

Community Based Solid Waste Management Through Public-Private-Community Partnerships: Experience of Waste Concern in Bangladesh

by

Iftekhar Enayetullah

Director, Waste Concern

Q. S. I. Hashmi

Deputy Director, Dept. of Environment

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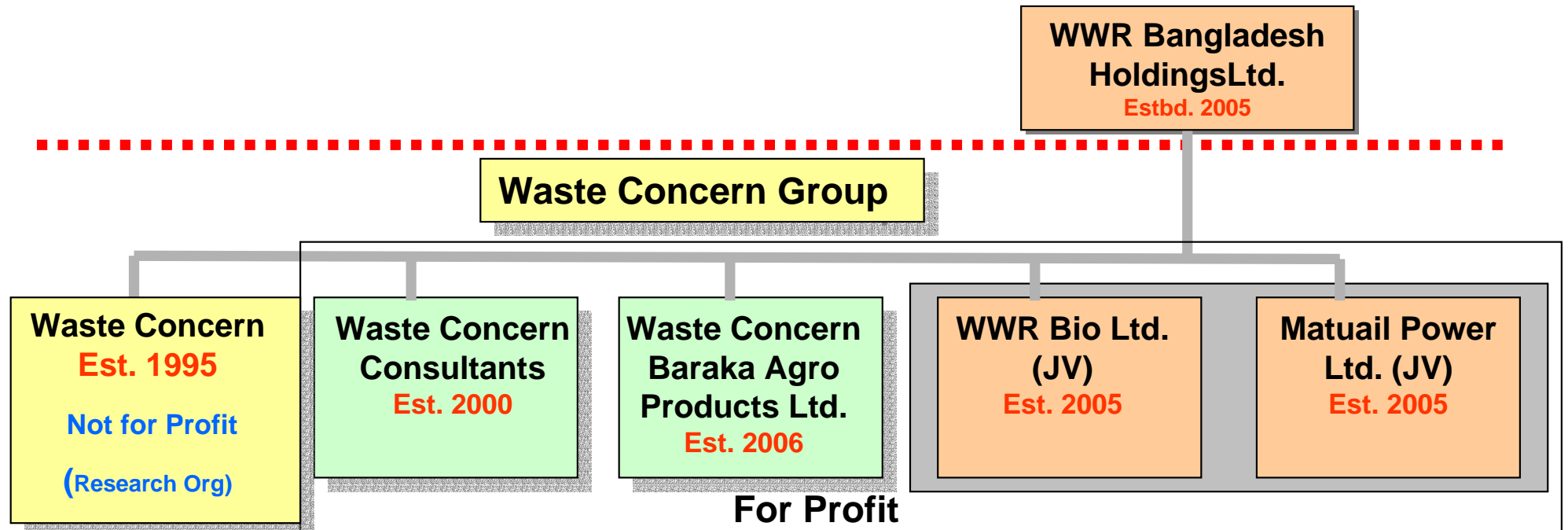


Presentation Outline

- I. Urbanization in Bangladesh
- II. **Solid Waste Management Situation in Bangladesh**
- III. Problems of Solid Waste Management in Urban Areas of Bangladesh
- IV. **Approach Followed by Waste Concern to Solve the Problems**
- V. How Solid Waste is Converted into Resource Through Public- Private-Community Partnerships (PPCP)
- VI. **Impact of the PPCP Model**
- VII. Lessons Learnt

Brief Introduction of Waste Concern

- ❑ In 1995, Waste Concern, a national research organization was established in Bangladesh.
- ❑ In 2005, **Waste Concern Group** was formed as a Social Business Enterprise (SBE) comprising of a number of special purpose companies.
- ❑ Our main objective is to promote the idea of *converting waste into resource*.



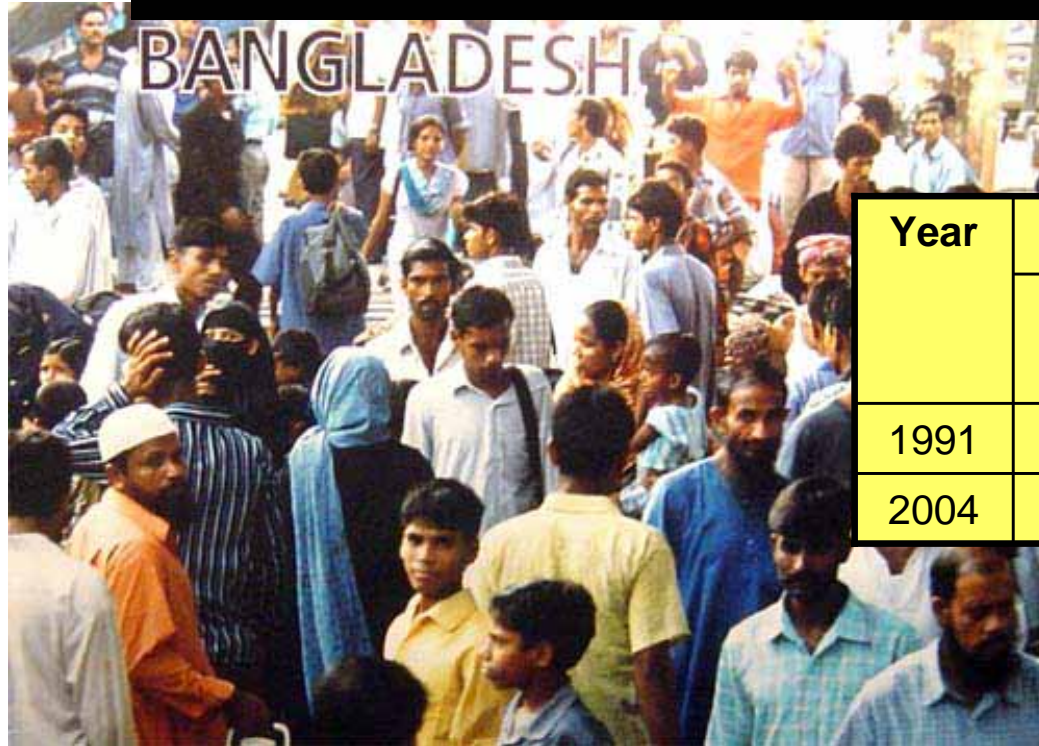
❑ Fields of Activity:

- ✓ Solid Waste Management and Resource Recovery
- ✓ Clinical & Hazardous Waste Management
- ✓ Policy on Waste Management
- ✓ Climate Change & Clean Development Mechanism
- ✓ Industrial Pollution Control
- ✓ EMS & ISO 14001
- ✓ Organic Farming
- ✓ Ecological Sanitation
- ✓ Renewable Energy



web: www.wasteconcern.org

Urbanization in Bangladesh



Year	Urban Population Density/Sq.Km.		
	Bangladesh Urban	Dhaka Mega City	Dhaka City Corporation Area
1991	2179	4795	15333
2004	3008	8573	18055

Year	Total Urban Population	Percent of Urban Population	Average Annual Growth Rate (%)
1951	1819773	4.33	1.69
1961	2640726	5.19	3.75
1974	6273602	8.78	6.62
1981	13535963	15.54	10.63
1991	20872204	20.15	5.43
2001	28808477	23.39	3.27
2025*	78440000	40.00	-

* source: UMP, Asia News, Summer, 1999

Total Waste Generation in Urban Areas of Bangladesh in 2005

City/Town	*WGR (kg/cap/day)	No. of City/Town	Total Population (2005)	Population** (2005)	TWG*** (Ton/day)		Average TWG (Ton/day)
					Dry season	Wet season	
Dhaka	0.56	1	6,116,731	6,728,404	3,767.91	5,501.14	4,634.52
Chittagong	0.48	1	2,383,725	2,622,098	1,258.61	1,837.57	1,548.09
Rajshahi	0.3	1	425,798	468,378	140.51	205.15	172.83
Khulna	0.27	1	879,422	967,365	261.19	381.34	321.26
Barisal	0.25	1	397,281	437,009	109.25	159.51	134.38
Sylhet	0.3	1	351,724	386,896	116.07	169.46	142.76
Pourashavas	0.25	298	13,831,187	15,214,306	3,803.58	5,553.22	4,678.40
Other Urban Centers	0.15	218	8,379,647	9,217,612	1,382.64	2,018.66	1,700.65
Total	-	522	32,765,516	36,042,067	10,839.75	15,826.04	13,332.89

*WGR= Waste Generation Rate,

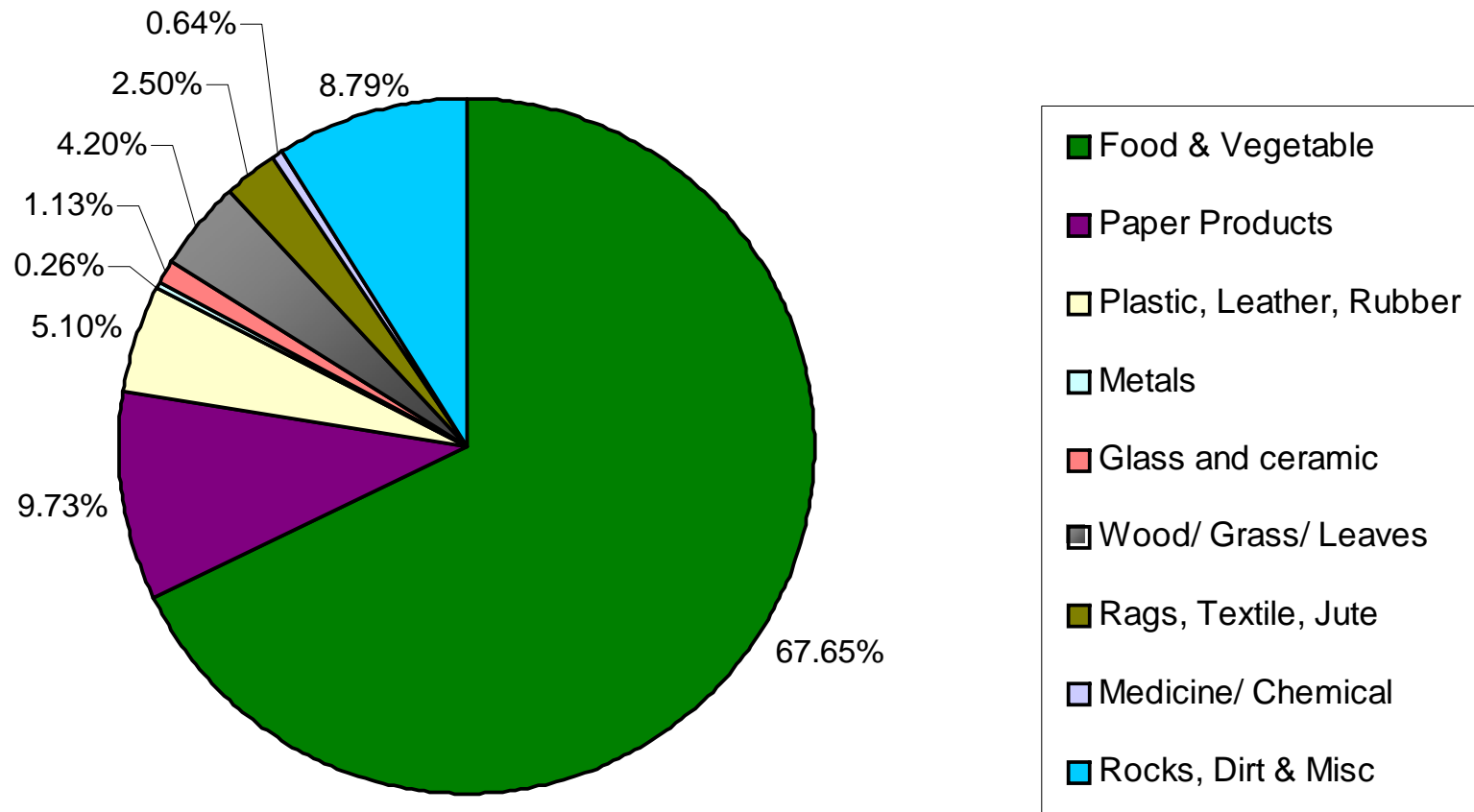
** Including 10% increase for floating population,

***TWG= Total Waste Generation, which increases 46% in wet season from dry season

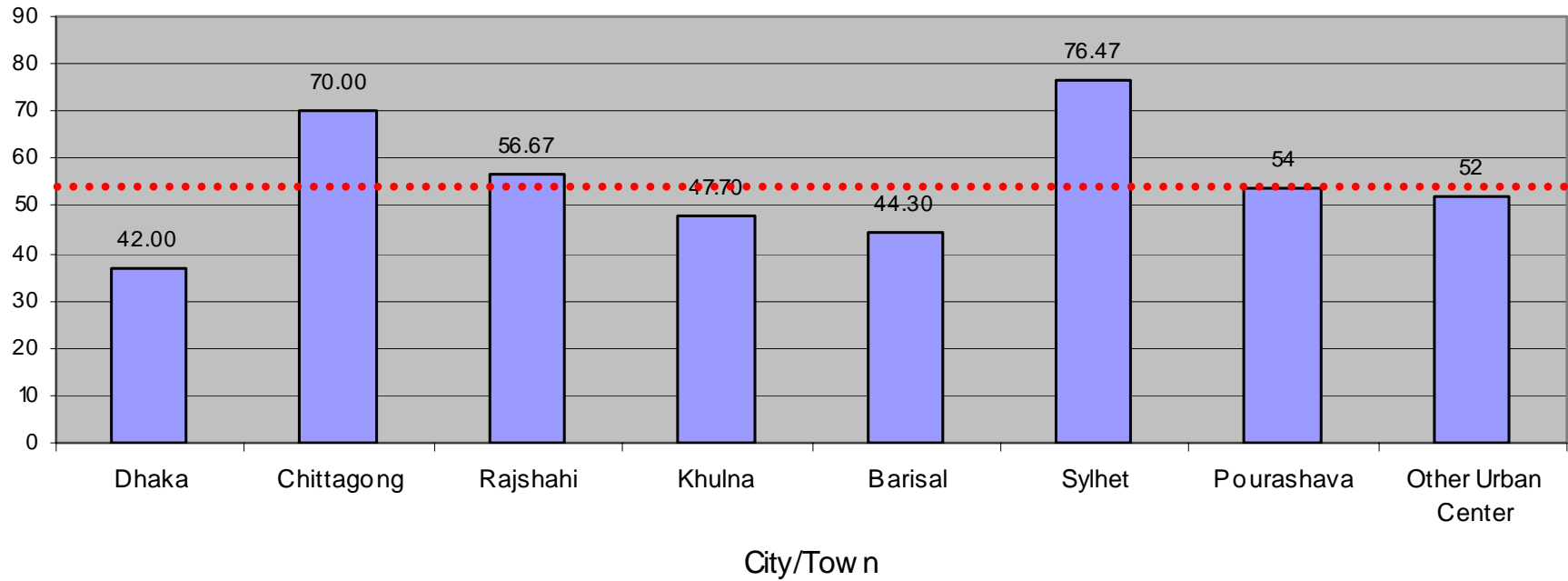
Source: 1 JICA (2004), 2 Chittagong City Corporation, 3 Field Survey, 4 Sinha (2000), 5 Field Survey, 6 Sylhet City Corporation, 7, 8 Field Survey

Average per capita urban waste generation rate is estimated as 0.41 kg/capita/day.

Fig 1: Average Physical Composition of Urban Solid Waste



Waste Collection Efficiency in Different Areas



RECYCLING INDUSTRIES IN DHAKA CITY



ALUMINIUM



PLASTIC



GLASS



PAPER



BONES



POLYTHENE

▪ **120,000** urban poor from the informal sector are involved in the recycling trade chain of Dhaka city

▪ **15%** of the total generated waste in Dhaka (mainly inorganic) which amounts 475 tonnes/day are recycled daily.

Informal Recycling of Inorganic Solid Waste and Savings through Recycling (in 2005)

City/Town	TWG* (Ton/day)	No. of City/Town	% of Inorganic Waste Recycling**	Savings through recycling per year, (Tk. million)
Dhaka	4,634.52	1	15.00	170.00
Chittagong	1,548.09	1	12.45	28.96
Rajshahi	172.83	1	6.7	1.00
Khulna	321.26	1	6.00	6.94
Barisal	134.38	1	5.42	5.14
Sylhet	142.76	1	4.23	3.44
Pourashava	4,678.40	298	3.89	8,862.52
Other Urban Center	1,700.65	218	4.00	1,627.50
Total	13,332.89	522	-	10,705.5 (15.29 million US \$)

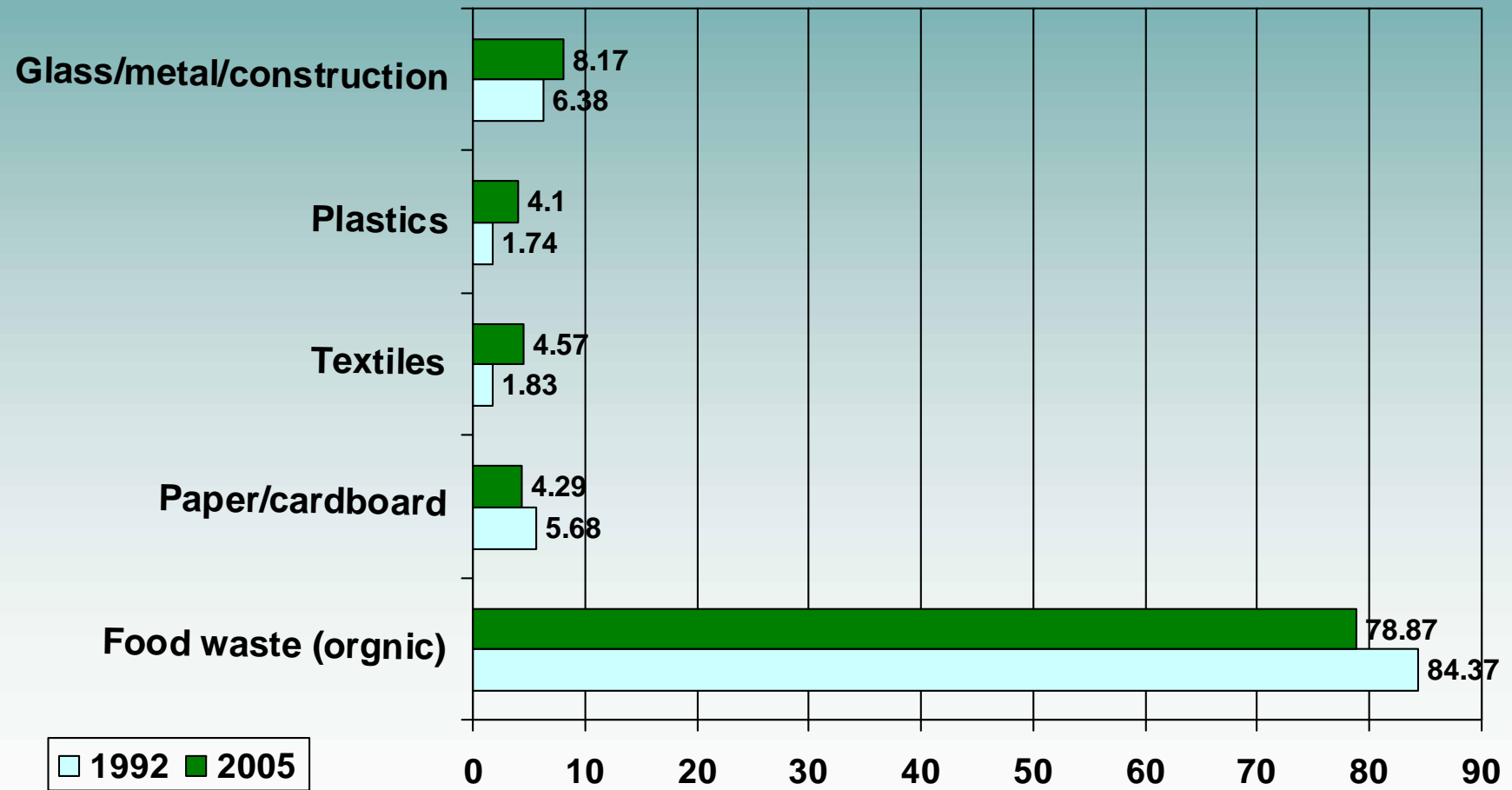
1 US \$ = BDT 70

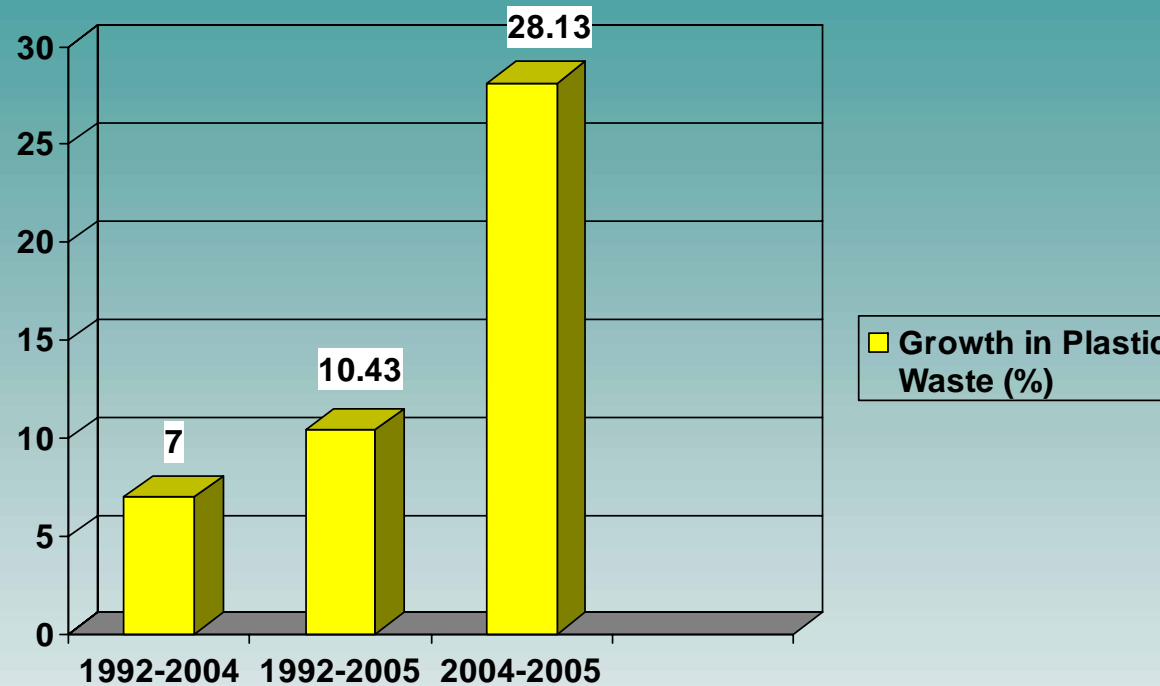
Relationship of GDP & Population with Waste Generation

Year	Urban Population	Total Urban Waste Generation (Ton/day)	Per Capita Waste Generation Rate in urban areas Kg/cap/day	Per Capita GDP
1991	20.8 million	6493	0.31*	US \$ 220
2005	32.76 million	13,330	0.41**	US \$ 482****
2025	78.44 million	47,000	0.60***	-

* World Bank, 1998, ** Waste Concern, 2005, *** UMP, 1999, **** GOB, 2006

Comparative Analysis of Composition of Waste Dhaka City Between 1992 & 2005





Comparison	1992* (%)	2004**	2005***
% of Plastic in DCC waste	1.74	3.2	4.1

* BUET/World Bank

** JICA, 2004

*** Waste Concern, 2005

Growth of Plastic Waste in DCC area

WASTE GENERATION IS RAPIDLY INCREASING



MAJOR PORTION OF THE WASTE IS ORGANIC



Low-lying areas, drains and canals are clogged with waste



Low-lying areas, drains and canals are clogged with waste



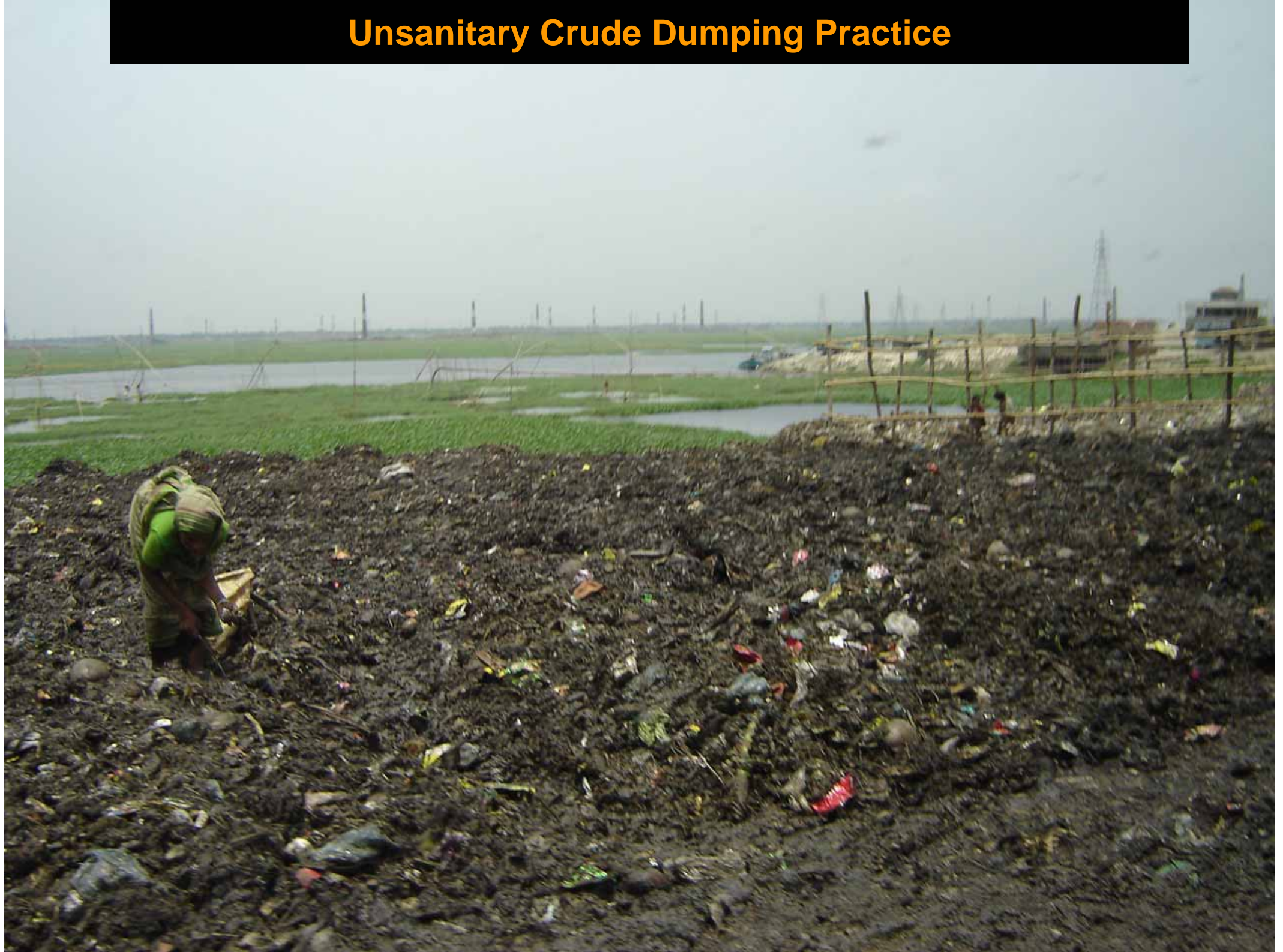
Unsanitary Crude Dumping Practice



Unsanitary Crude Dumping Practice



Unsanitary Crude Dumping Practice



Unsanitary Crude Dumping Practice

Mymensingh Town



Unsanitary Crude Dumping Practice

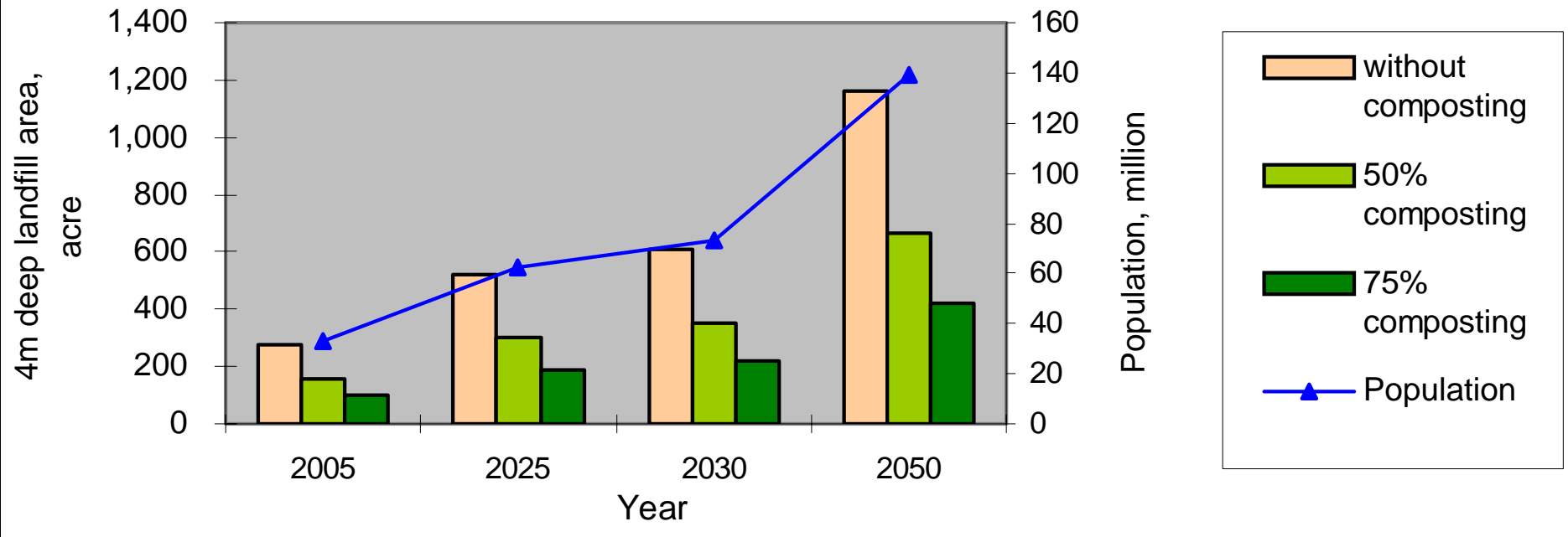


Landfill Volume Requirement per Year for Urban Solid Waste Disposal

City / Town	TWG* (Ton/day)	Waste Collection Rate, %	Landfill area required with 4m depth, acre per year	
			With existing collection efficiency	With 100% collection efficiency
Dhaka	4,634.52	42.00	39.89	94.97
Chittagong	1,548.09	70.00	22.21	31.72
Rajshahi	172.83	56.67	2.01	3.54
Khulna	321.26	47.70	3.14	6.58
Barisal	134.38	44.30	1.22	2.75
Sylhet	142.76	76.47	2.24	2.93
Pourashava	4,678.40	54.42	52.17	95.87
Urban Center	1,700.65	52	18.12	34.85
Total	13,332.89	-	140.99	273.21

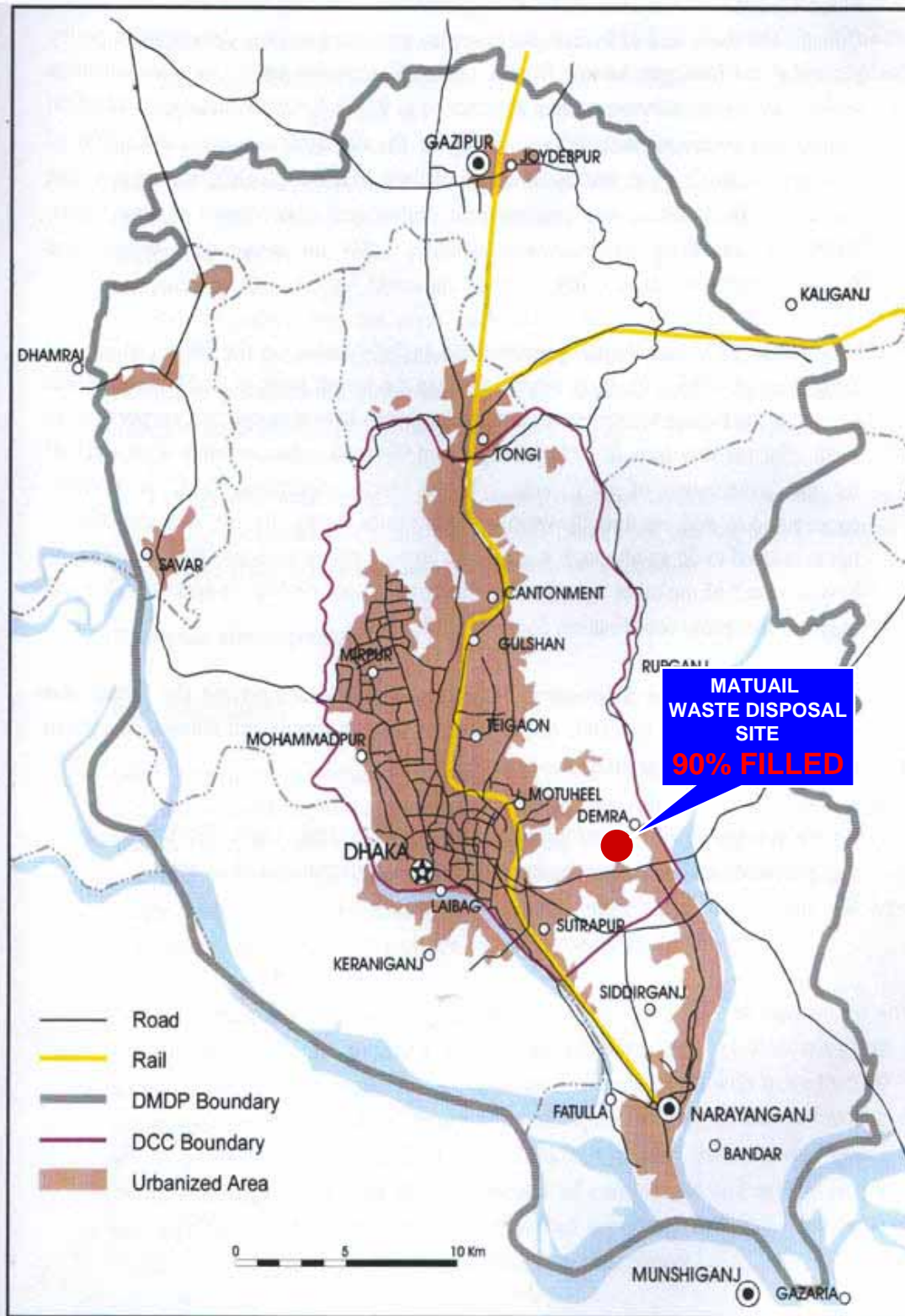
*TWG = Total Waste Generation

Fig 8: Projection of Future Landfill Requirement



Green House Gas Emission Potential of Urban Solid Waste

City/Town	TWG*, (Ton/day)	GHG emission potential, million ton CO ₂ e / year
Dhaka	4,634.52	0.76
Chittagong	1,548.09	0.25
Rajshahi	172.83	0.03
Khulna	321.26	0.05
Barisal	134.38	0.02
Sylhet	142.76	0.02
Pourashava	4,678.40	0.77
Other Urban Center	1,700.65	0.28
Total	13,332.89	2.19



Demographic Profile of Dhaka Mega City

In terms of population Dhaka was the 11th biggest city in the year 2000 and will be the 4th largest city in world in 2015

- Total Population : 11.3 million (2004)
- Administrative Area : 1353 Sq. Km
- Population Growth Rate : 4.33% (1991-2001)
- GDP (Per Capita) : US \$ 500

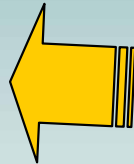
Dhaka City Map Showing the only official dumpsite (unsanitary) of the city which will be filled-up within a year.

Negative Impacts of Unmanaged Waste

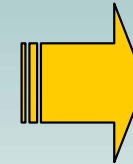
VERMINS
*Spreading more than
40 Diseases*



METHANE GAS
*Bad Odor &
Green House
gas*



LEACHATE
*Polluting
Ground
& Surface Water*



PROBLEMS OF SOLID WASTE MANAGEMENT

PROBLEMS OF SOLID WASTE MANAGEMENT



WASTE GENERATION RAPIDLY INCREASING

CITY AUTHORITY CANNOT COPE WITH THE SITUATION

LACK OF SOURCE SEPARATION

INADEQUATE WASTE COLLECTION

SHORTAGE OF LAND FOR WASTE DISPOSAL

POLLUTING SURFACE AND GROUND WATER

ORGANIC WASTE IS LEFT UNUTILIZED

LACK OF AWARENESS AMONG CITIZENS

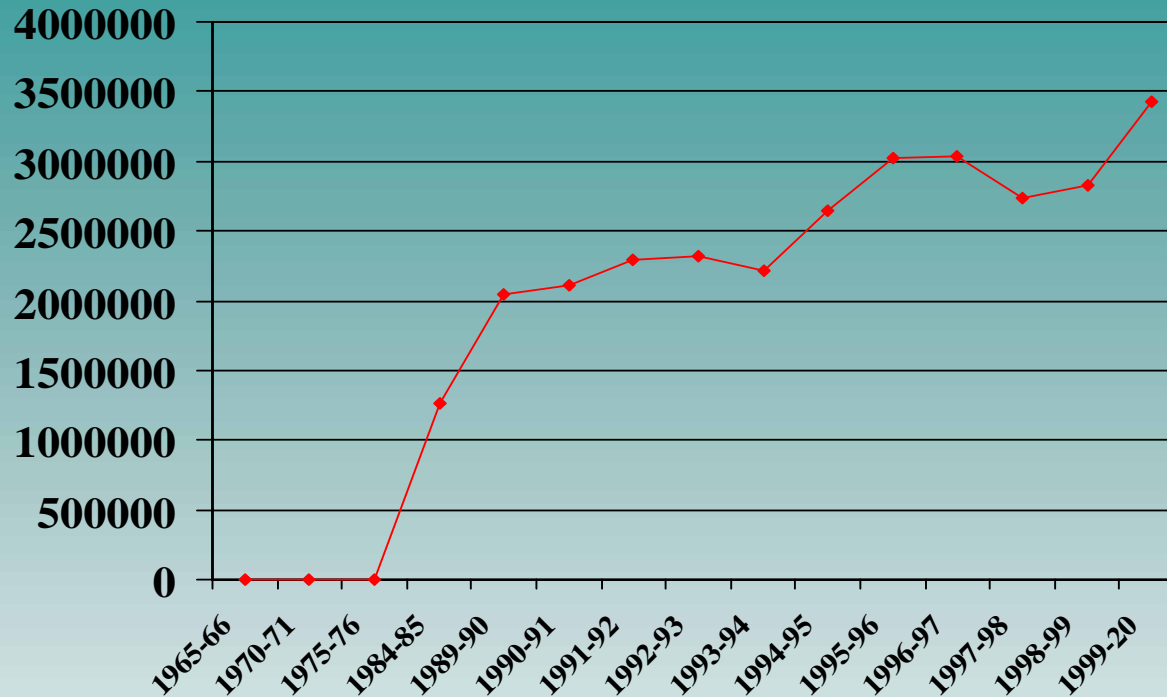
LACK OF PARTNERSHIP BETWEEN STAKEHOLDERS

EMISSION OF GREEN HOUSE GAS

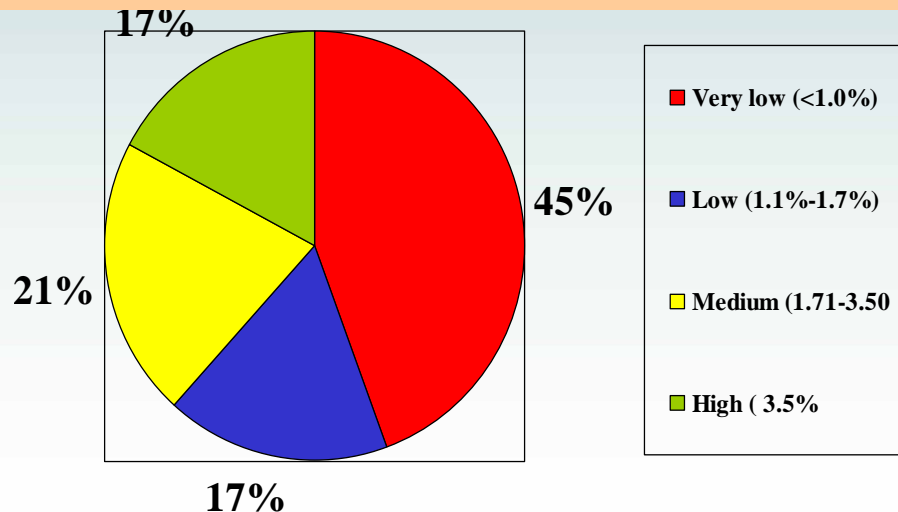


SOIL CONDITION OF BANGLADESH

REDUCES THE HARMFUL EFFECTS OF CHEMICAL FERTILIZER



Graph Showing the Increase of Chemical Fertilizer Consumption in Bangladesh



83% of cultivable land in Bangladesh has less than 3.5% organic matter (more than 3.5% is considered to be good soil)

Pie Diagram Showing Depletion of Organic Matter From the Soil of Bangladesh

Waste Concern's Believes ...

'Waste is merely raw material in the wrong place', (Talbot, 1920). Eighty six years ago, Fedrick A. Talbot in his book, Millions from Waste wrote this line.



ENVIRONMENTAL AND HEALTH PROBLEMS IN URBAN AREAS DUE TO UNMANAGED WASTE

ADDRESSING TWO MAJOR PROBLEMS



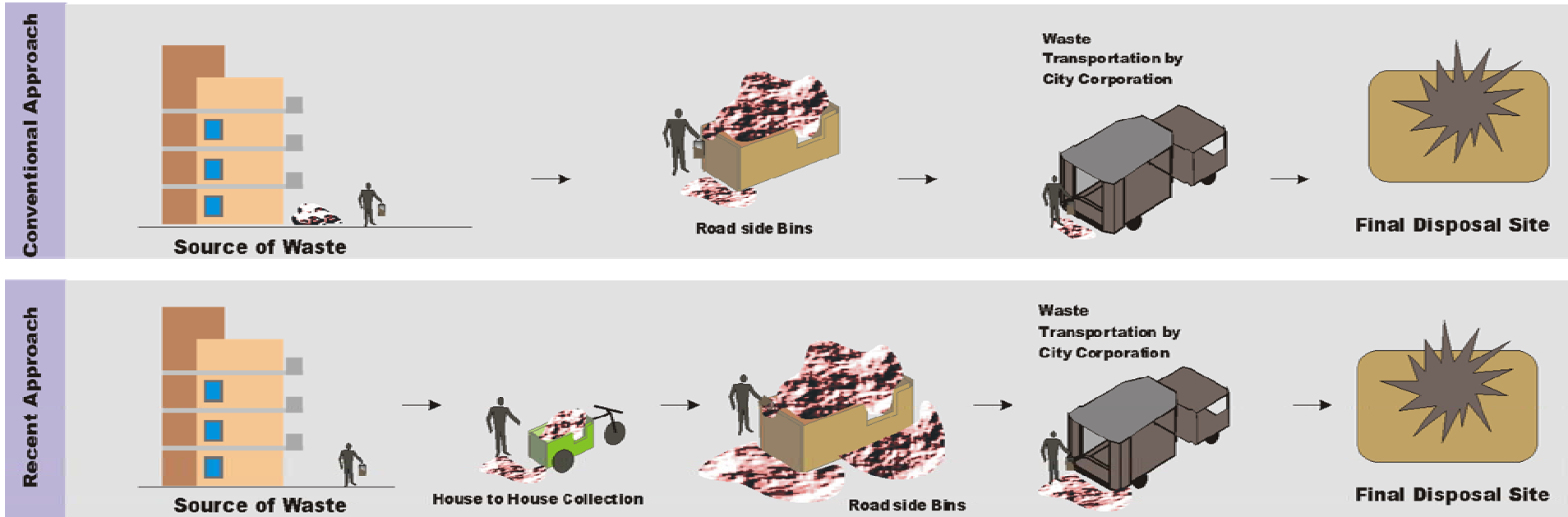
ORGANIC MATTER DEPLETION IN THE SOIL OF RURAL AREAS



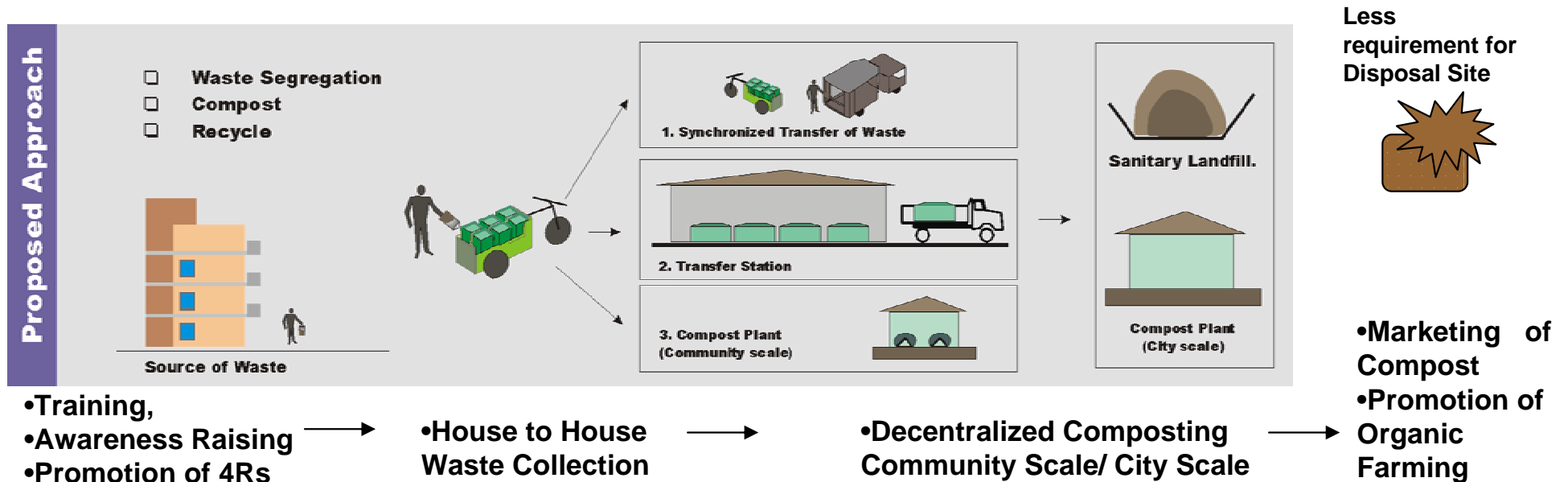
SOLUTION

- Converting Organic Waste Into Compost Using Community Based Decentralized Approach Integrated with House to House Waste Collection**
- Use of Compost/Enriched Compost in Agriculture**

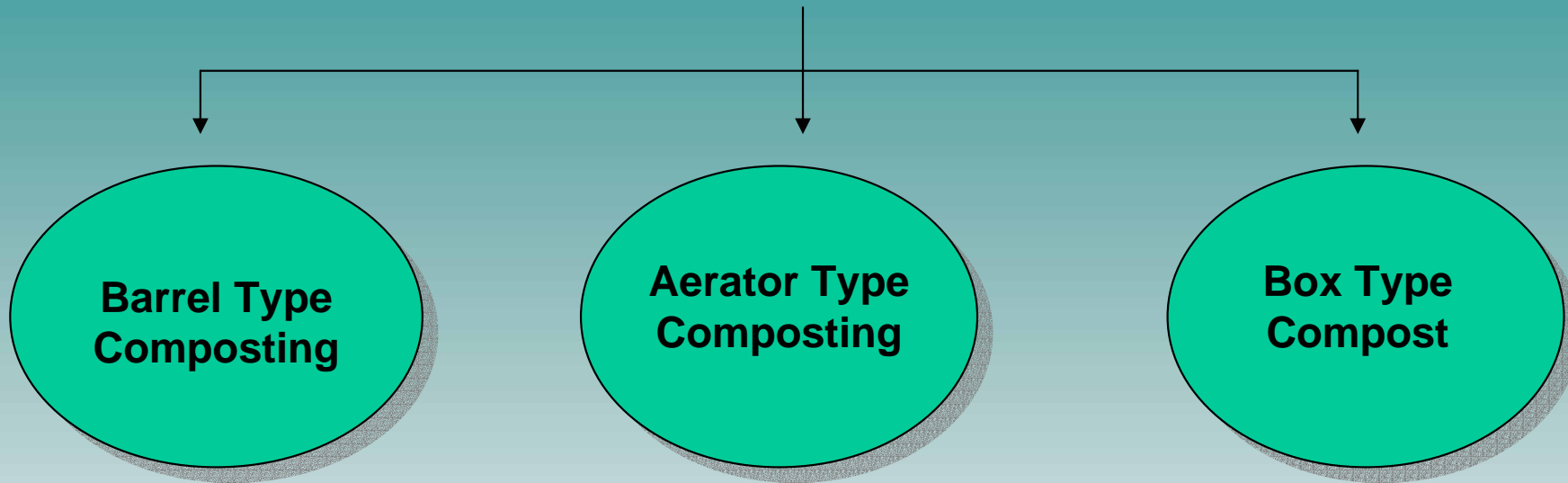
Conventional End-of-Pipe Solution of Solid Waste Management



Approach of Waste Concern Based on 3R Principle



Composting Methods Used by Waste Concern



Major Advantage Using Waste Concern's Methods are:

- Simple, affordable, labor intensive, low cost
- Suitable to our socio-economic and climatic condition



Community Based Urban Solid Waste Management in Dhaka (component 3.3.2)

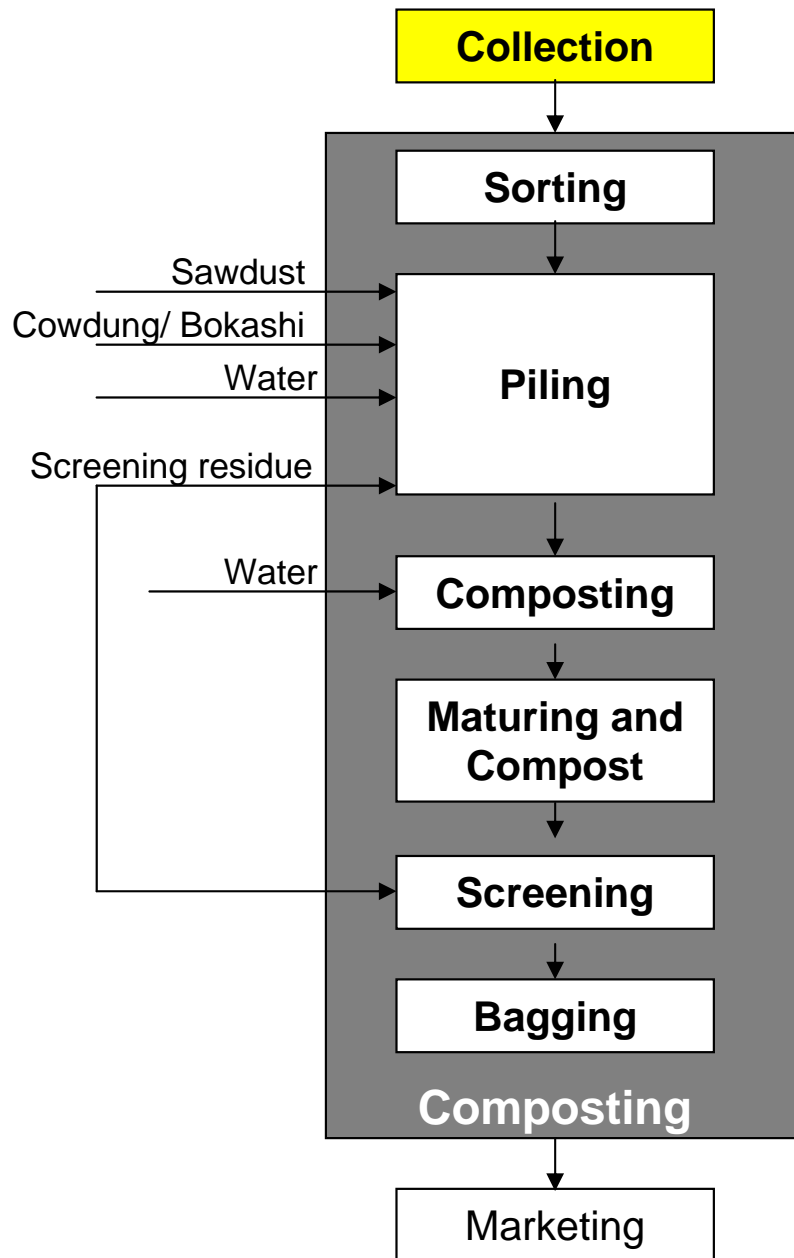
Implementing Agency: Ministry of Environment & Forest

Sub-Implementing Agency: Waste Concern

Supported by: UNDP

Community Based Composting

Different Steps of Composting Process



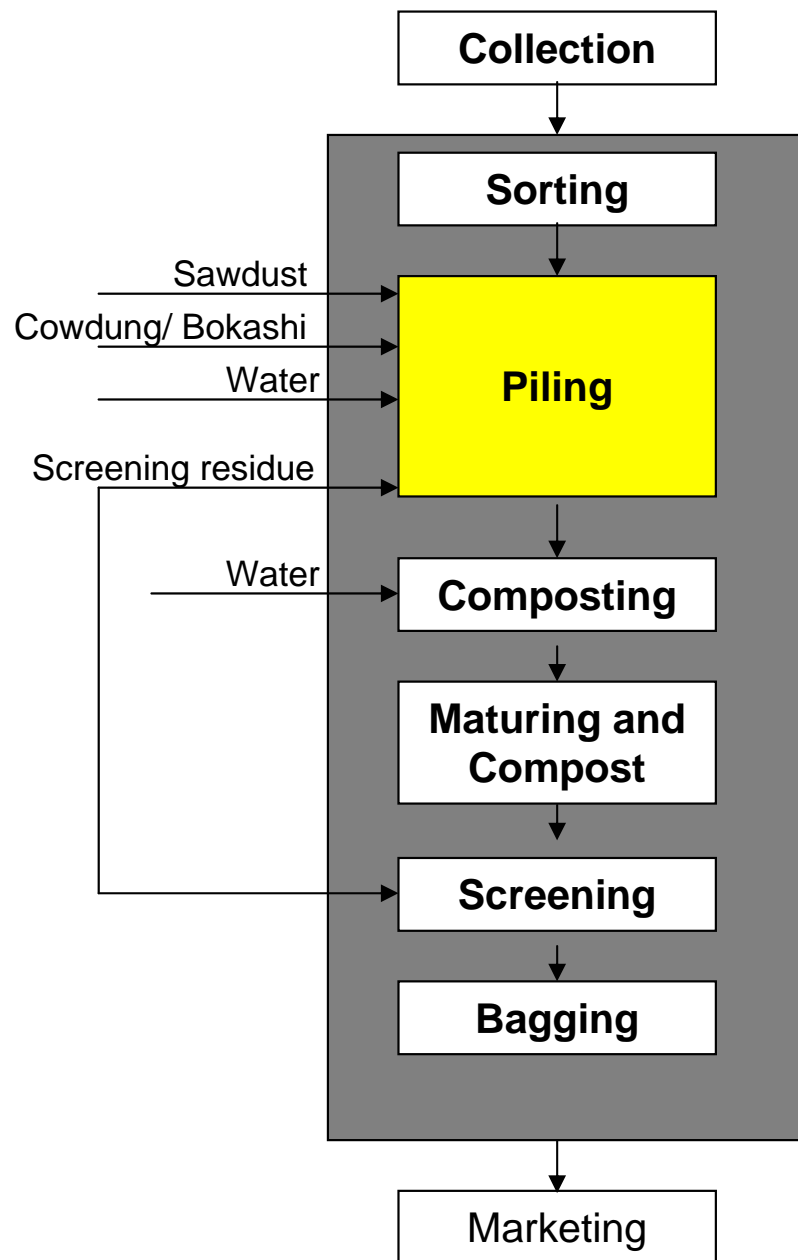
For a 3 ton/day capacity plant

- 6 Workers for Collection waste (mainly men)
- 10 workers for Composting Process (mainly women)
- Daily House-to-house Collection
- 1430 households
- Capacity of Rickshaw Van= 1.18 m³

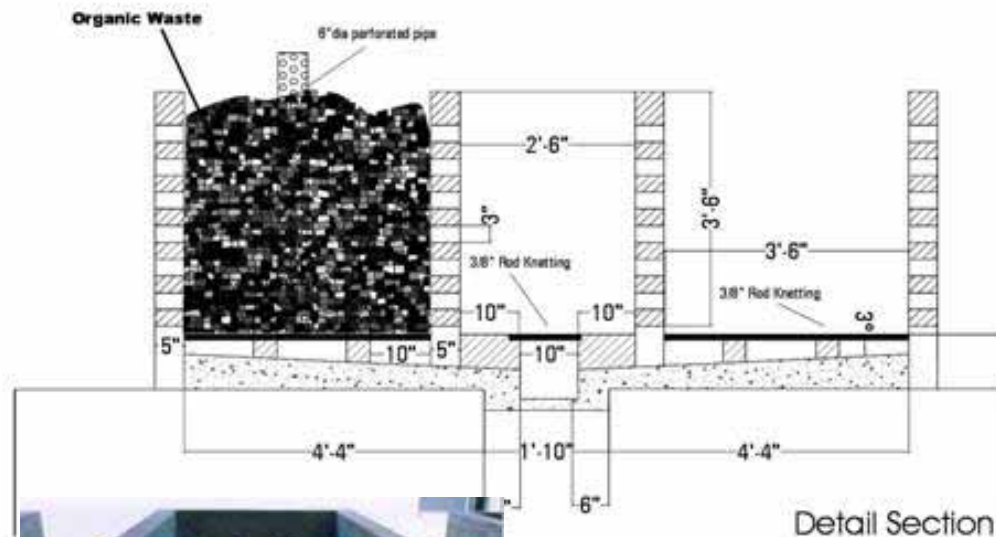


Collection

Different Steps of Composting Process



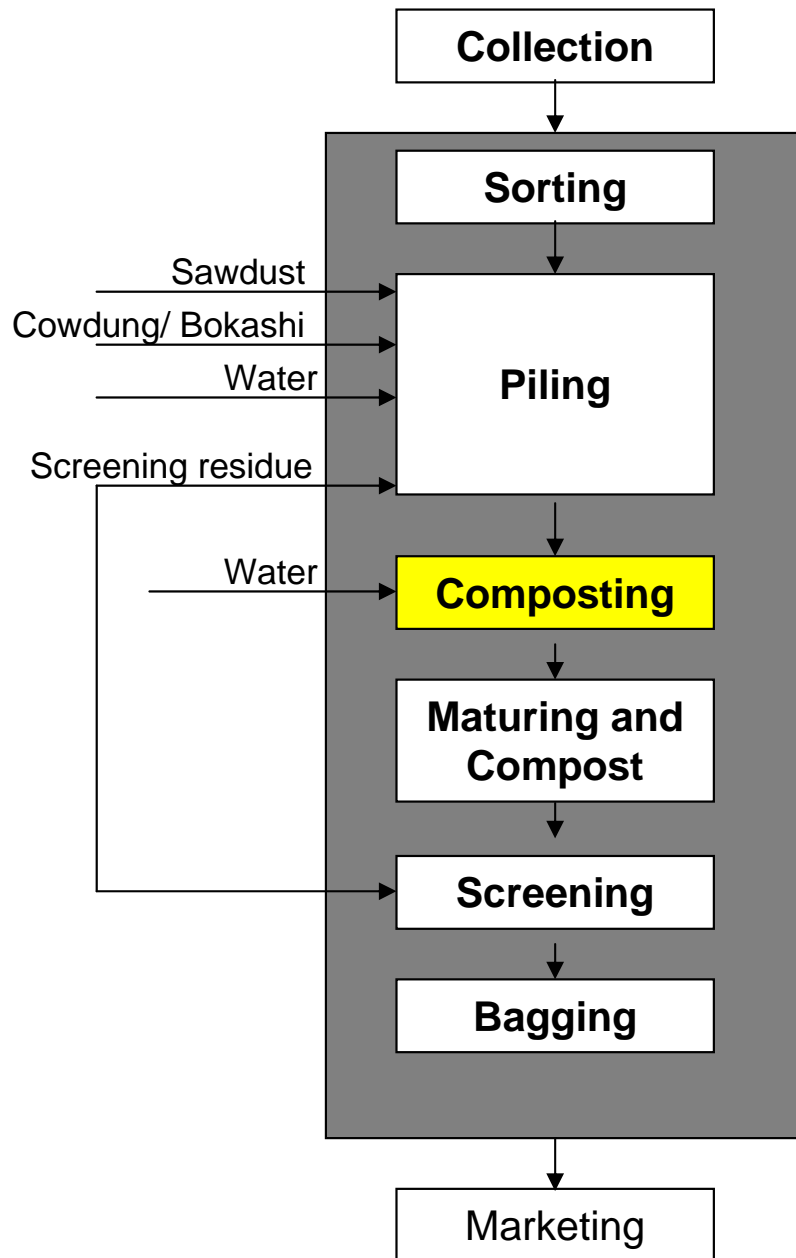
Box Method



- Use of additives for optimizing Process
- Roof Covered Concrete Slab
- Bamboo Aerator/ perforated brick box
- Low cost technique
- Labor intensive

Composting

Different Steps of Composting Process



Aerator Method



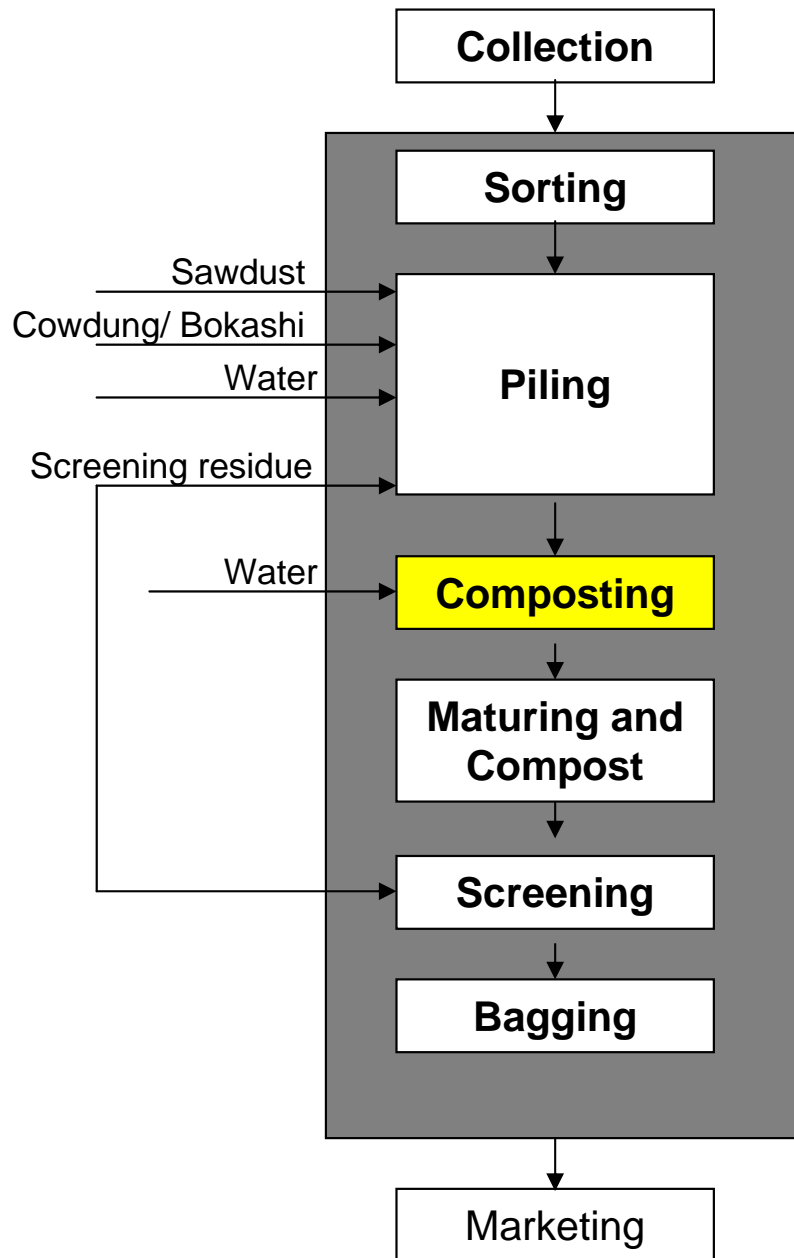
Box Method



Composting



Different Steps of Composting Process



TEMPERATURE CONTROL

Thermophilic Phase (40-70° C)

Takes 27 days

Mesophilic Phase & Maturation (20-40° C)

11 + 15 days

-Temperature is monitored and records are kept to assess the trends



Composting

Survival Time (in days) of Pathogen by Different Treatment Method

Types of Treatment	Bacteria	Virus	Protozoa	Helminths
Night soil, faeces at 20-30 C	90 days	175 days	10 days	Many months
Composting (anaerobic) septic tank/ pit latrine	60 days	60 days	30 days	Many months
Thermophilic Composting 50-60°C	7 days	7 days	7 days	7 days
Waste Stabilization Pond Retention time >20days	20 days	20 days	20 days	20 days

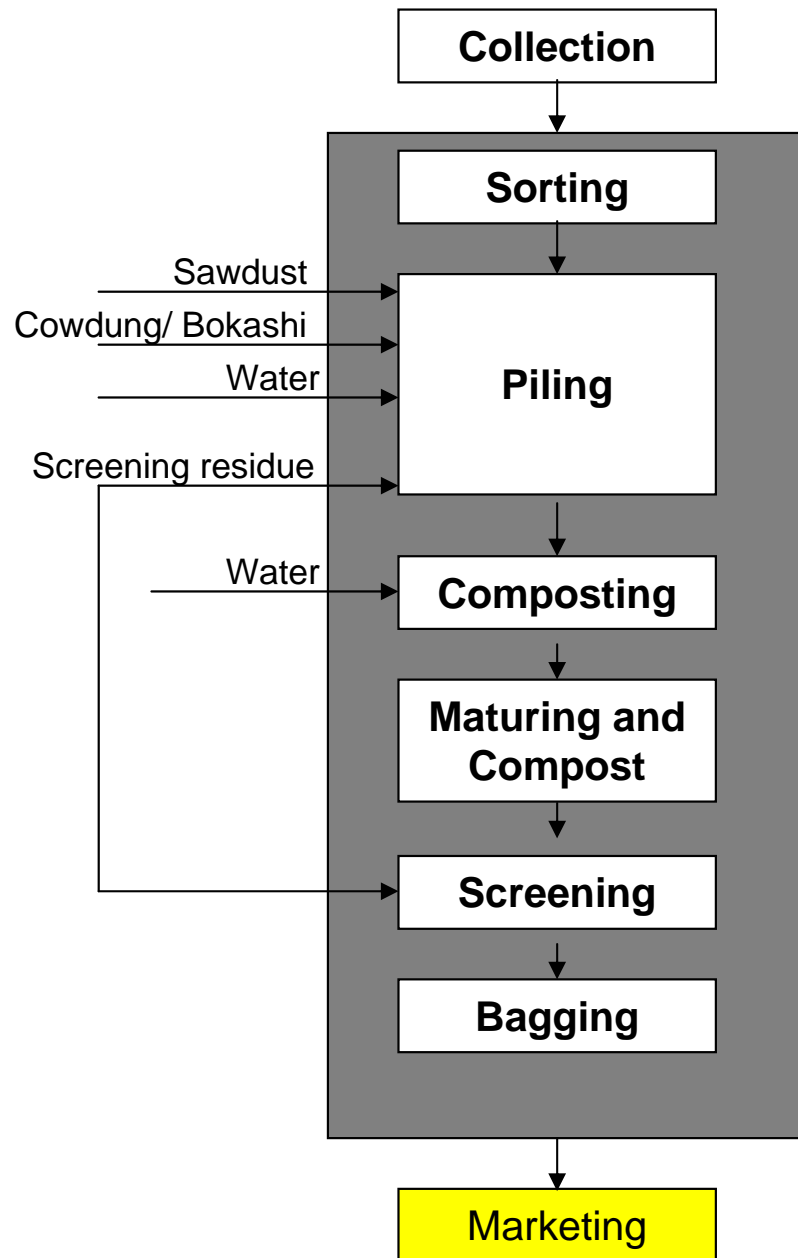
Source: IDA (1990)





Screening and Bagging

Different Steps of Composting Process



BAGGING

■ 40 kg bags



Marketing

IMPACT OF THE PROJECT



Composting



MARKETING OF COMPOST BY PRIVATE SECTOR



Innovation..... Marketing of nutrient enriched compost (compost blended with fertilizers)

- FERTILIZER COMPANY**
- Grinding
 - Enriching
 - Screening
 - Distribution through own retail channels
 - Directly to Farmers and nurseries
 - Own use for demonstration plot



Compost (8mm)

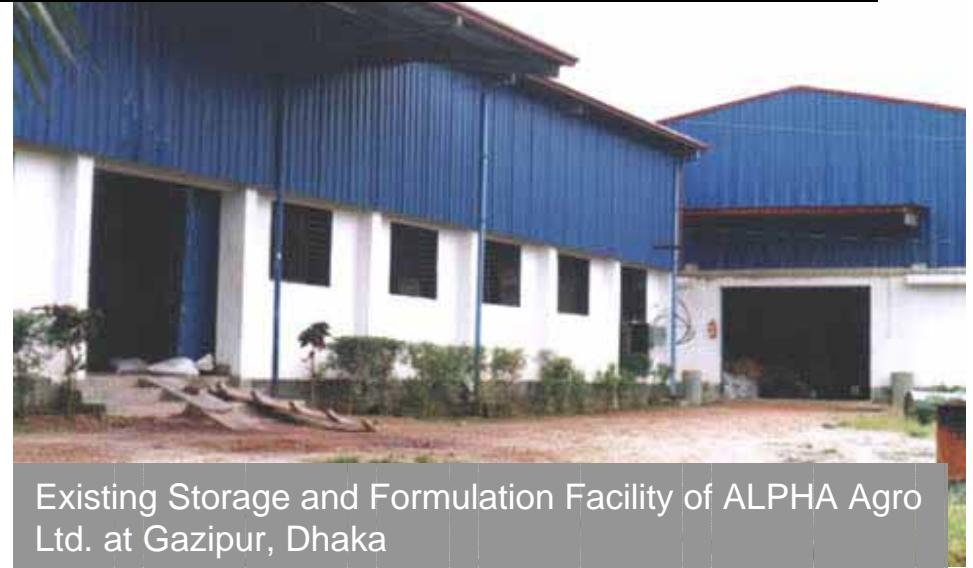
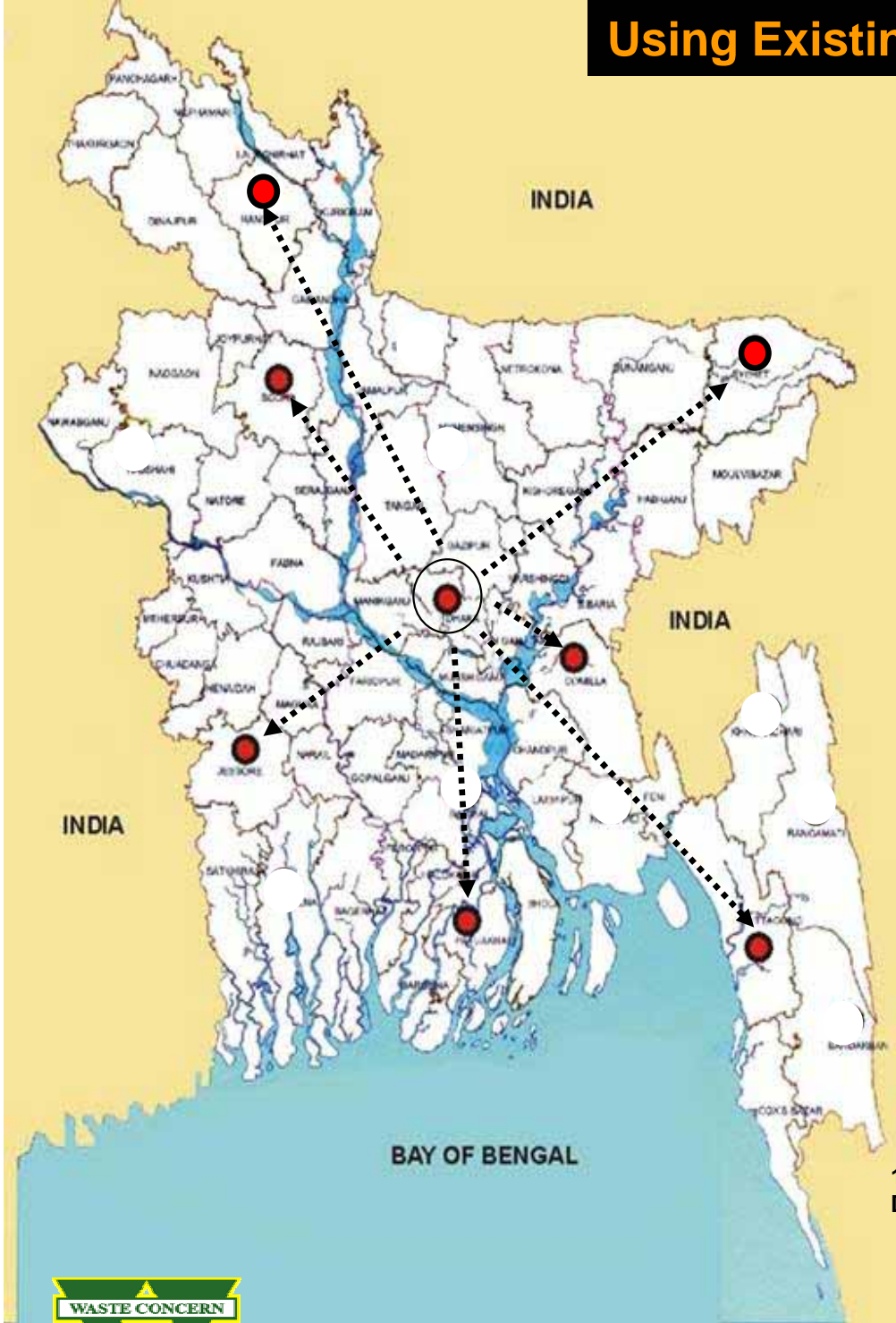


Compost (4mm)

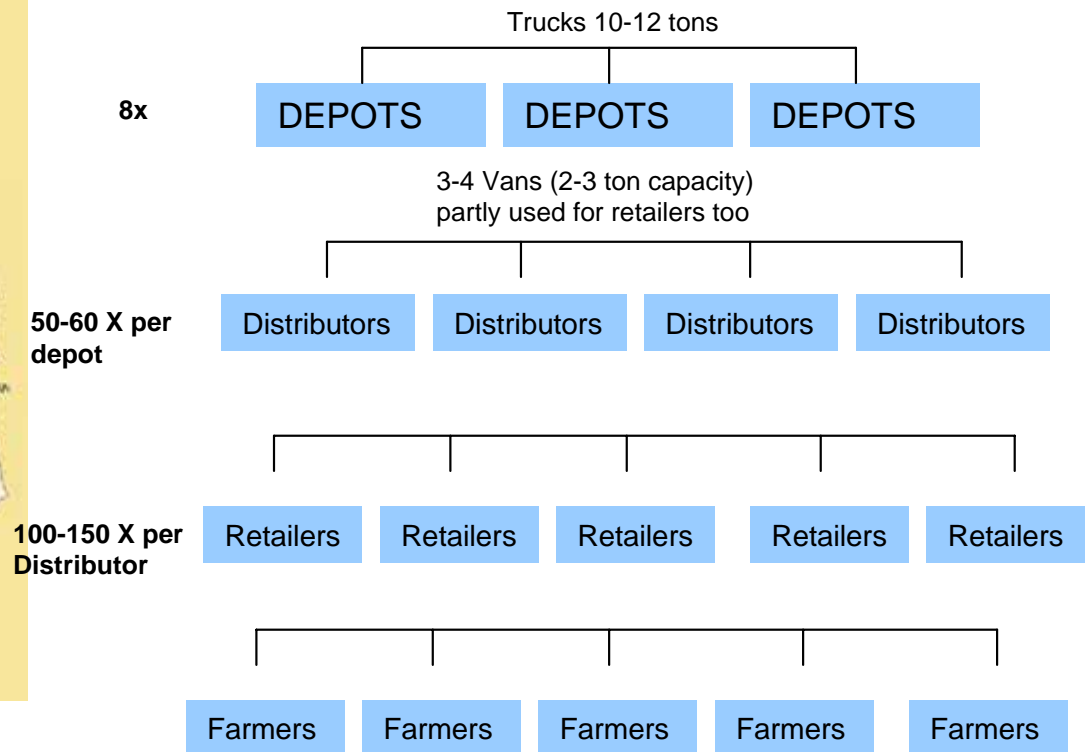


Enriched & Granular

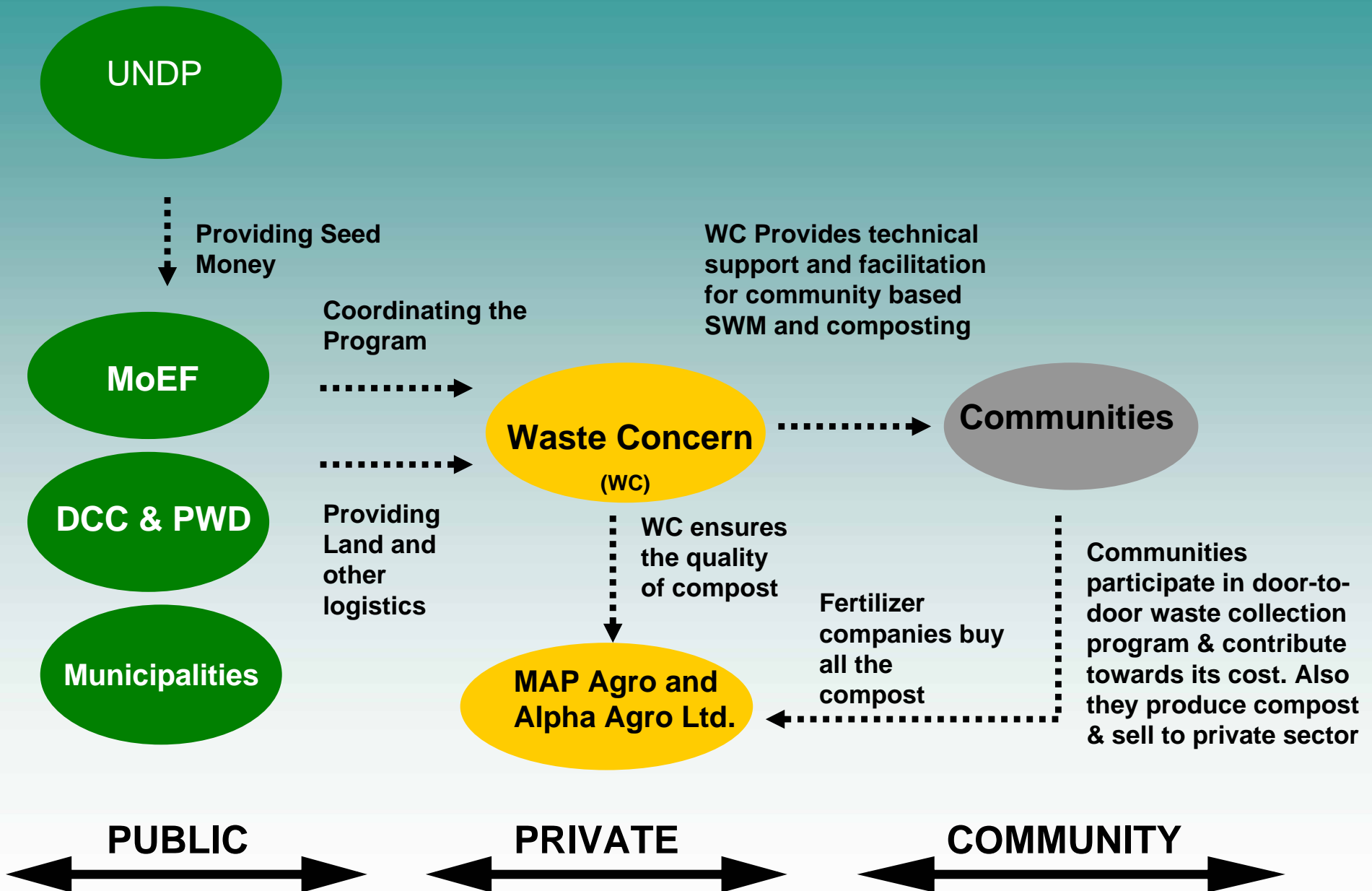
Using Existing Country-wide Marketing Network



ALPHA Agro



PARTNERSHIP MODEL OF COMMUNITY BASED COMPOSTING UNDER SEMP



IMPACT OF THE PROJECT

- ❑ Communities are Cleaner and Healthier
- ❑ Communities are Participating and Have Ownership of The Project
- ❑ Saves Money and Landfill Area for Local Authorities
- ❑ Promotes Sustainable Farming



Beneficiary from the project in 38 replication in 20 towns of Bangladesh:

Total Beneficiary:

60,000

(directly from Waste Concern's project)

2,72,500

(from replications by others)

Excluding Farmers



BEFORE Intervention



AFTER Intervention

IMPACT OF THE PROJECT

GENERATES EMPLOYMENT FOR THE URBAN POOR



- Helping the destitute and hardcore people for new employment
- Integrates informal labor for the production of compost
- Reduce the number of waste pickers near the dustbins & landfill sites
- 16,000 new employment can be created for the urban poor of Dhaka City and 90,000 for country

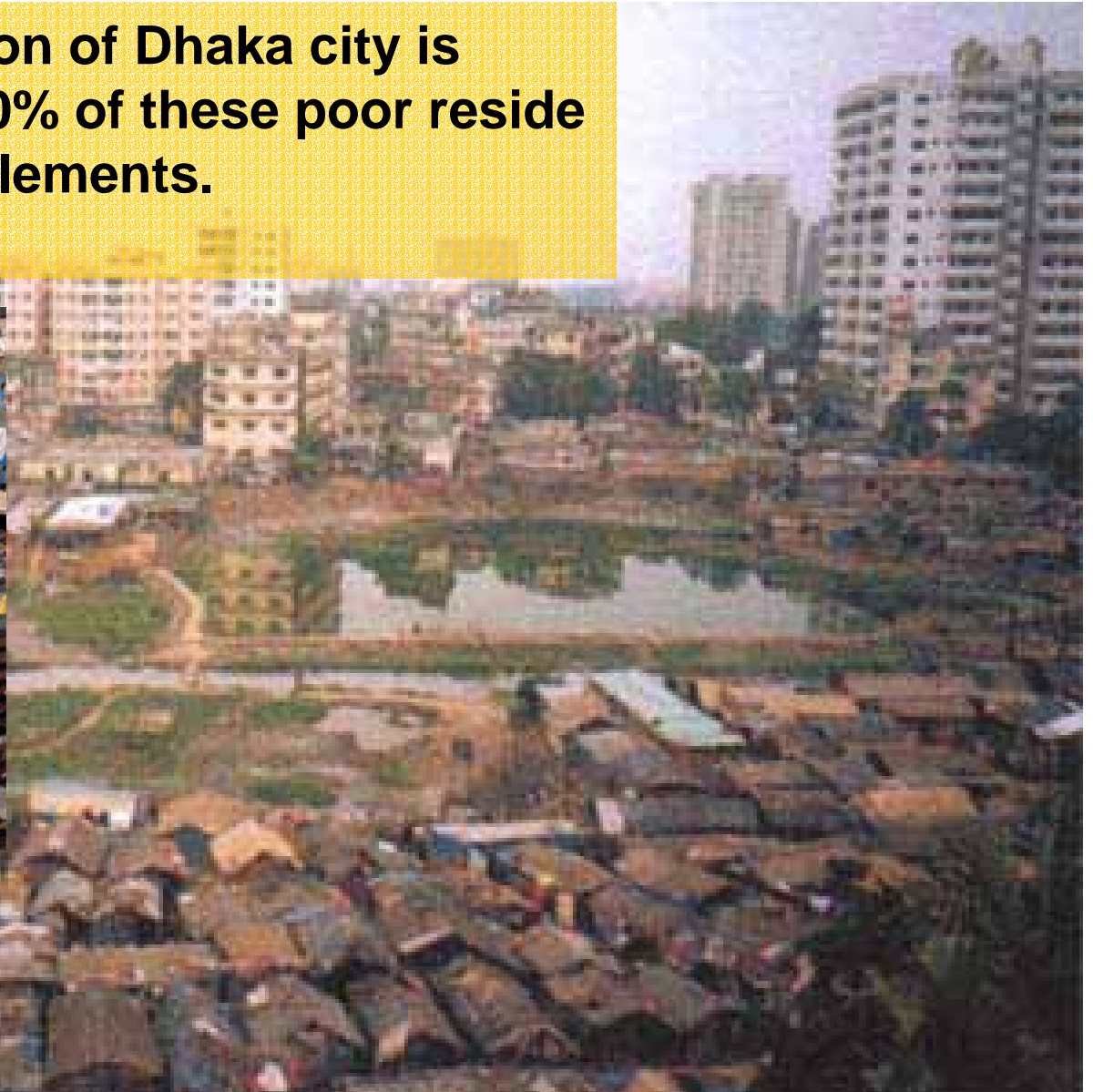
Cost Recovery/ Sustainability of Community Based Model

- **The project is financially viable**
- **Fixed cost of 3 ton capacity plant is US \$ 8800**
- **Operational cost per year is US \$ 10200**
- **Per year income from the project is US \$ 14,800**
- **70% is the income from sale proceeds of compost**
- **30% is the income from charges for house-to-house waste collection**
- **Pay back period of the investment is 23 months**



Barrel Type Composting

40% of the urban population of Dhaka city is below poverty level and 50% of these poor reside in slums and squatter settlements.



- Introduction of `Barrel Type' composting system
- Build awareness, provide training and create income opportunities from compost for the slum dwellers

Using Public-Private-Community Partnership Approach being replicated in several slums of Dhaka and other communities outside Dhaka city



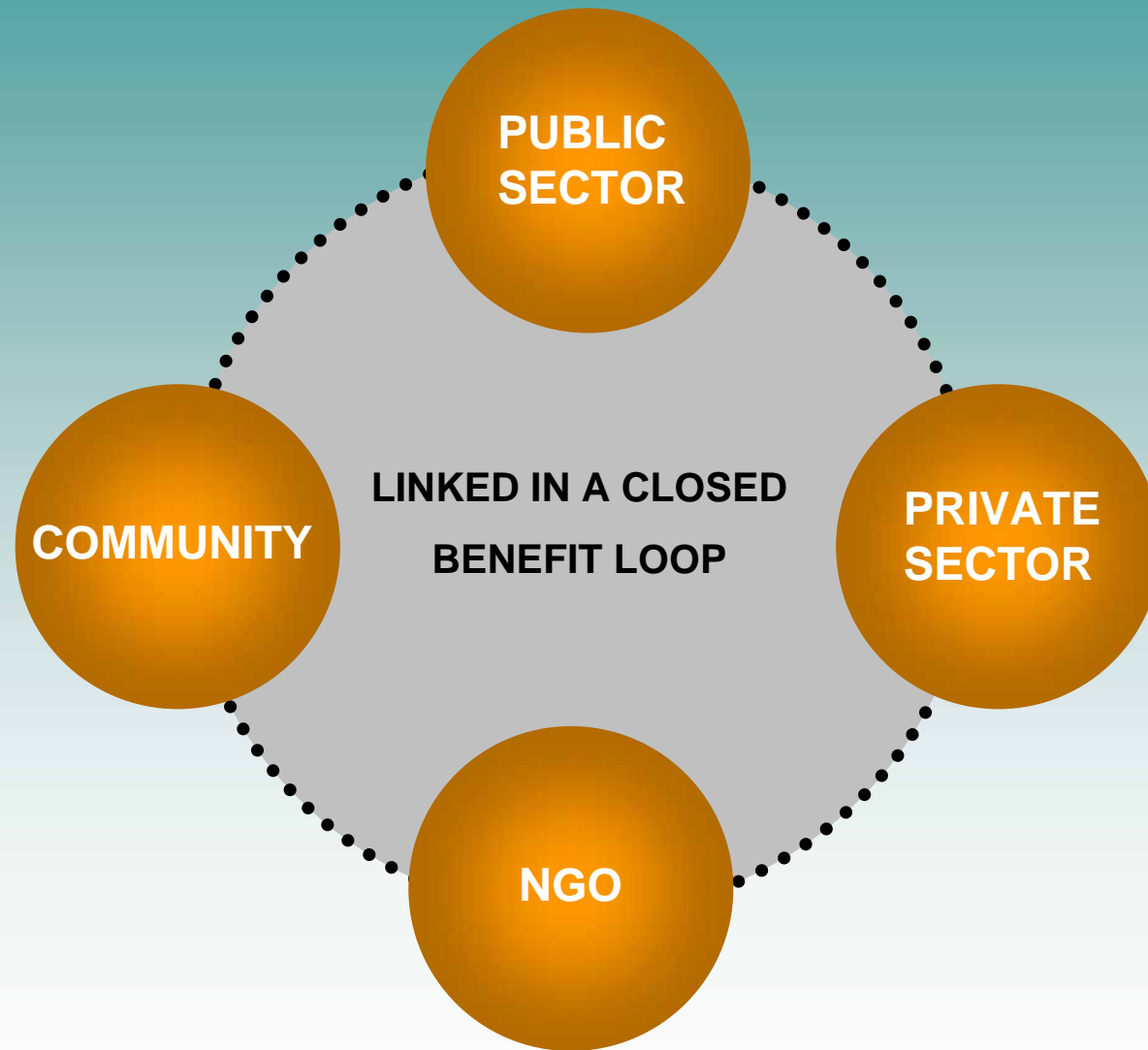
- Significantly Reduced Littering of Waste
- Improved the solid waste and health problems of the slum

Barrel Type Composting in the Slums

Salient Feature of the Project

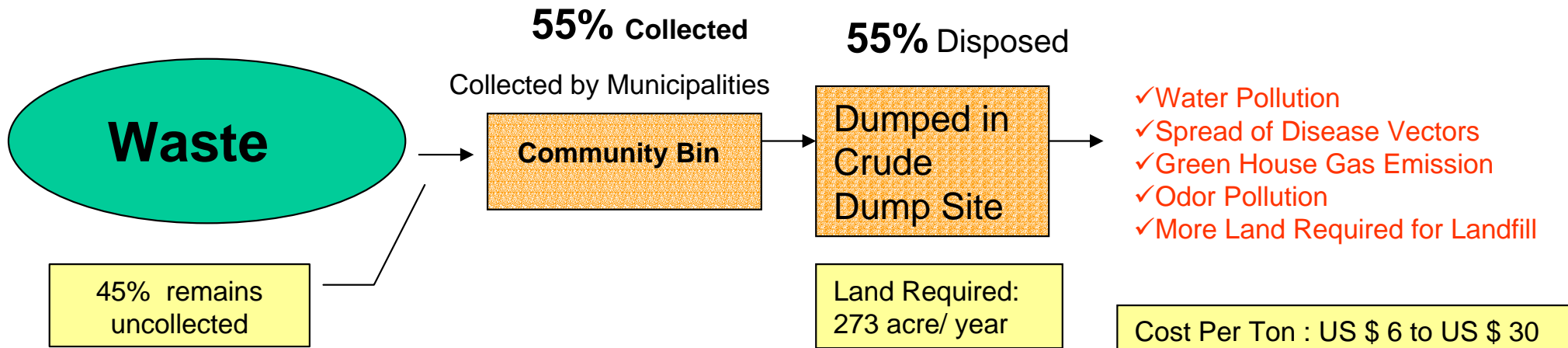
- One green barrel (for organic waste) is provided for a group of 5-6 Nos. of households and placed on a raised base with concrete ring.
- Specially designed 200 liter bottomless perforated steel/ plastic barrel with a lid used for this system.
- Semi Aerobic Composting Technique is followed in Barrel System. Within three months time period compost is produced.
- Yellow barrels used for disposal of inorganic waste.
- The households sharing the income from sale proceeds of the compost.
- Cost of a compost barrel is around US \$ 20
- Compost worth between US \$ 10-11 can be produced each year
- Cost recovery 23 months

PROFITS FOR ALL STAKEHOLDERS CAN BE A KEY TO SUSTAINABLE WASTE MANAGEMENT SERVICES



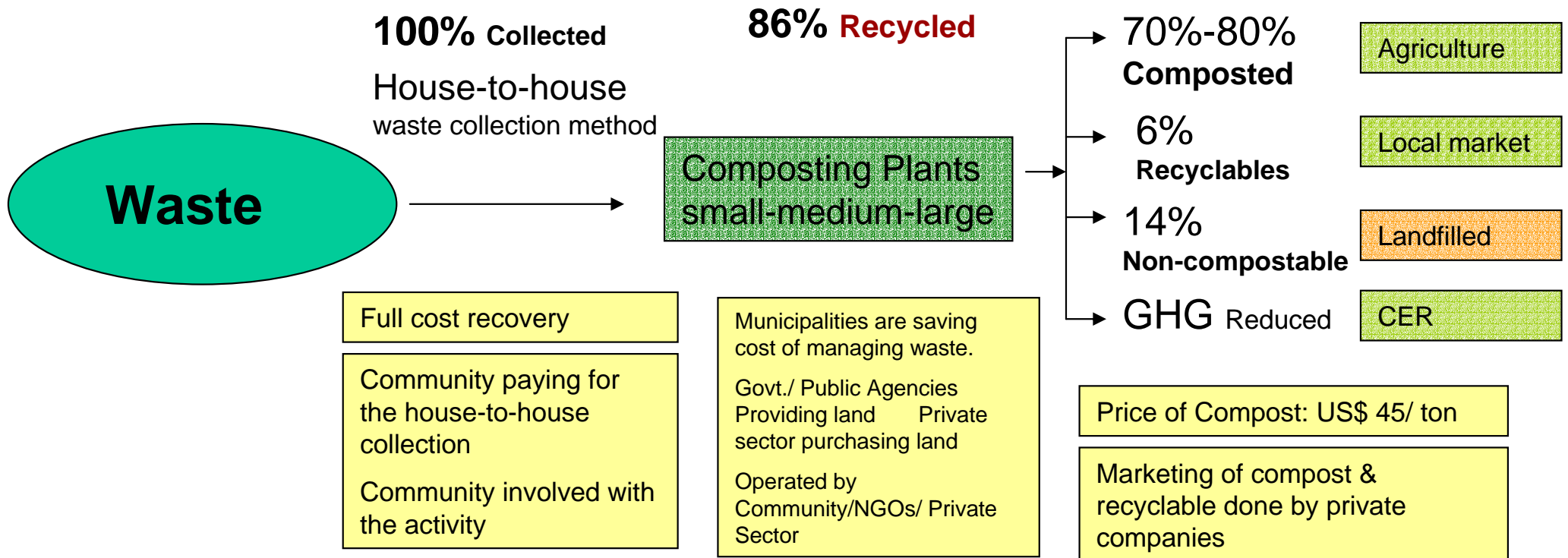
Public Sector: No Partnership

PROBLEMS



Conventional end-of-pipe solution (based on collection-transportation-disposal)

Existing Practice



Decentralized Approach: Based on Partnerships

Growth Over Time and Barrier Faced

- Lack of technology
- Lack of finance
- Lack of awareness
- Lack of partnership

- Land for composting provided by Government
- Policy change
- Majority Grant from GoB & External Agencies for Piloting and some private investments

Land and waste collection by private sector

small and medium scale

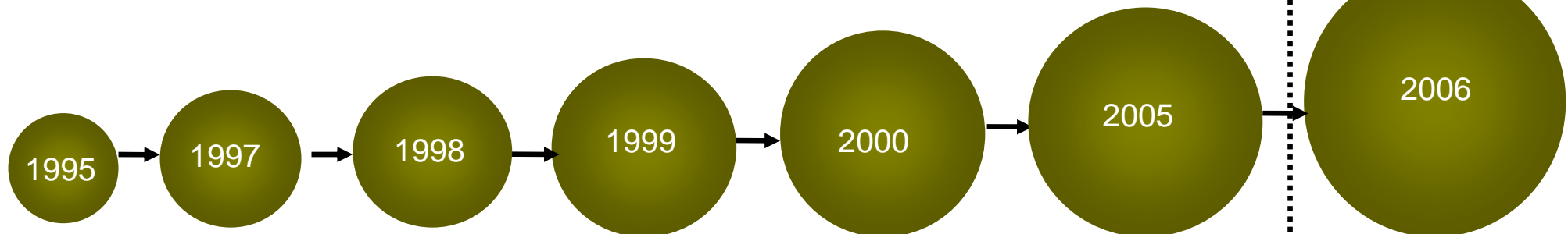
Large scale

Demonstration

Partnership

Replication

Scaling-up



Waste Concern starts pilot community based resource recovery project in Dhaka

Regional Urban Development Office (RUDO)- South Asia supports to increase the capacity of the project and to further test the model

With support from MoEF, UNDP, Waste Concern under SEMP selected to replicate the model in 5 (five) communities of Dhaka City

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

Replication of the model in Dhaka, Khulna & Sylhet cities.

38 replications of this model in more than 20 cities/ towns of Bangladesh
Regional replication in other Asian countries (Vietnam, Sri Lanka).

700 Tons/ day capacity
Decentralized large scale Composting project under CDM located in suitable locations of Dhaka city

Replication in 20 cities and Towns of Bangladesh



Replication in 20 cities and Towns of Bangladesh



Rangamati, Chittagong Hill Tract



Barisal



Patuakhali



Jessore

Replication in 20 cities and Towns of Bangladesh



Replication in 20 cities and Towns of Bangladesh



Replication in Rural Areas of Bangladesh



Recycling Training Center (RTC), Dhaka



To promote idea of *converting waste into resource*

A regional recycling training center has been established with the support from UNDP under the Sustainable Environment Management Program (SEMP) for Technology Demonstration and Hands-on training.

Regional Recycling Training Center, Dhaka

This training center consists:

TRAINING CENCER: For 30 participants/batch

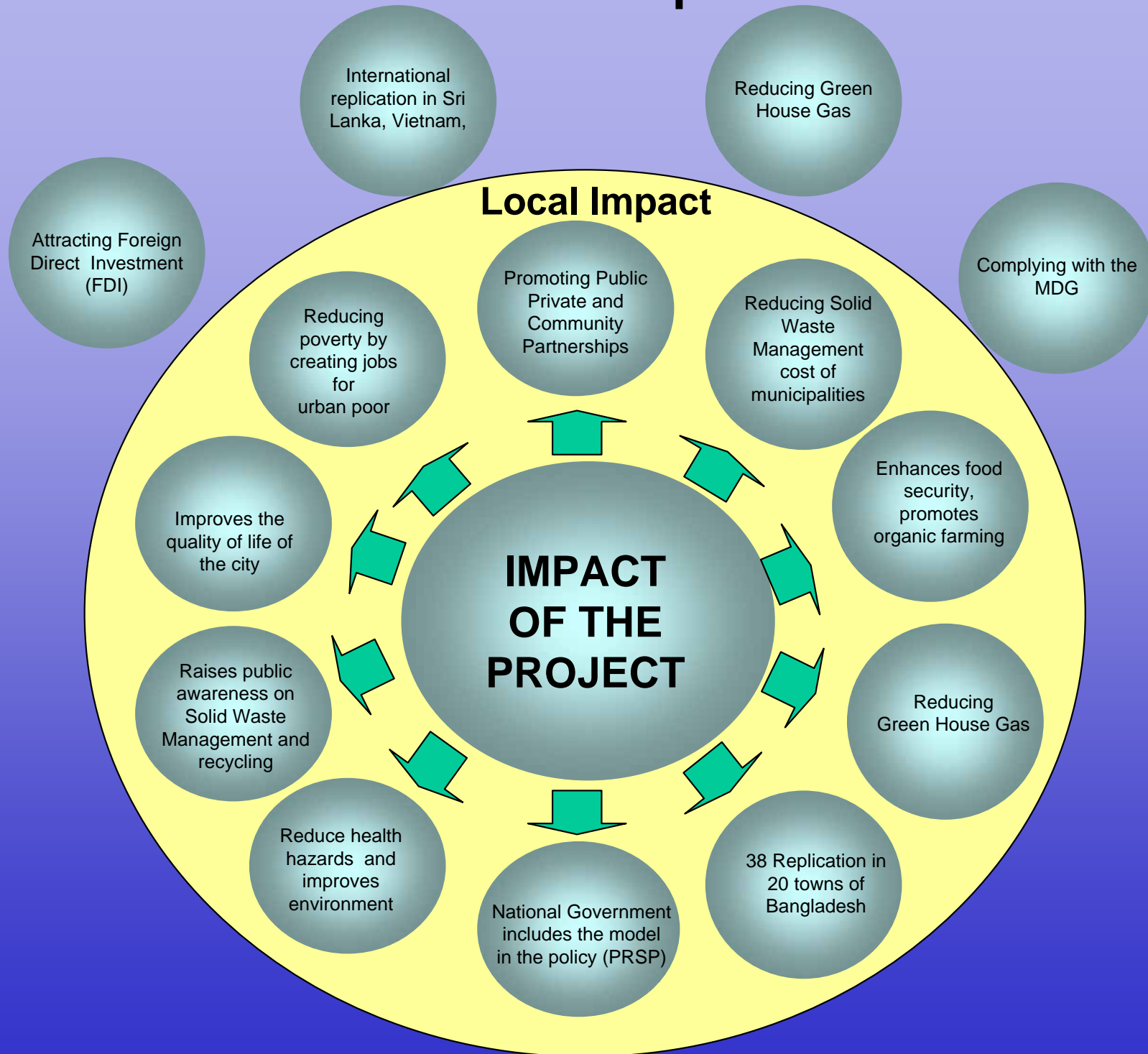
TECHOLOGY DEMONSTRATION:

- 8 (eight) tons capacity composting plant
- Waste Water Treatment
- Eco-toilet
- Rain water harvesting
- Energy efficiency
- Training Room Facility
- Compost Enrichment Facility

❑ A Handbook on Decentralized Composting has been developed to help others to carryout waste to resource activities. This handbook jointly prepared by Waste Concern and SANDEC with the support from UNDP, SDC under SEMP



Global Impact



3R Principal for Solid Waste Reflected in the National and Local Government Policies and Plan

POLICY

National Policy for Water Supply and Sanitation, 1998

According to this policy the government shall take measures for recycling of waste as much as possible and use organic waste materials for compost and bio-gas production;

Draft National Urban Policy- 2006

CDM and Recycling has been emphasized in this policy

RULES

Lead Acid Battery Recycling and Management Rules, 2006: Under this rules collection and recycling has been improved. This rules is based on a detail study carried out by Waste Concern on 2005 under SEMP.

Draft National Solid Waste Management Handling Rules, 2005: 3R principal has been used. This rule has been prepared by Waste Concern under SEMP.

STRATEGY

Poverty Reduction Strategy Paper (PRSP) 2005: Here EMS has been promoted. To improve the solid waste management situation, special focus is given to segregation of waste at source along with the promotion of recycle, reduce and reuse of industrial and other solid waste etc.

National Sanitation Strategy 2005: Its goal is to achieve 100% sanitation coverage by 2010. Here emphasis on resource recovery and recycling has been given as top priority to improve urban sanitation situation instead of disposal.

ACTION PLAN

Dhaka Environment Management Plant 2005

Waste recycling has been promoted, less land filling encouraged, EMS promoted among industries.

National Environmental Management Action Plan (NEMAP) (1995):

This is a plan of the Government of Bangladesh (GoB), prepared by the Ministry of Environment and Forest (MoEF) in consultation with people from all walks of life. Waste Concern is promoting 3R, under the Sustainable Environment Management Programme (SEMP) of NEMAP.

Solid Waste Management Action Plan for Eight Secondary Towns in Bangladesh (2005): Under the Secondary Towns Integrated Flood Protection (Phase-2) Project of Local Government Engineering Department, GoB. This strategy is based on based on 4 R principle i.e. reduce, reuse, recycle and recover of the waste.

DECLARATION

Dhaka Declaration 2004 on Waste Management by SAARC countries during 10–12 October 2004. SAARC countries agree to encourage NGOs and private companies to establish community based composting, segregation of waste at source, separate collection and resource recovery from wastes with particular focus on composting.

Solid Waste Management and Sanitation in Eight Secondary Towns in Bangladesh (2005)

Secondary Towns Integrated Flood Protection (Phase-2) Project
Local Government Engineering Department, GoB

Strategy for Solid Waste Management

- The present solid waste management practice being followed is based on the end-of-pipe approach, i.e. collect-transport-dispose. This approach is neither sustainable nor cost-effective.
- The strategy for solid waste management is based on 4 R's principle i.e. reduce, reuse, recycle and recovery of the waste.

Main objectives of this strategy is:

- Prioritizing waste avoidance over recycling and recycling over the other forms of environmentally sound disposal methods;
- Reuse non-avoidable waste as far as possible;
- Maintain the content of hazardous substances in waste at the lowest possible level;
- Guarantee an environmentally sound waste collection, transportation, resource recovery and disposal system; and
- Promotion of Public-Private-Community Partnerships in solid waste management