnership and appropriate risk sharing (M3)
- Community participation (social capital) (M4)
- Need for champion organization (Ambassador) (M5)
- Embedded business plan (entrepreneurship in the approach) (M6)
- Product quality control (M7)
- Sustainable benefits sharing (M8)
- Regulatory framework to promote partnerships (M9)
- Identification of other complementing sectors (organic and inorganic) and designing the interface between them (M10)
- Demand-supply dynamics (M11)
- Pricing policies (compost, fertilizers and fuels) and regulation of compost price (M12)
- Macro-economic impacts (eg. employment generation, support to the economy say by helping to achieve better recycling, more agricultural productivity) (M13)

Detailed explanation on each of these strategies/measures is presented in the following sections while analyzing the results.

7. Discussion and policy recommendations

Urban innovative practices are the result of ever increasing need for alternative methods of management, away from the conventional methods of environmental management. One of such innovations is the Dhaka's community-based decentralized composting (DCDC). It has been giving very good results and spreading across to the other areas within Dhaka and also other cities in Bangladesh. However, community based composting has been a failure in many other cities. Thus, in an attempt to identify the key factors/strategies for its success so

that it can be replicated in the other developing cities of Asia, the following conclusion are made-

- The technology has to be appropriate and suitable to the local conditions. Need of higher capital investments dampen the initiative and burden the progress with set of constraints such as need to maintain a certain scale of operation irrespective of the conditions, need for the expertise in handling the equipment and so on.
- DCDC is a labour intensive and a local initiative. It would sustain only when it can become an integral part of the community. Utilization of local human resources in its operation and maintenance is the key to achieve such integration.
- Partnerships not only enhance the investment and efficiency but also provide a feel of ownership to all important actors - community and public and private sector in the present case. Moreover, partnership provides the continuity in the process chain. Hence, partnership is an essential strategy for DCDC and its replication.
- Involvement of community and its active participation is essential for the success of this practice. Waste segregation is the key without which this process could be another case of failure; community participation is important in achieving this.
- Initiatives like DCDC need a persistent effort and there is a need for a champion organization of ambassador to achieve such continuity in efforts. Many such initiatives in South-Asia have failed due to lack of champion organization. Thus ambassadors are important to make successful implementation of DCDC.
- Embedded entrepreneurship and business plan has been identified as one of the most important strategies to replicate DCDC in other developing cities of Asia. This has been the secret behind this successful innovative urban practice of Dhaka. DCDC has a business approach which essentially embedded the “market character” to it and that has created much needed “efficiency” in the system. Hence, for better replication of DCDC in other cities it is essential to examine what are the strategies to achieve better involvement of private sector in solid waste management.
- More than its production, disposal of compost generated in this process is a major challenge and its disposal, in longer term perspective, depends on its quality and

acceptability in the market. Hence, measures are needed to ensure the product quality control.

- As DCDC has many actors involved, sustainable benefit sharing is important to maintain the equity and balance in the process to make it sustain in longer run.
- Multi-stakeholder partnership is an essential strategy for DCDC and hence, the government needs to develop regulatory framework to develop and execute such partnerships. In Asia, absence of such regulations is a major bottle neck to build partnerships.
- Complete execution of DCDC deals with many sectors viz. formal waste management department, informal sector, recycling industry, fertilizer industry, pesticides marketing agencies and farmers (the end users). Unless these interacting sectors complement each other, there is a possibility of unsustainable flow of material. Hence, providing an interface for these complementing sectors is an important aspect while attempting to replicate this process in other cities.
- The other major factors/strategies for the success and replication of DCDC are Assessment of demand-supply dynamics for the compost generated; Formulation of pricing policies (compost, fertilizers and fuels), regulation of compost prices and Assessment of the other macro-economic impacts.

Dhaka's Community-based Decentralized Composting is labour intensive and less capital intensive option mostly suitable for cities with less systemic efficiency in waste management, lack of land for landfilling, considerable activity of rag picking by informal sector and existence of urban poor deriving livelihood on scavenging activity. Existence of major agriculture activity and potential demand for the compost generated are also pre-conditions for the successful implementation/replication of DCDC.

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