**BANGLADESH ENVIRONMENT NETWORK (BEN)**

*presents*

BI-MONTHLY WEBINAR #18

# WASTE MANAGEMENT IN BANGLADESH:
## TECHNICAL-POLICY CHALLENGES AND WAY FORWARD

FEBRUARY 14, 2026 | 10 AM – 12 AM (NEW YORK/TORONTO) | 9 PM – 11 PM (DHAKA)

# KEYNOTE SPEAKERS

**Hossain M Azam, PhD, P.E.**

Associate Professor of Environmental Engineering

Department of Civil Engineering

University of the District of Columbia (UDC)

4200 Connecticut Avenue NW, Washington, DC

Phone: +19192715347

Email: hossain.azam@udc.edu

**Md. Sahariar Kabir Nion**

Research Assistant

Azam Research Group/Water Energy Food Climate (WEFC) Nexus Lab & BEN Fellow

62/5 West Tejturibajar, Farmgate, Dhaka

Phone: +8801777123418

Email: sknion7@gmail.com

# GLOBAL OVERVIEW
## THE GLOBAL WASTE CRISIS

### I. Daily Global Waste Generation

- An estimated 2.126 billion tonnes of municipal solid waste were generated in 2020
- Expected to grow to 3.782 billion tonnes by 2050 under a business-as-usual scenario

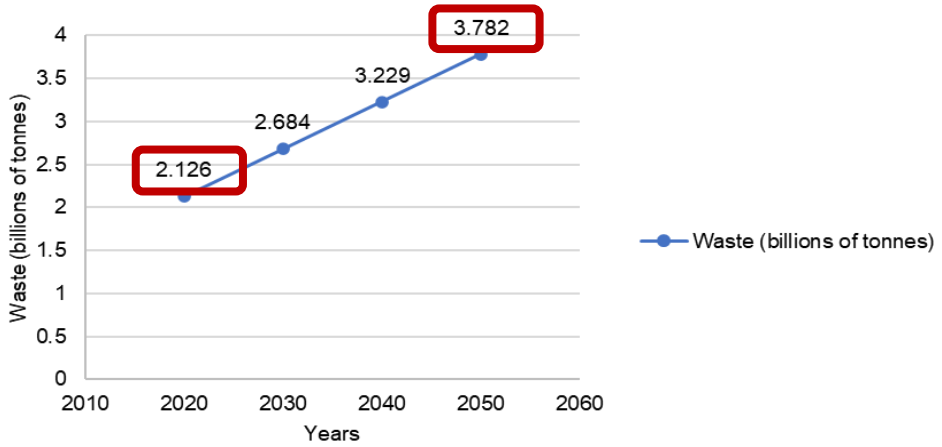



**Figure:** Projections of global municipal solid waste generation per year in 2030, 2040, and 2050 if urgent action is not taken

### II. Waste Generation Per Capita Per Day

- Low income = 0.43 kg
- lower-middle income = 0.61 kg
- upper-middle income = 0.69 kg
- high income = 1.57 kg

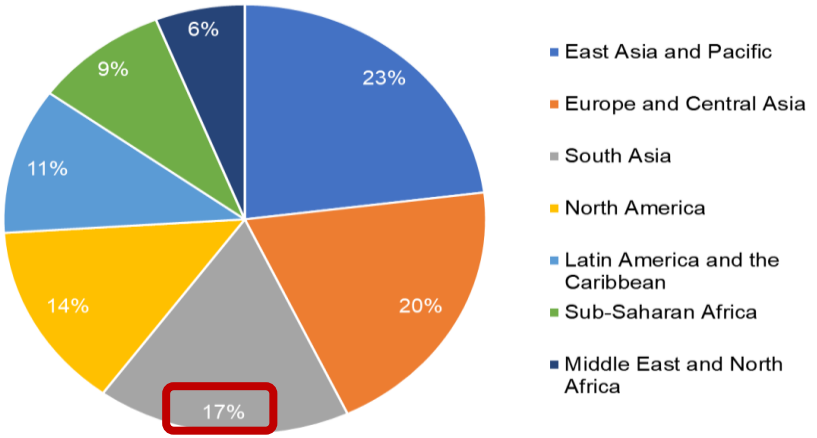



**Figure:** Share of waste generated, by region percentage (%)

Source: UNEP & ISWA, Global Waste Management Outlook (2024);World Bank, What a Waste 2.0 (2018)

# GLOBAL OVERVIEW

## THE GLOBAL WASTE CRISIS (Contd.)


**Bangladesh**
Lower middle ($1,026-$4,035)

**Figure:** Definition of income levels map

Source: World Bank, What a Waste 2.0 (2018)

# GLOBAL OVERVIEW
## TYPES OF WASTE

I. Classification of waste based on source
- Municipal Solid Waste
- Industrial Waste
- Agricultural Waste
- Construction and Demolition Waste
- Hazardous Waste
- Electronic Waste

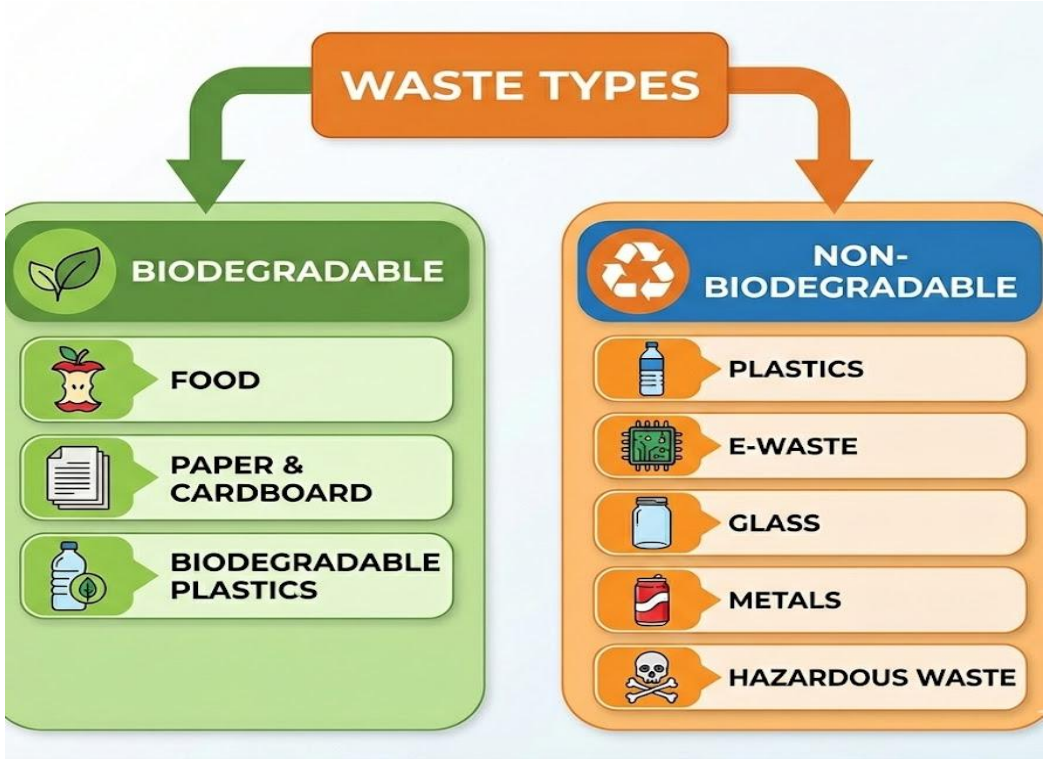



**Figure:** Types of waste materials

Source: Salam, A., Tasnia, R., Kashem, S. B. A., Ashraf, A., Kunju, A., Majid, M. E., ... & Chowdhury, M. E. (2025). Waste classification into plastics, industrial, domestic, and agriculture waste. In Harnessing Automation and Machine Learning for Resource Recovery and Value Creation (pp. 91-113). Elsevier.

# GLOBAL OVERVIEW
## WASTE COMPOSITION

I. High-Income Countries
- Organic waste: 32%
- Paper and cardboard: 25%
- Plastics: 13%
- Glass, metals, and others: 30%

II. Middle Income Countries
- Organic waste: 53%[a]-54%[b]
- Paper and cardboard: 12%[a]-12.5%[b]
- Plastics: 11%[a,b]
- Glass, metals, and others: 23%[a]-23.5%[b]

III. Low-Income Countries
- Organic waste: 56%
- Paper and cardboard: 7%
- Plastics: 6.4%
- Glass, metals, and others: 30%

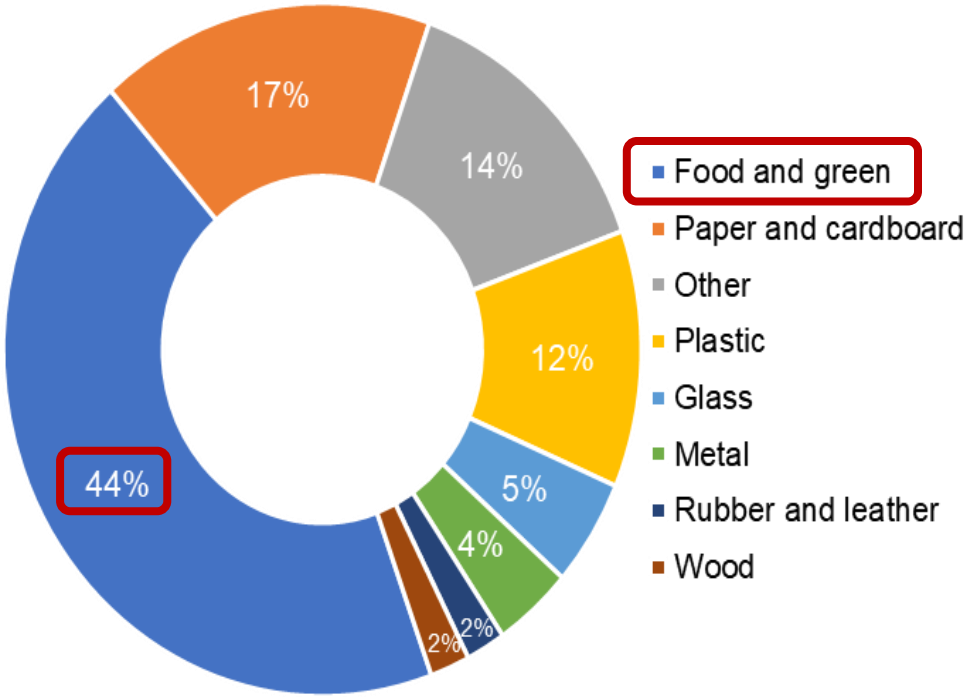



**Figure:** Global waste composition (%)

Source: World Bank, What a Waste 2.0 (2018)

a=Higher middle income countries; b=Lower middle income countries

# GLOBAL OVERVIEW

## E-WASTE OVERVIEW

I. Generation
- 2025: 65.3 million tonnes
- 2030 projection: 82 million tonnes
- Asia generates 48-50% of global e-waste

II. Collection and Recycling
- Formally collected: Only 22.3% globally

III. Value at Stake:
- Raw material value in 2019 e-waste: $91 billion
- Gold content: 7% of the total gold

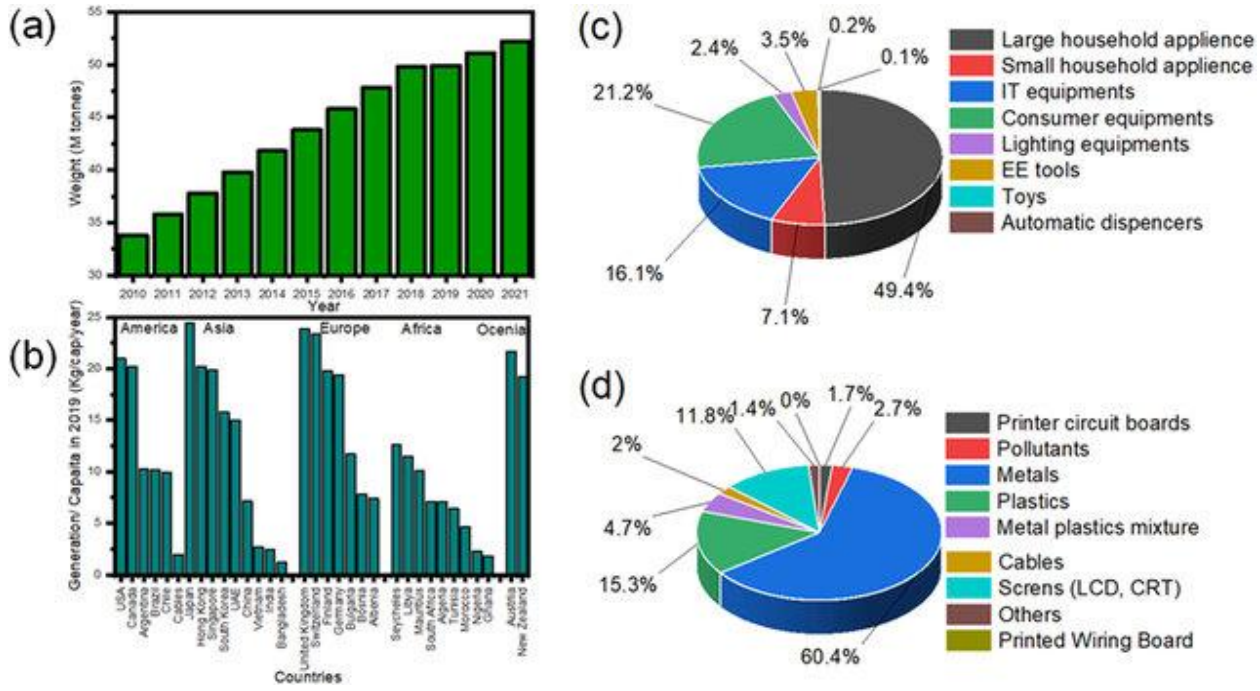



**Figure:** Global e-waste generation scenario over the period.
(a) Global quantity of e-waste generation (2020-2030 are estimated)
(b) E-waste generation per capita in 2019 in different countries.
(c) Composition and major sources of e-waste; average composition
(d) Materials fractions of E-waste.
(e) (a-b) (data adopted from Baldé et al., 2015; Borthakur et al., 2019; Forti et al., 2020);
(f) (c-d) (data adopted from (Kaya, 2016; Vats and Singh, 2015; Widmer et al., 2005)

Source: Chakraborty, S. C., Qamruzzaman, M., Zaman, M. W. U., Alam, M. M., Hossain, M. D., Pramanik, B. K., ... & Moni, M. A. (2022). Metals in e-waste: Occurrence, fate, impacts and remediation technologies. Process Safety and Environmental Protection, 162, 230-252.

# GLOBAL OVERVIEW
## WASTE MANAGEMENT

I. Waste Collection Rates

- High income: 96%
- Upper-middle income: 82%
- Lower-middle income: 51%
- Low income: 39%

II. Global Municipal Solid Waste Destinations

- Controlled Waste (62%)
  - ✓ Landfilling: 641,256 thousand tonnes
  - ✓ Recycling: 404,271 thousand tonnes
  - ✓ Waste-to-energy: 274,800 thousand tonnes

- Uncontrolled Waste (38%)
  - ✓ Uncontrolled disposal: 805,644 thousand tonnes

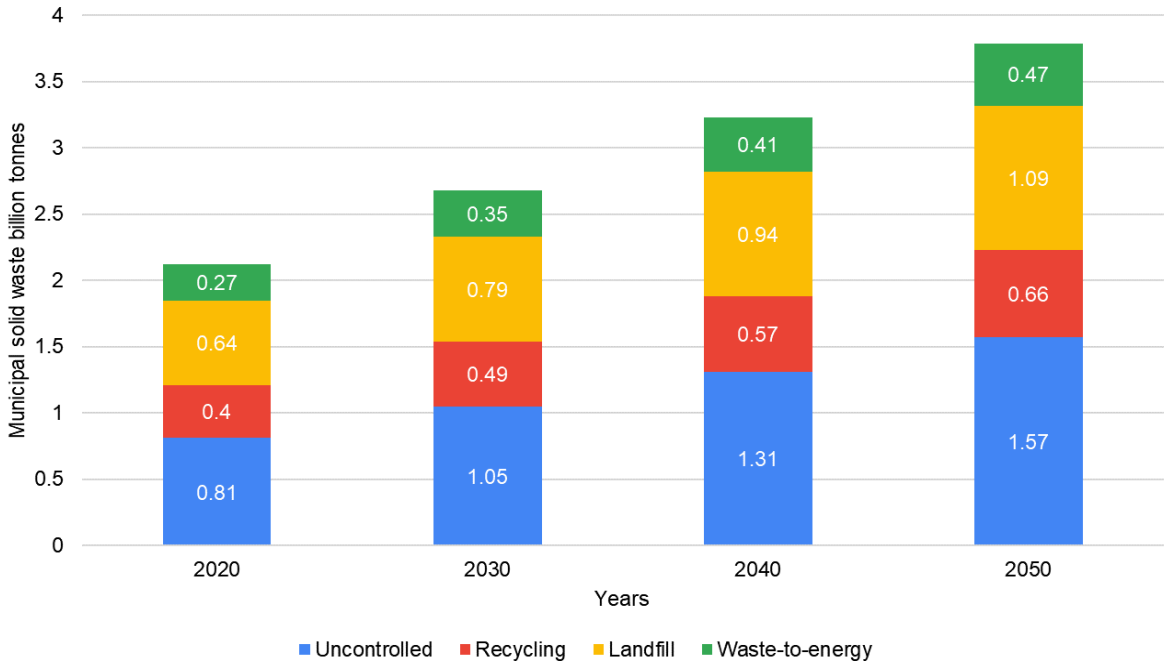
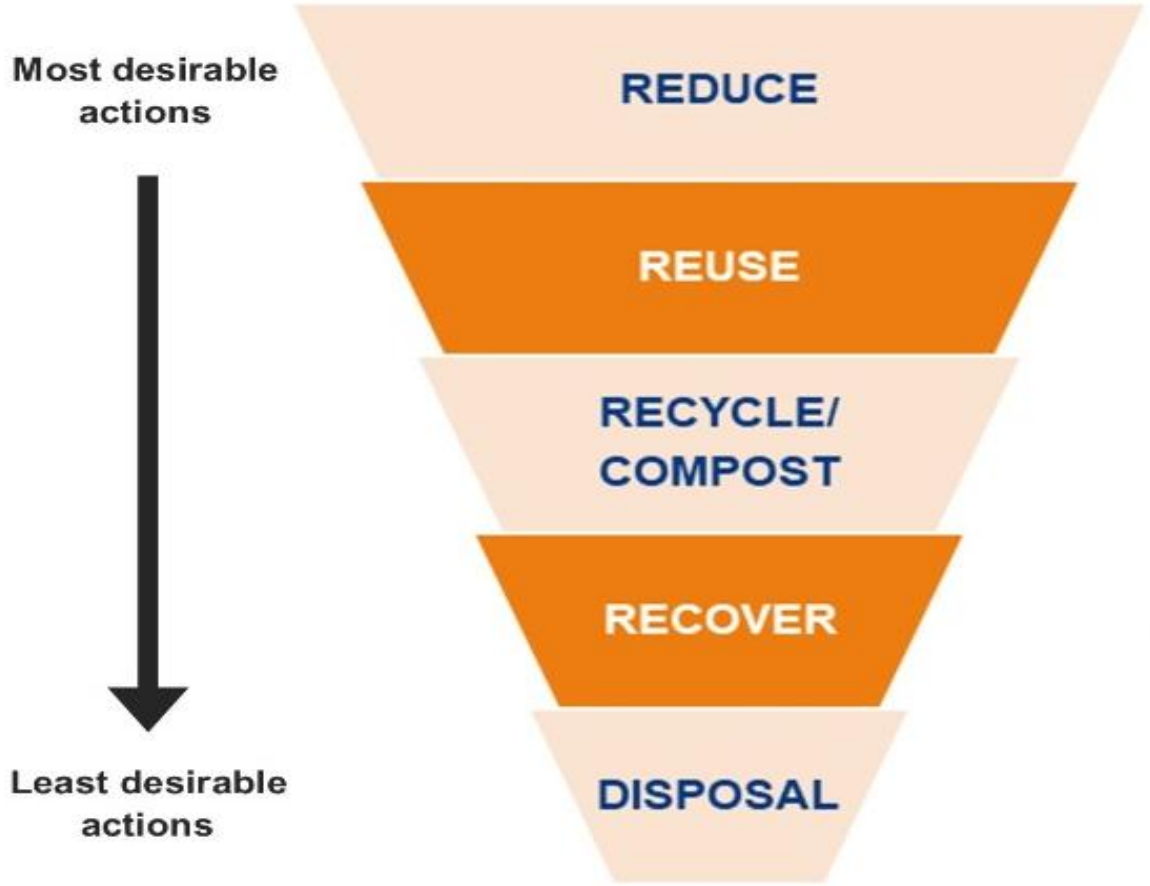



**Figure:** Projected global municipal solid waste destinations in 2030, 2040, and 2050 compared with 2020

Source: World Bank, What a Waste 2.0 (2018)

# GLOBAL OVERVIEW
## INTEGRATED SOLID WASTE MANAGEMENT




Using fewer materials in design and manufacturing, keeping goods for longer usage time and re-use, using few hazardous materials, etc.

Checking, cleaning, repairing, refurbishing entire items or parts/ components.

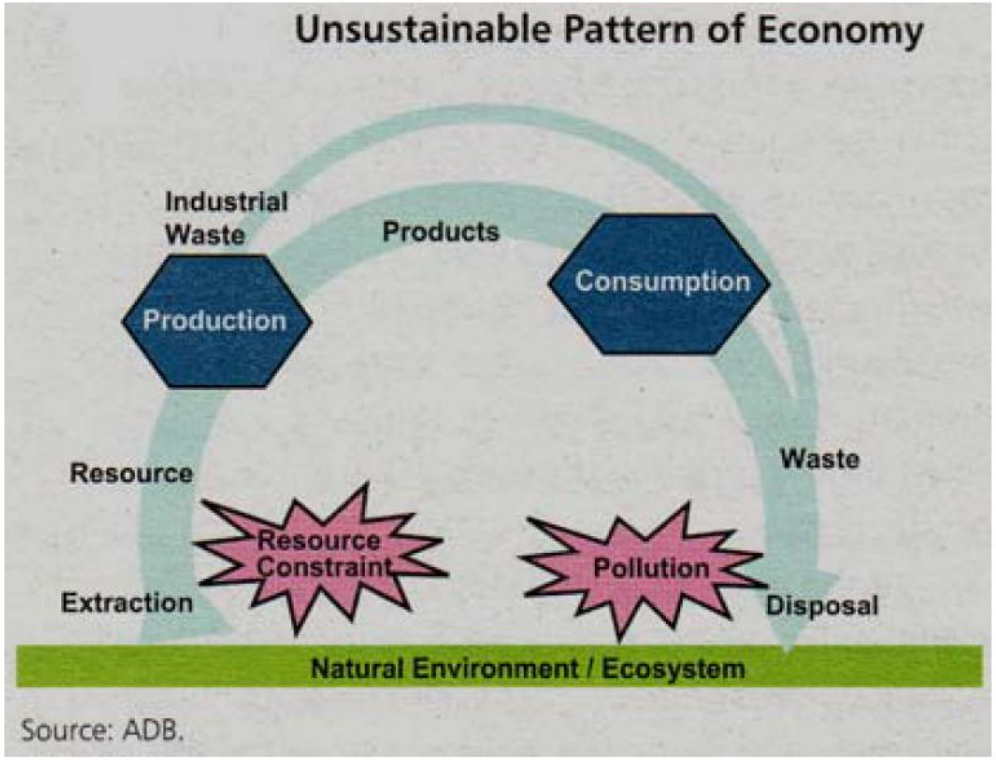
Turning waste into new substances or products, including composting if quality protocols are met.

Including anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy, and materials from waste.

Landfill and incineration without energy recovery.

Source: Eurofins, Brief overview of integrated waste management for manufacturing, (2024)

# GLOBAL OVERVIEW
## 3R'S OF WASTE MANAGEMENT





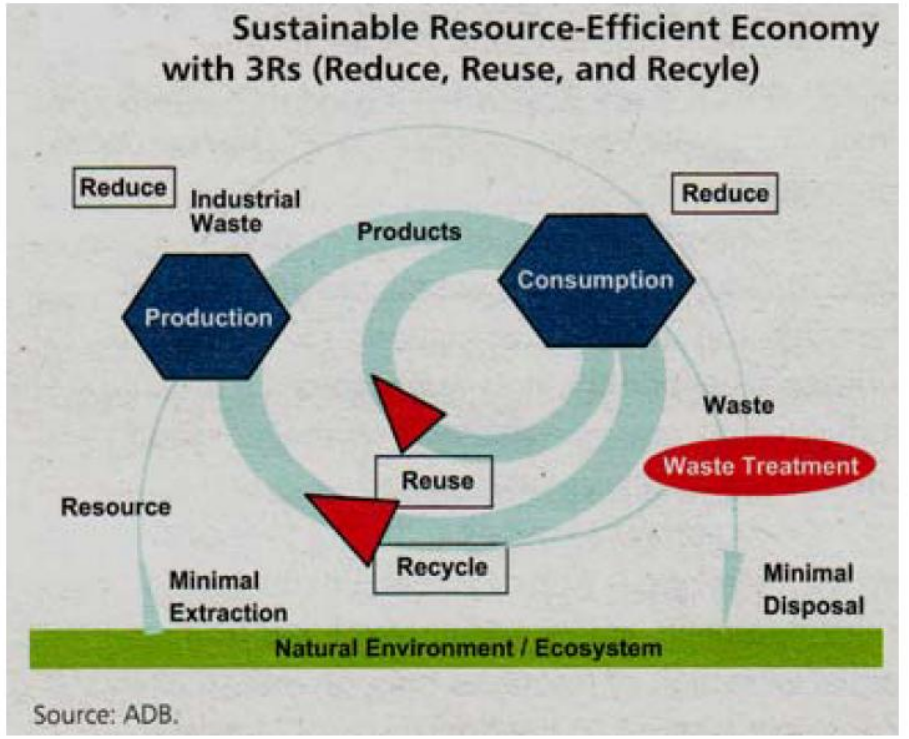



**Figure:** Benefits provided by the implementation of the 3Rs principles

Source: National 3R Strategy, 2010

# GLOBAL OVERVIEW
## 3R'S OF WASTE MANAGEMENT

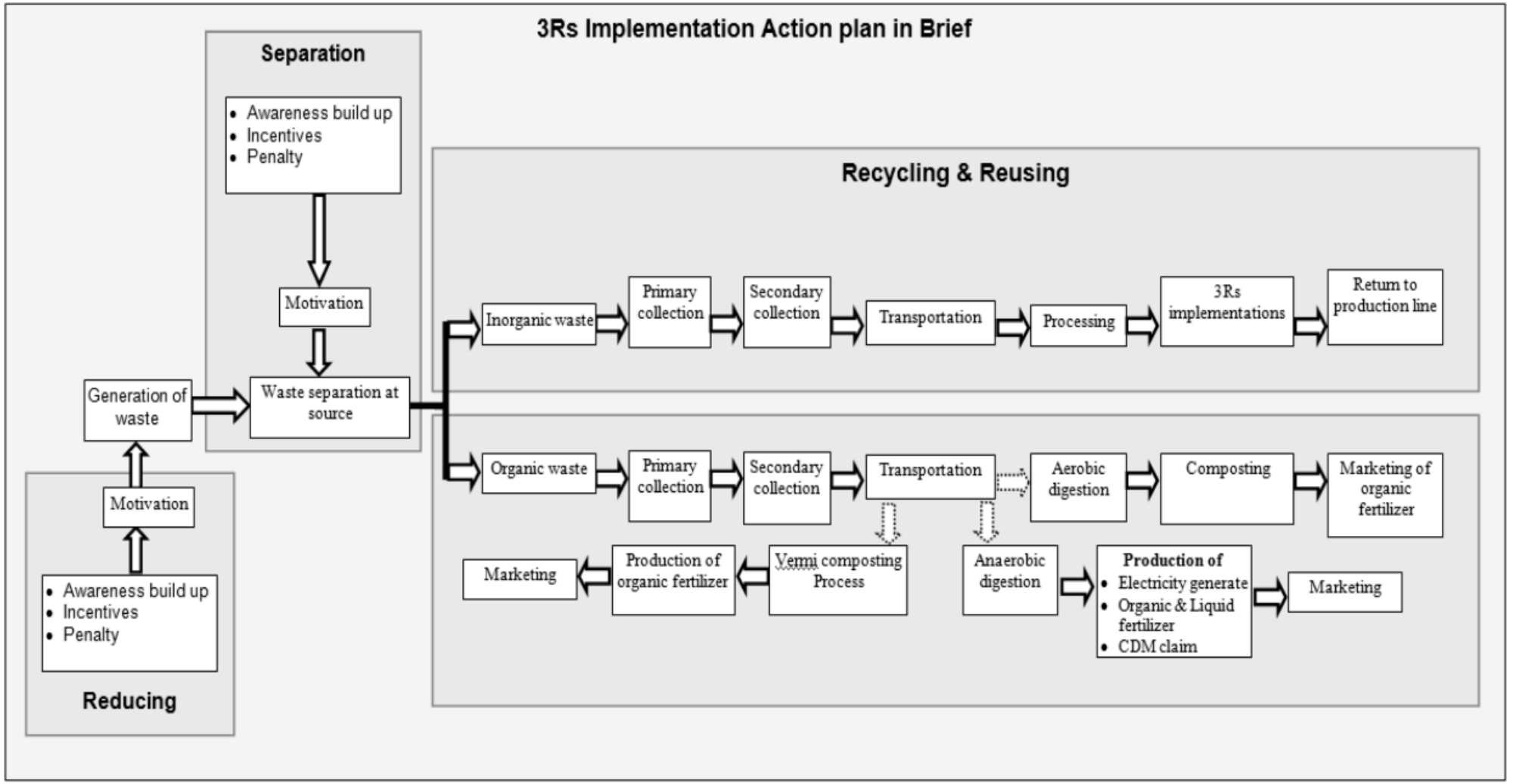



Figure 5: 3Rs Implementation action plan in brief way

Source: National 3R Strategy, 2010 & Chowdhury et al., 2024

# GLOBAL OVERVIEW
## ENVIRONMENTAL AND HEALTH IMPACTS

I. Climate Impact
- Wastes account approximately 5% of global greenhouse gas emissions
- Waste sector emissions at 1.6 billion tonnes of $CO_2$ equivalent annually

II. Marine Pollution
- 8 million tonnes of plastic enter our oceans annually
- Five Asian countries, including South Asian nations, account for 60 percent of this leakage

III. Public Health
- Around 1 million deaths annually are attributable to inadequate solid waste management

IV. Economic Costs
- The global waste management cost is estimated at $252.3 billion annually which also does not capture intergenerational costs

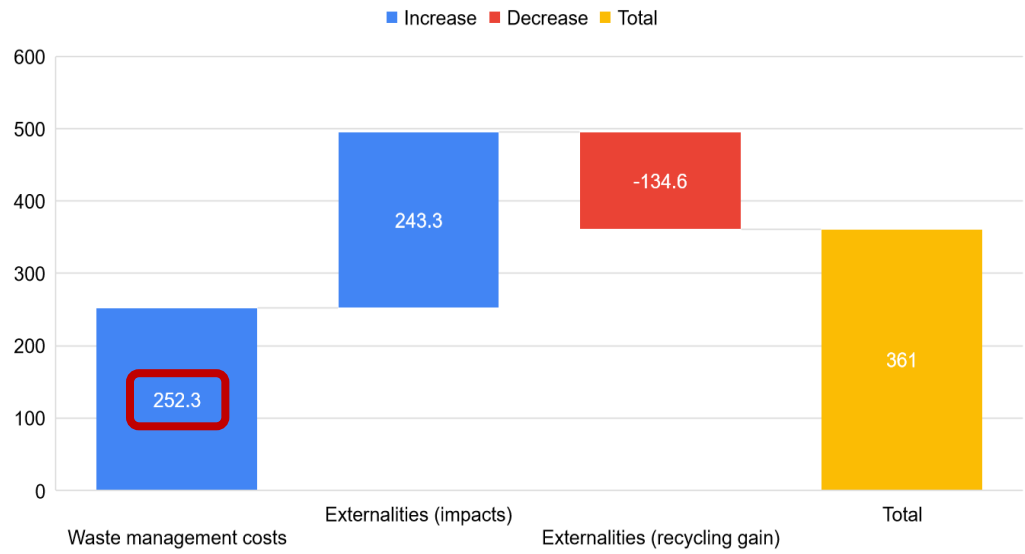



**Figure:** Direct costs, externalities and total overall costs of municipal solid waste and its management (2020) (US$2020)

Source: World Bank, What a Waste 2.0 (2018)

# GLOBAL OVERVIEW
## WASTE MANAGEMENT TECHNOLOGY

| Technology | Advantages | Disadvantages |
|---|---|---|
| Composting | Reduces landfill waste and methane emissions; produces nutrient-rich soil amendment that improves water retention and cuts fertilizer costs. | Time-consuming decomposition; attracts pests, produces odors, requires regular maintenance; limited to organic waste. |
| Anaerobic Digestion/Biogas | Generates renewable biogas for energy; low energy use, reduces organic waste volume and sludge; mitigates greenhouse gases via methane capture. | Sensitive to temperature/pH changes; long retention times, incomplete pollutant removal; potential odors and higher operational costs. |
| Waste-to-Energy | Reduces waste volume by over 85%; produces electricity/heat, destroys pathogens; recovers some metals. | Emits CO2, NOx, and toxins; destroys recyclable materials; high costs, air pollution risks to nearby communities. |
| Sanitary Landfill | Cost-effective waste containment; prevents groundwater pollution via liners, captures methane for energy; controls odors and pests. | Limited space and lifespan; risks leachate/groundwater contamination, methane emissions; long-term monitoring needed. |
| Recycling and Materials Recovery | Conserves resources/energy; reduces landfill use and raw material demand; supports circular economy. | High initial costs and contamination issues; market-dependent, outdated processes lead to low recovery rates. |

**Figure:** Global waste management technologies, their advantages, and disadvantages

Source: Sensoneo, Global Waste Index 2025 (2025)

# GLOBAL OVERVIEW

## GLOBAL LEADERS IN WASTE MANAGEMENT

I. South Korea
- Achieved a 54% recycling rate
- Has mandated food waste recycling since 2005

II. Germany
- Recycles 45 percent of its municipal waste
- Utilizes rigorous source separation requirements and substantial public investment in collection infrastructure

III. Slovenia
- Has a 45% municipal waste recycling rate
- Capital investment in waste collection and processing facilities

IV. Japan
- Maintains the lowest per capita waste generation rates at 920 g/person/day (United States 2.6 kg/person/day)

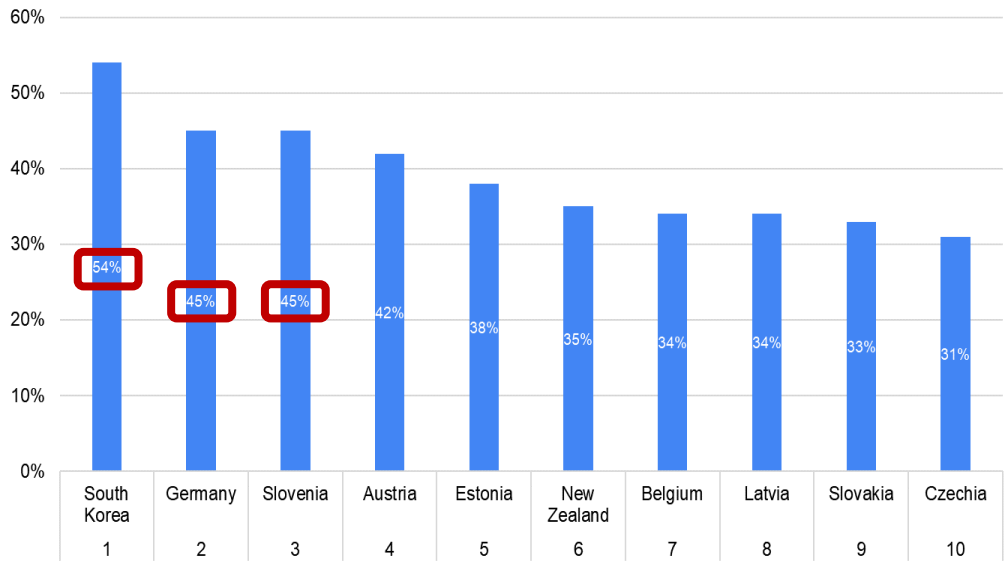



**Figure:** World top recycling countries according to Global Waste Index 2025

Source: Sensoneo, Global Waste Index 2025 (2025)

# REGIONAL OVERVIEW
## DEVELOPMENT-WASTE NEXUS

### I. Income Level Dynamics

- Low Income: Waste generation is modest, but management capacity remains minimal
- Middle Income: Waste generation accelerates rapidly, frequently overtaking the development of infrastructure
- High Income: Generation rates may level as management capacity finally strengthens

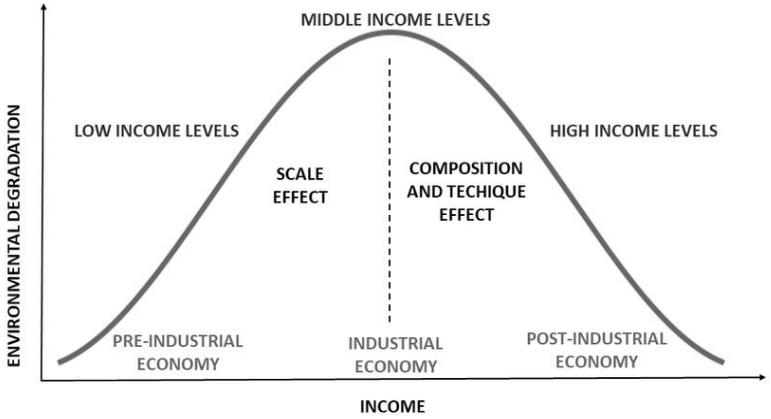



**Figure:** Environmental Kuznets curve (Mitić et al. 2019)

### II. Status

- Maldives: Prevalence of single-use plastics causes high waste generation by tourism-driven consumption reaching up to 3.5 kg/person/day
- India: Waste generation is projected to more than double, rising from 62 million tonnes to 165 million tonnes by 2030
- Bhutan: Growing economy driving a rise in plastics and paper that accounts for 33% of the waste stream

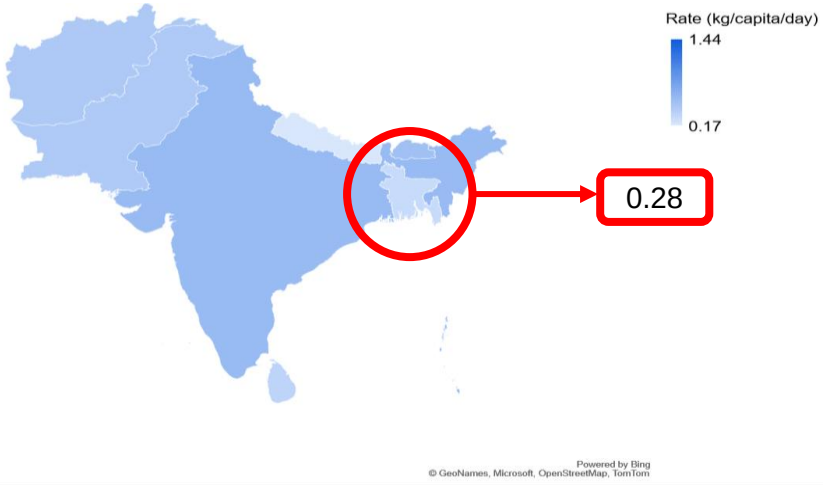



**Figure:** Waste generation rates: South Asia region

Source: World Bank, What a Waste 2.0 (2018); Huang, Y., Rahman, S. U., Meo, M. S., Ali, M. S. E., & Khan, S. (2024). Revisiting the environmental Kuznets curve: assessing the impact of climate policy uncertainty in the Belt and Road Initiative. Environmental Science and Pollution Research, 31(7), 10579-10593.

# REGIONAL OVERVIEW
## ASIAN DEVELOPMENT CORRIDOR

I. Japan (1950s–1970s)
- Implemented strict environmental regulations, adopted advanced waste technologies

II. South Korea (1980s–2000s)
- Introduced volume-based waste fees, enforced exte producer responsibility, and aggressive national recy targets

III. China (2000s–Present)
- Enacted the restricting waste imports, rapidly expanded WtE infrastructure, and launched mandat sorting programs

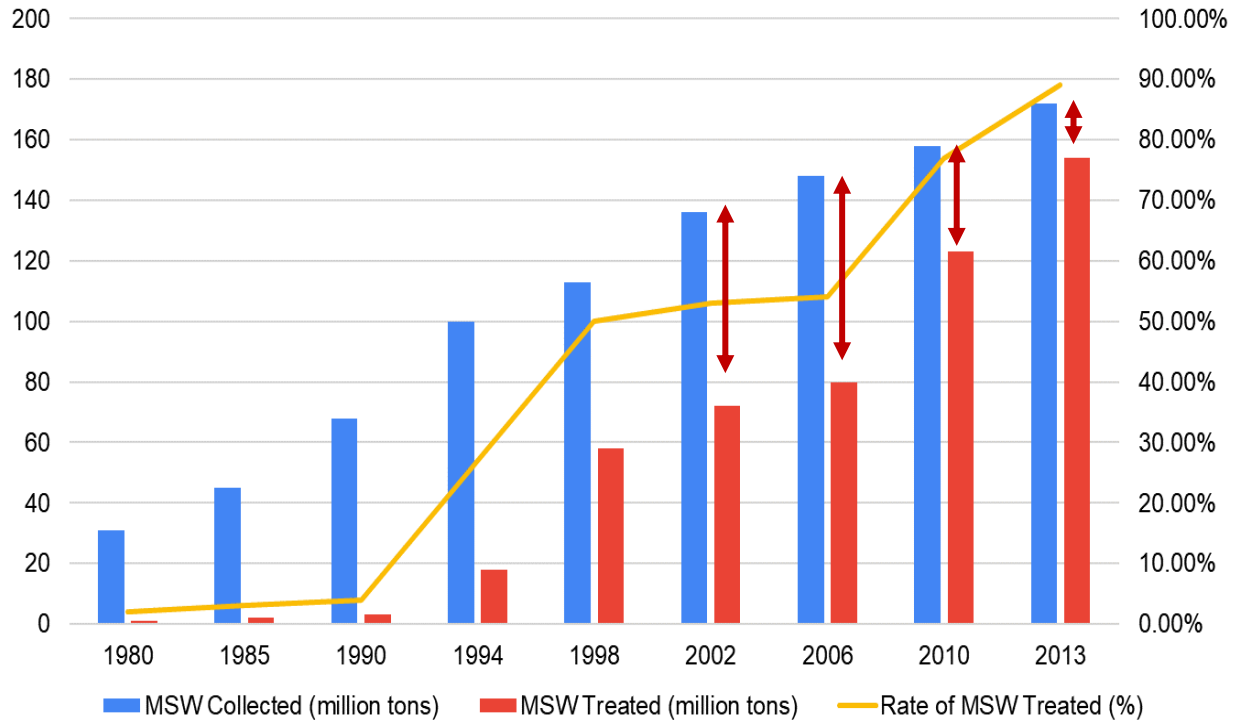



**Figure:** Municipal solid waste (MSW) management in China from 1980 to 2013

IV. India (Current)
- Launched the Swachh Bharat Mission, 2016 Solid Waste Management Rules mandate source segregation and prioritize WtE solutions

Source: Zhang, D., Huang, G., Xu, Y., & Gong, Q. (2015). Waste-to-energy in China: Key challenges and opportunities. Energies, 8(12), 14182-14196.

# BANGLADESH CONTEXT
## OVERVIEW

I. Demographics
- GDP per capita: $2,593 - $2,960
- Poverty rate: 27.9%
- Life expectancy: 74.07 years
- Population: 175.7 million

II. Waste management
- National generation: 23,688T/day
- Per capita generation: 0.6–0.8 kg/day
- Collection efficiency: 45–55% nationally
- Proper disposal: 30.44%
- Recycling rate: 3.15%

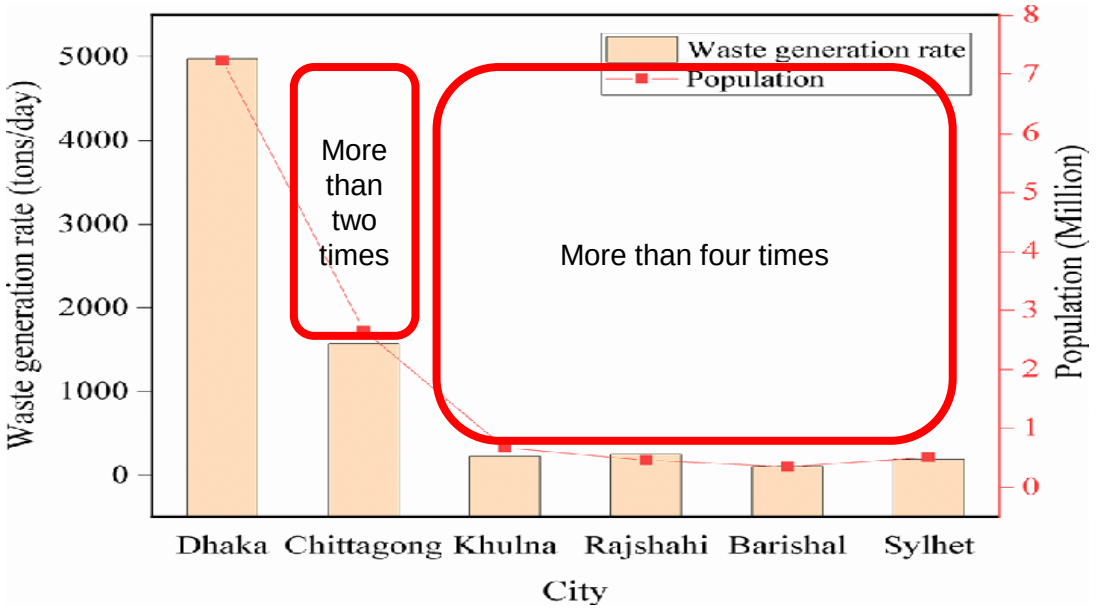



**Figure:** Waste generation rate and population of major cities of Bangladesh. Data has been adapted from (Alam and Qiao 2020)

Source: Parvin, F., & Tareq, S. M. (2021). Impact of landfill leachate contamination on surface and groundwater of Bangladesh: a systematic review and possible public health risks assessment. Applied water science, 11(6), 100.

# BANGLADESH CONTEXT

## SPATIAL AND ENVIRONMENTAL CONSTRAINTS

I. Population Density
- With 1,300 to 1,366 people per square kilometer, creates a unique set of challenges for high-volume collection

II. Rapid Urbanization
- 40.5% to 41.2% of the population is urban
- Projection to reach 56% to 60% percent by 2050 which equates to an additional of more than 40 million urban residents over the next three decades

III. Dhaka Dynamics
- Dhaka's metropolitan area houses 22 million people, reaching a density of approximately 14,500 people per square kilometer
- During business hours, the city's population swells to over 25 million due to commuters

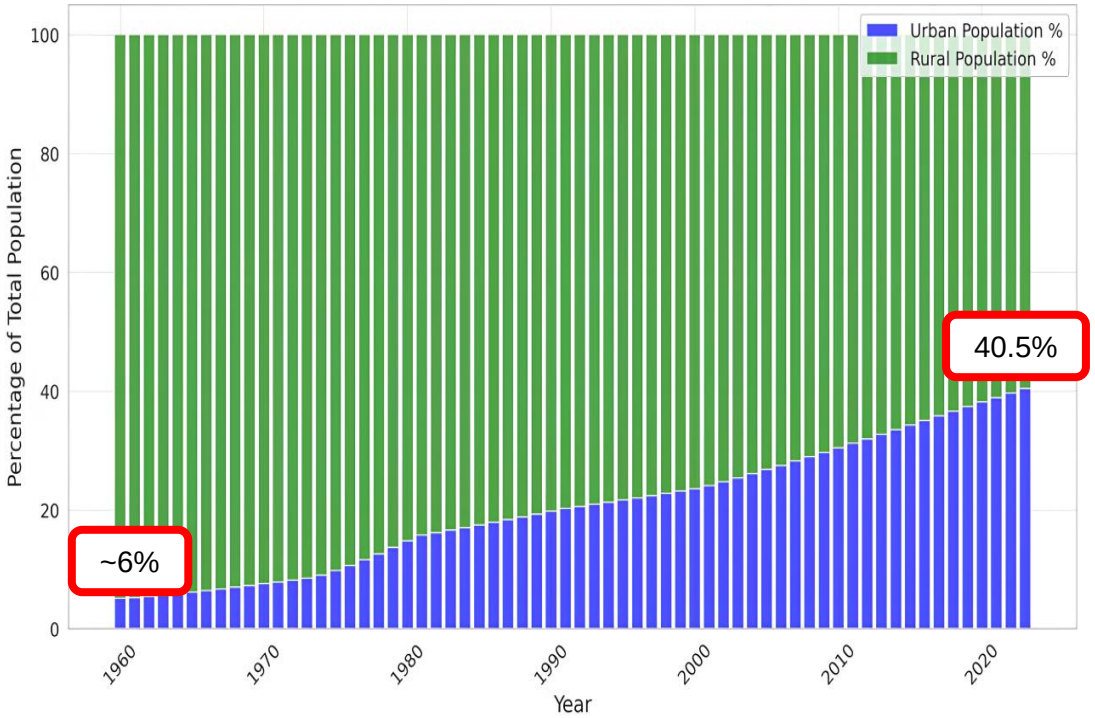



**Figure:** Bangladesh Urban vs Rural Population percentage (1960-2023)

IV. Extreme Climate Vulnerability
- Bangladesh ranks seventh globally on the Climate Risk Index
- Poor waste management directly worsens climate change scenario

Source: World Bank

# WASTE DYNAMICS
## URBAN OVERVIEW

I. Dhaka Metropolitan Waste Profile
- Daily Generation of approximately 6,800T to 7,500T
- Collection Rate:
  - ✓ DNCC: Approximately 77% to 80%
  - ✓ DSCC: Approximately 78% to 82%

II. Implications of Organic Content
- The high moisture significantly reduces the calorific value, making traditional incineration less efficient
- Organic loads create optimal conditions for methane generation
- Organic waste represents significant untapped potential for resource recovery through composting or biogas production
- The rapid decomposition of organics in Dhaka's climate accelerates the proliferation of disease vectors.

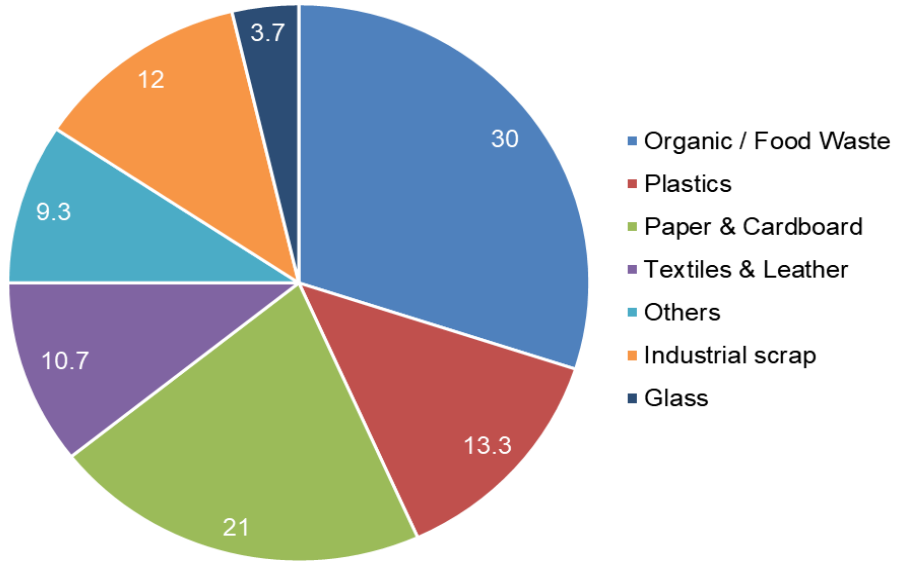



**Figure:** Waste composition in Dhaka's waste

Source: Rahul, Fahad & Rahman, Md & Rahman, Md & Waseem, Muhammad & Audrika, Suneha. (2026). SOLID WASTE MANAGEMENT IN DHAKA CITY. 10.

# WASTE DYNAMICS
## DHAKA COLLECTION CHALLENGE

I. Formal Sector
- Government
  - ✓ DNCC operates 17 dump trucks, 35 open trucks, 25 compactors, 33 container carriers, and 8 arm rolls
  - ✓ DSCC operates 24 dump trucks, 142 open trucks, 21 compactors, 82 container carriers, and 12 arm rolls
- Private
  - ✓ Handles door-to-door collection in most wards.
  - ✓ 340 providers registered in DNCC
  - ✓ 51 providers DSCC
  - ✓ Uses vans or rickshaws to deliver household waste to the STS and charge residents small service fees

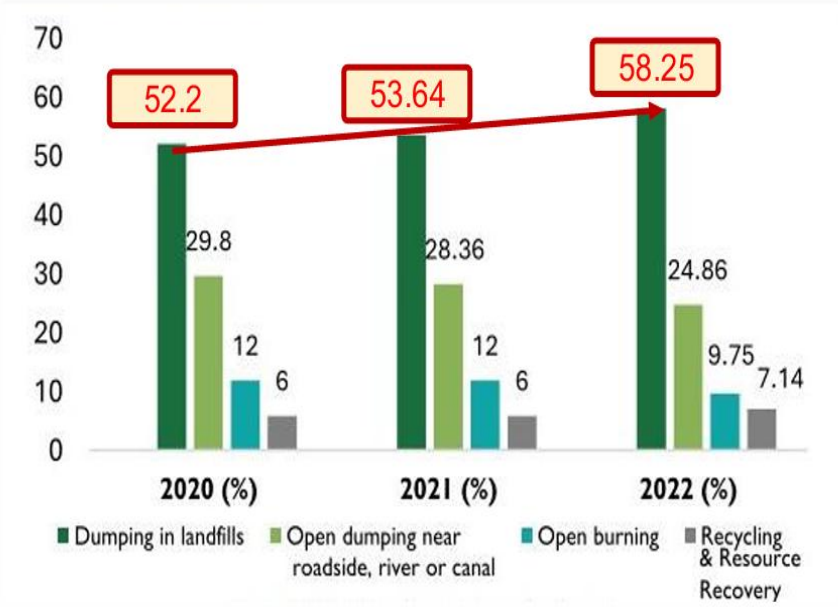



**Figure:** Solid waste disposal methods

II. Informal Sector
- Waste collectors, locally known as tokai collects waste from households
- Performs critical manual sorting to recover valuables before waste reaches STS

Source: Waste Concern, 2022

# WASTE DYNAMICS
## DISPOSAL SITES

I. Matuail Landfill
- Started as an open dump in 1995
- Converted into a sanitary landfill in 2006–2007
- Daily receipt: approximately 1,150T to 1,760T
- Area: 100 acres
- Condition: Critically over capacity

II. Aminbazar Landfill
- Established in 2007 as overflow solution
- Daily receipt: approximately 2,000T to 3,000T
- Area: 52 acres
- Condition: Critically over capacity

III. Operational reality
- Neither site has functional leachate treatment
- No methane capture or flaring
- No bio-cover utilized

| Name of city | Total area (sq. km.) | Number of dumpsites | Waste collection efficiency (%) | Landfill area required with 4 m depth (acre/year) | |
|---|---|---|---|---|---|
| | | | | With existing collection efficiency | With 100% collection efficiency |
| Dhaka | 360 | 2 | 42 | 39.89 | 94.97 |
| Chittagong | 168 | 2 | 70 | 22.21 | 31.72 |
| Khulna | 47 | 1 | 47.7 | 3.14 | 6.58 |
| Rajshahi | 96 | 1 | 56.67 | 2.01 | 3.54 |
| Sylhet | 26.5 | 1 | 76.47 | 2.24 | 2.93 |
| Barisal | 45 | 1 | 44.3 | 1.22 | 2.75 |
| Pourashavas | – | – | 54.42 | 52.17 | 95.87 |
| Other sub-cities | – | – | 52 | 18.12 | 34.21 |

**Table:** Dumpsites, waste collection efficiency and required landfill area in major cities (Alam & Qiao, 2020).

Alam, O., & Qiao, X. (2020). An in-depth review on municipal solid waste management, treatment and disposal in Bangladesh. Sustainable Cities and Society, 52, 101775.

# WASTE DYNAMICS
## SECONDARY CITIES

I. Chittagong
- Population: 5.5 million metropolitan
- Daily waste: approximately 2,800 tonnes
- Collection: 50-55 percent

II. Khulna
- Population: 1.5 million
- Daily waste: approximately 500 tonnes
- Collection: 40-45 percent
- projecting 4.8x increase: 0.117 → 0.561 t/capita (2020-2050)

III. Rajshahi
- Population: 900,000
- Daily waste: approximately 300 tonnes

IV. Sylhet
- Population: 700,000
- Daily waste: approximately 250 tonnes

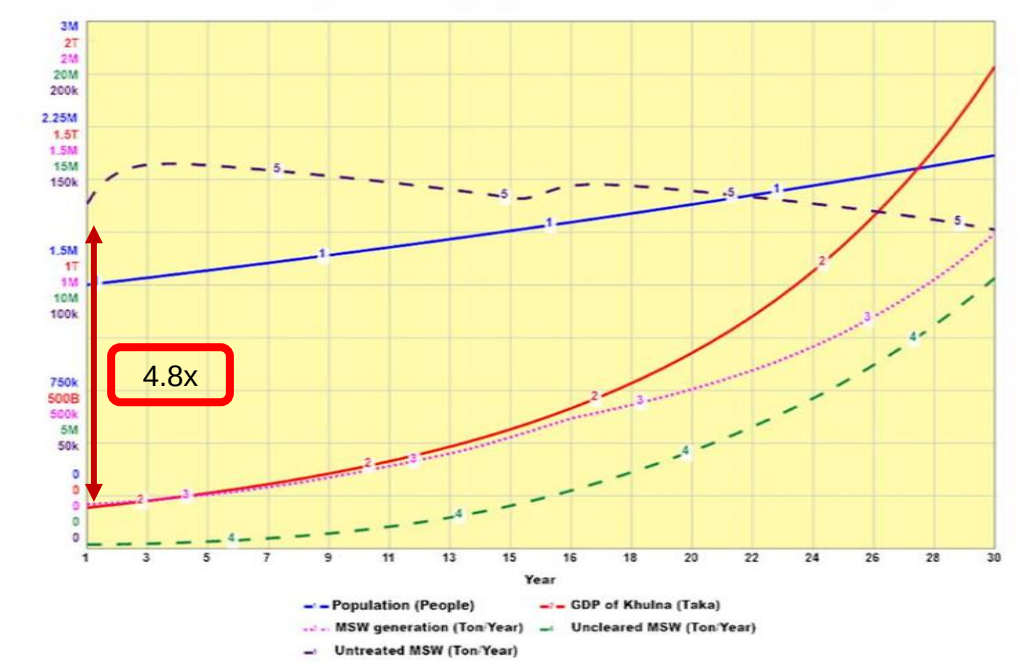



**Figure:** Population, GDP, MSW generation, uncleared and untreated MSW of Khulna city from the year of 2020 to 2050

Source: Rafew, S. M., & Rafizul, I. M. (2021). Application of system dynamics model for municipal solid waste management in Khulna city of Bangladesh. Waste Management, 129, 1-19.

# WASTE DYNAMICS
## RURAL CONTEXT

I. Rural waste generation
- Per capita: 0.15-0.25 kg per day (significantly lower than urban)
- Total estimated: 15,000-25,000 tonnes per day
- Composition: 80+ percent organic

II. Traditional management
- Organic waste fed to livestock or composted
- Minimal packaging in local markets
- Repair and reuse culture
- Natural decomposition in homestead gardens

III. Collection coverage
- Zero percent formal collection in rural areas
- Union Parishad's doesnt have dedicated waste management

| Waste Type | Examples | Key Issues |
|---|---|---|
| Packaged consumer goods | Sachets, plastic bottles, processed food packaging | Proliferating single-use plastics overwhelm informal dumping and burning practices |
| Agricultural inputs | Pesticide containers, fertilizer bags, plastic mulch | Hazardous residues contaminate soil/water; no rural recycling or safe disposal |
| E-waste | Mobile phones, batteries, electronic equipment | Growing from rural electrification; toxic leaching without collection systems |
| Medical waste | Clinical waste from rural health centers | Infectious materials dumped openly; lacks treatment or segregation protocols |

**Table:** Types of rural waste, examples, and key issues in Bangladesh

# WASTE DYNAMICS
## AGRICULTURAL WASTE STREAMS

I. Annual agricultural residue generation
- Rice straw and husk: approximately 40-60 million tonnes
- Jute sticks: approximately 3 million tonnes
- Sugarcane bagasse: approximately 1.5 million tonnes
- Other crop residues: approximately 10 million tonnes

II. Opportunity
- Biogas generation for cooking and electricity
- Briquette production for clean fuel
- Biochar for soil amendment
- Industrial feedstock for bioeconomy

| Agricultural crops | Residue | Utilization |
|---|---|---|
| Rice | Rice straw | i. Animal feed ii. Animal bedding iii. Housing materials iv. Fuel |
| | Rice husk | i. Poultry bedding ii. Cattle feed iii. Fuel |
| Wheat | Wheat straw | i. Fuel ii. Housing material |
| Jute | Jute stalk | i. Fuel ii. Housing material |
| Groundnut | Groundnut straw | i. Fuel ii. Animal feed |
| Vegetable | Vegetable plants | i. Fuel ii. Animal feed |
| Pulse | Pulse straw | i. Fuel ii. Animal feed |
| Sugarcane | Sugarcane leafs | i. Fuel ii. Animal feed |
| | Sugarcane bagasse | i. Fuel |
| Maize | Maize leaf and straw | i. Fuel ii. Animal feed |
| | Maize husk | i. Fuel |

**Table:** Utilization pattern of agricultural residue in Bangladesh

Source: Halder, P. K., Hossain, M. A., Paul, N., & Khan, I. (2014). Agricultural residue potential for electricity generation in Bangladesh. *IOSR J Mech Civ Eng (IOSR-JMCE)*, *11*, 89-95.

# GAP ANALYSIS
## COLLECTION INFRASTRUCTURE

I. Overview
- Vehicle deficit: ~2,500 units
- Capital requirement: approximately $250 million for vehicles alone
- Operating cost increase: 80-100 percent above current levels

II. Secondary collection gap
- Limited transfer stations
- Need for more transfer stations in Dhaka alone
- Absence of materials recovery facilities for segregated waste

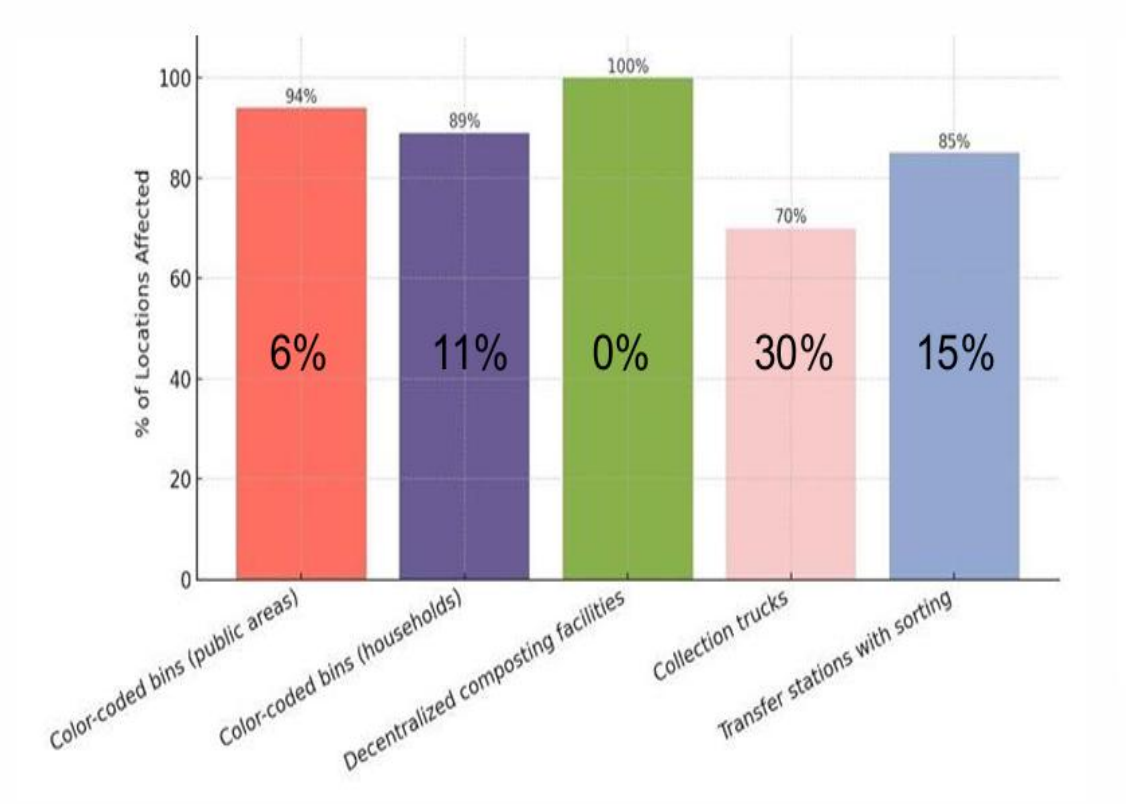



**Figure:** Infrastructure Gaps in Waste Management

# GAP ANALYSIS
## TREATMENT AND DISPOSAL

I. Current treatment capacity
- Composting: approximately 700 tonnes per day (vs. 20,000 tonnes of organic waste)
- Waste-to-energy: Essentially zero operational capacity
- Materials recovery: Limited to informal sector
- Landfill: Two semi-controlled sites in Dhaka, inadequate elsewhere

II. Sanitary landfill
- Minimum requirement for residual waste
- Causing serious ozone layer damages in our country
- Need engineered facilities with leachate treatment, gas capture
- No gas capture, inadequate leachate treatment

| Scenarios |
|---|
| Business-as-usual, B0 (only landfilling) |
| Alternative scenario A1 (landfilling + composting) |
| Alternative scenario A2 (landfilling + composting + incineration) |
| Alternative scenario A3 (landfilling + composting + incineration) |
| Alternative scenario A4 (landfilling + incineration) |

| Indicator | B0 | A1 | A2 | A3 | A4 |
|---|---|---|---|---|---|
| Fine particulate matter formation | – | ✓ | ✓ | – | – |
| Freshwater ecotoxicity | – | ✓ | ✓ | ✓ | – |
| Freshwater eutrophication | – | ✓ | ✓ | – | – |
| Global warming | – | – | – | ✓ | ✓ |
| Human carcinogenic toxicity | – | ✓ | – | – | – |
| Human non-carcinogenic toxicity | – | – | ✓ | – | – |
| Land use (for initial years) | – | – | – | ✓ | ✓ |
| Marine ecotoxicity | – | ✓ | ✓ | ✓ | – |
| Marine eutrophication | – | – | ✓ | – | – |
| Ozone formation, human health | ✓ | – | – | – | – |
| Ozone formation, terrestrial ecosystems | ✓ | – | – | – | – |
| Stratospheric ozone depletion | ✓ | – | – | – | – |
| Terrestrial acidification | – | ✓ | ✓ | – | – |
| Terrestrial ecotoxicity | – | ✓ | – | – | – |
| Water consumption | – | – | ✓ | – | – |

**Figure:** Summary of the Dhaka City municipal solid waste life cycle analysis

Source: Joarder, S. M., & Mamtaz, R. (2025). Assessment of environmental sustainability of solid waste management system of Dhaka city through life cycle analysis. Scientific Reports, 15(1), 36560.

# GAP ANALYSIS
## POLICY AND REGULATORY GAPS

I. Critical policy gaps

- No legislation requiring producers to manage post-consumer packaging
- No enforceable technical standards for landfill construction and operation
- No guidelines for cost-reflective user fees
- No policy framework for recognizing and supporting waste workers
- Rules exist but penalties are minimal and rarely applied
- Limited framework for public-private partnerships
- 2002 polythene ban remains unenforced

| Regulatory Documents | Approving agency |
|---|---|
| • Local Govt. (City Corporation/ Pourashava) Acts, 2009 Amended 2011 | • The Parliament |
| • Environmental Conservation Act 1995 | • The Parliament |
| • Environmental Conservation Rules 1997 | • DoE, MoEFCC |
| • Medical Waste Management Rules, 2008 | • DoE, MoEFCC |
| • Solid Waste Management Rules, 2021 | • DoE, MoEFCC |
| • National Policy for Safe Water Supple and Sanitation,1998 | • LGD, MoLGRDC |
| • Environment Policy, 2018 | • DoE, MoEFCC |
| • National 3R Strategy for Waste Management, 2010 | • DoE, MoEFCC |
| • National Strategy for Water Supply and Sanitation, 2021 | • LGD, MoLGRDC |
| • 8th Five Year Plan | • Planning commission, Ministry of PLanning |
| • Perspective Plan for Bangladesh 2021-2041 | • Planning commission, Ministry of PLanning |

**Table:** Regulatory documents for waste management in Bangladesh and their approving agency

# GAP ANALYSIS

## HUMAN RESOURCE AND KNOWLEDGE GAPS

I. Skills gaps
- Few qualified solid waste engineers
- Limited sanitary landfill operators
- No certified hazardous waste technicians
- Minimal environmental monitoring capacity

II. Knowledge gaps:
- No national waste database
- Inconsistent monitoring and reporting
- Limited research on local waste characteristics
- Poor documentation of informal sector

III. Human Cost
- No PPE
- Severe health risks
- Toxic fume exposure at dumpsites

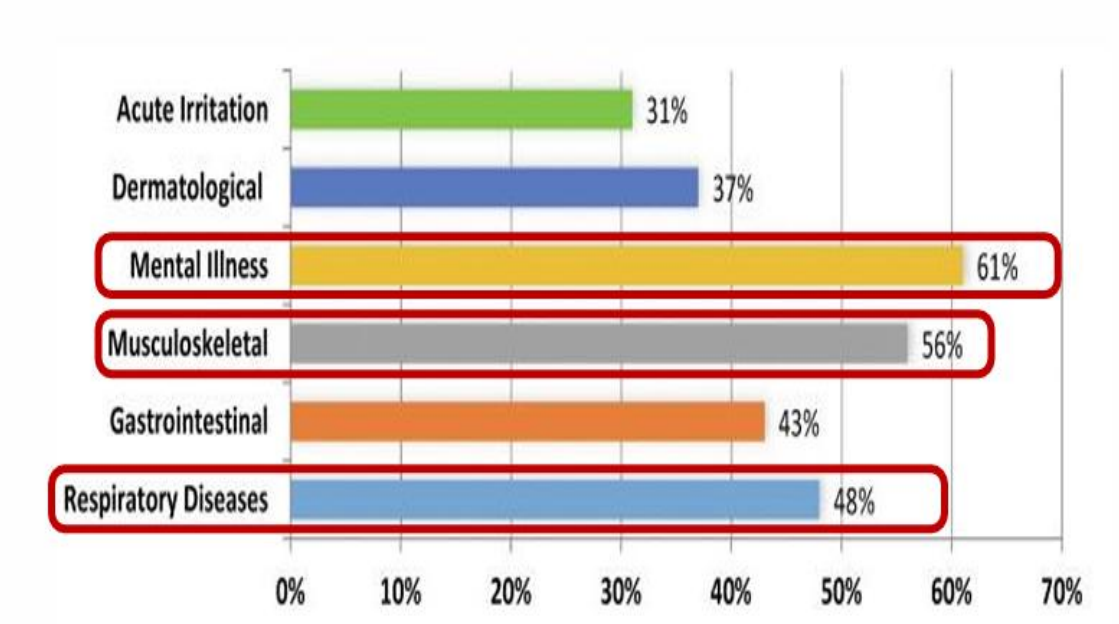



**Figure:** Types of diseases among the waste collectors

Source: Hossain, S., Hossain, M. F., Liu, B., Ara, A., Alsaoud, H., & Patwary, M. A. M. (2025). Health Challenges Among Waste Collectors in Bangladesh: Exploring Risk Factors Using Multi-level Modeling. Safety and Health at Work, 16(1), 13-20.

# GAP ANALYSIS

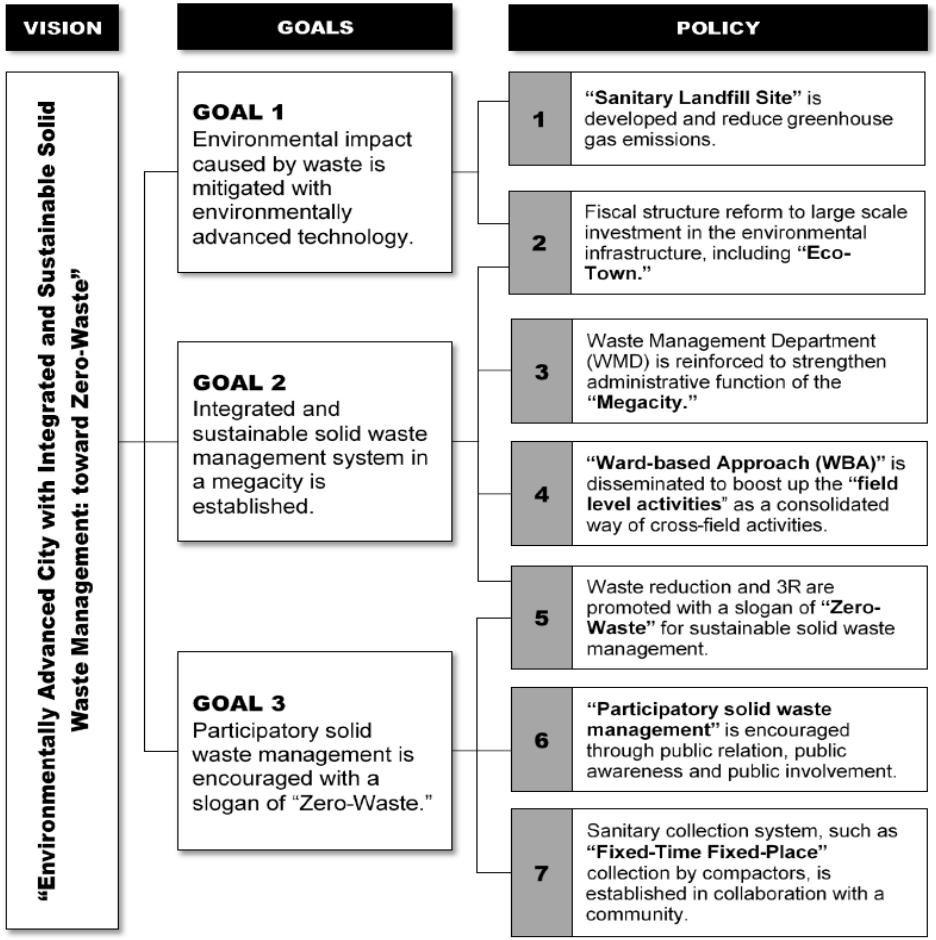
## JICA'S NEW MASTER PLAN TARGET BY 2032

| | Present condition | Target by 2032 |
|---|---|---|
| Waste Collection | The expanded area of Dhaka is not covered | 100 % area coverage |
| Waste Reduction | 0 % (No action) | 12 – 13 % |
| Recycling | 10 % | 44 – 48 % |
| Landfill Disposal | 73 – 80 % | 29 – 33 % |

| | Current | By 2032 |
|---|---|---|
| Waste generation | 6,510 tons/day | 8,498 tons/day (DNCC: 4,763 tons/day, DSCC: 3,735 tons /day) |
| Waste collection | 5,463 tons/day | 7,649 tons/day |
| Landfill site | DNCC: Amin Bazar LFS; DSCC: Matuail LFS | DNCC: New Amin Bazar LFS + New LFS; DSCC: New Matuail LFS |
| Intermediate treatment | None | Waste-to-Energy, recycling, Biogas, compost, waste sorting etc. |
| Organization | Waste Management Department (WMD) | Strengthen WMD with new sections (intermediate treatment, PR/PA, WBA etc.) |
| Collection equipment | Various types(trucks, compactor etc.) | Mostly compactors |

# GAP ANALYSIS

## JICA'S NEW MASTER PLAN TARGET BY 2032




| Year | | Year 2025 Target (%) | Year 2032 Target (%) |
|---|---|---|---|
| **Collection** | DNCC | 83 | 90 |
| | DSCC | 86 | 90 |
| **Reduction** | DNCC | 7 | 12 |
| | DSCC | 7 | 13 |
| **Recycling** | DNCC | 44 | 44 |
| | DSCC | 49 | 48 |
| **Disposal** | DNCC | 40 | 43 |
| | DSCC | 30 | 29 |

# GAP ANALYSIS

## JICA'S NEW MASTER PLAN BY 2032

I. Infrastructure Deficiencies
- DNCC lost one-fourth of its waste collection vehicles due to flooding damage in 2024
- The plan called for waste-to-energy, biogas, and composting facilities by 2032, but none exist as of 2026
- Despite urgent need, no new landfills have been developed to replace near-full existing sites

II. Institutional Weaknesses
- The planned expansion with new sections for intermediate treatment, PR/PA, and ward-based approach has not materialized
- While the plan called for mostly compactor trucks, procurement has been slow with some vehicles requiring 14+ months to import from Japan

III. Policy Implementation Failures
- Waste reduction initiatives remain unimplemented
- Community engagement and public awareness programs show minimal progress
- Despite being central to the master plan, the Reduce-Reuse-Recycle framework has been largely sidelined

IV. Systemic Issues
- The master plan suffered from overly ambitious targets without adequate implementation roadmaps.

# SOLUTION

## FIVE PILLARS OF SYSTEM TRANSFORMATION

I. Institutional Restructuring
- Unified Waste Management Authority
- Institutional Capacity Building

II. Infrastructure Investment
- Treatment Technology Transition
- Medical Waste Segregation
- Route Optimization Technology

III. Sustainable Financing
- Revenue Model Restructuring
- Public-Private Partnerships (PPPs)
- Market Incentives

IV. Informal Sector Formalization
- Worker Integration
- Access to health services

V. Community Engagement & Behavioral Change
- Active Participation
- Educational Campaigns

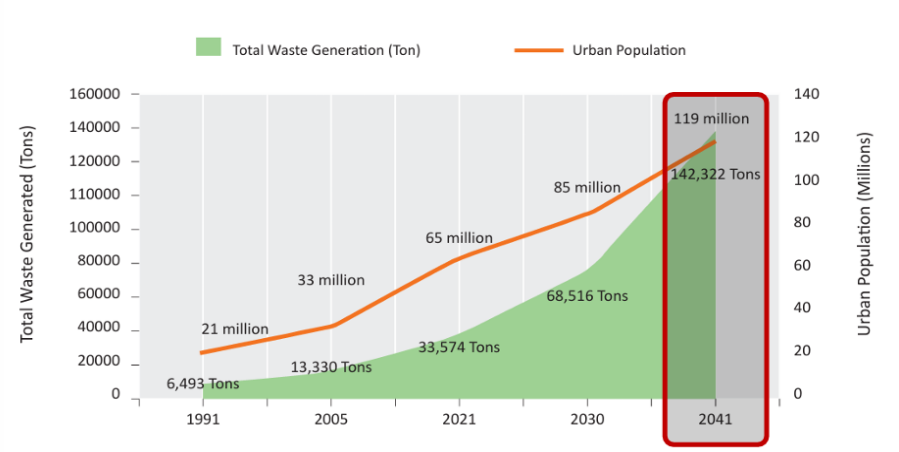



**Figure:** Waste generation for 1991, 2995, 2021, and projection of 2030, 2041

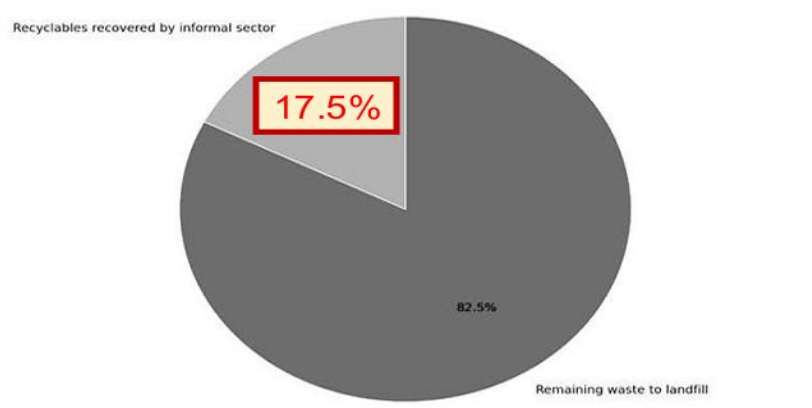



**Figure:** Recyclables recovery rate by informal sectors and remaining waste to landfill

Source: Waste Concern (2021)

# SOLUTION
## ISWM FOR BANGLADESH

I. Physical Components
- Extend collection coverage, currently 45-60% in low-income areas
- Transition from open dumping to sanitary landfills with leachate control
- Leverage informal sector recycling, 20-30% rates; composting for 67% organic waste

I. Governance Aspects
- Integrate informal recyclers, engage communities, public-private partnerships
- Cost recovery models, diverse revenue streams, affordability
- Clear responsibilities, coherent policies, capacity building

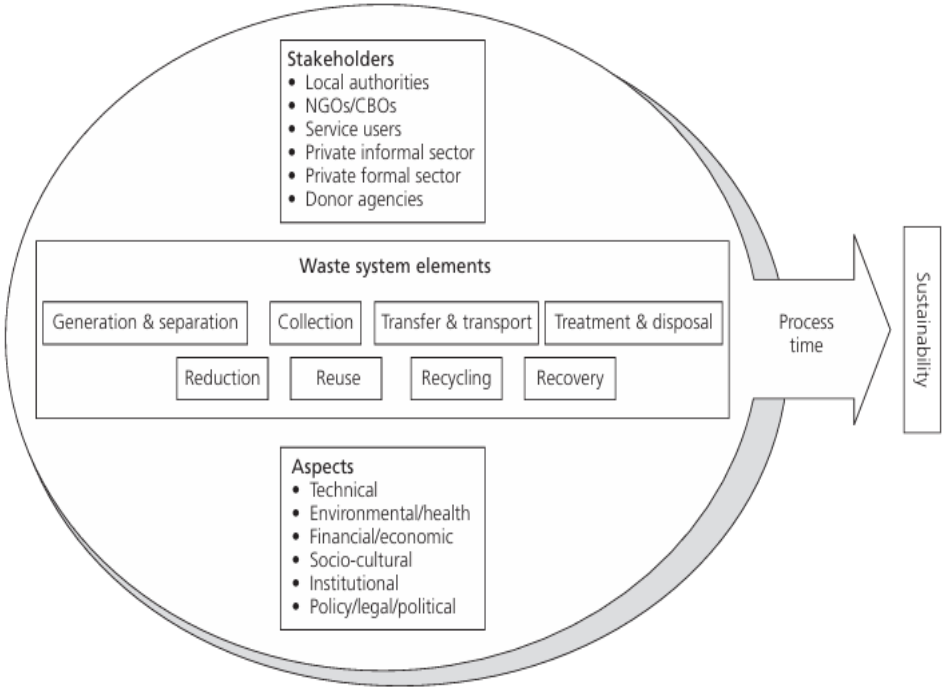



**Figure:** The ISWM framework. (a) Original version (sources: van Klundert and Anschu¨tz (2001) and Anschu¨tzet al. (2004); reproduced by permission of WASTE)

Source: Wilson, D. C., Velis, C. A., & Rodic, L. (2013). Integrated sustainable waste management in developing countries. Proceedings of the Institution of Civil Engineers - Waste and Resource Management, 166(2), 52–68.

# SOLUTION
## COMPOSTING TECHNOLOGY

I. Overview
- Maximum of waste in Bangladesh is organic
- No leachate generation, minimal GHG emissions
- Produces nutrient-rich amendments for agriculture
- Simple technology suitable for local conditions

II. Implementation Methods
- Windrow composting: Large-scale open-air piles with regular turning
- Aerated static pile: Forced air through stationary piles
- In-vessel composting: Enclosed systems with better odor control
- Community-level: Decentralized small-scale facilities

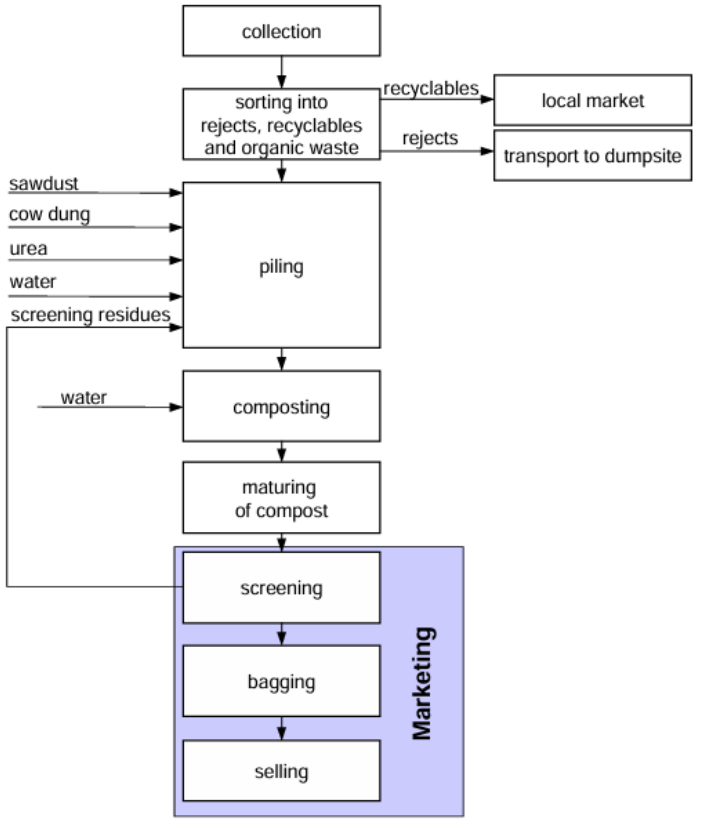



**Figure:** Flow Chart of Composting Process

Source: Zurbrügg, C., Drescher, S., Rytz, I., Sinha, M., & Enayetullah, I. (2002, July). Decentralised composting in Dhaka, Bangladesh production of compost and its marketing. In Proceedings of ISWA 2002 Annual Congress, Istanbul, Turkey (pp. 8-12).

# SOLUTION
## ANAEROBIC DIGESTION TECHNOLOGY

I. Environmental Benefits
- 92% GHG reduction compared to landfilling (methane capture for energy)
- 99.5% acidification reduction vs. traditional disposal
- Prevents fugitive methane and ammonia emissions
- Produces stable effluent with fewer volatile compounds

II. Co-Digestion Potential
- Combining cow dung, poultry litter, and organic waste increases biogas yield and reduces emissions for Bangladesh's agricultural sector

III. Dual Output
- Biogas for renewable energy generation + nutrient-rich digestate for agricultural fertilizer

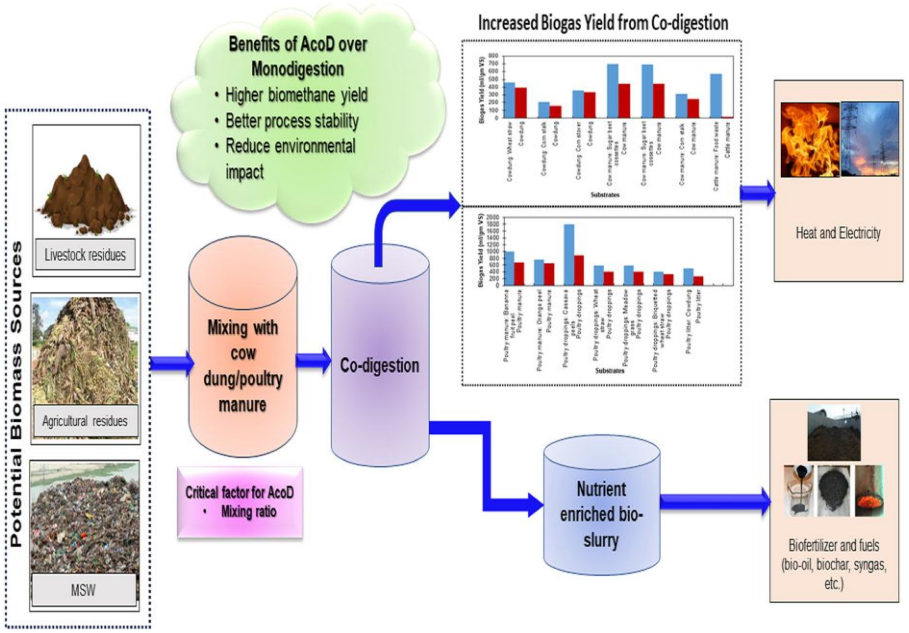



**Figure:** Overview of anaerobic digestion technology

Source: Saha, C. K., Nandi, R., Akter, S., Hossain, S., Kabir, K. B., Kirtania, K., ... & Alam, M. M. (2024). Technical prospects and challenges of anaerobic co-digestion in Bangladesh: A review. Renewable and Sustainable Energy Reviews, 197, 114412.

# SOLUTION

## MATERIAL RECOVERY FACILITIES TECHNOLOGY

I. Sylhet MRF
- Processes 60+ tonnes of waste daily
- Separates non-degradable materials (plastic, polythene) for cement co-processing
- Demonstrates circular economy approach in action

II. Informal Sector Integration
- Existing informal recycling achieves 20-30% rates, saving cities 20% of waste budgets. MRFs can formalize and enhance these systems.

III. Resource Recovery
- Systematic sorting enables recovery of paper, metals, glass, and plastics for industrial reprocessing and value creation.

**Figure:** Material Recovery Facility at Sylhet

Source: The Business Standard

# SOLUTION

## TECHNOLOGY PARTNERSHIPS

I. Japan:
- JICA already active in waste sector
- Leading composting and WtE technology
- Successful history in South Korea, China technology transfer

II. Germany:
- Leading recycling systems globally
- DSD/Green Dot model for EPR
- Technical standards and certification

III. China:
- Massive scale of recent investment
- Equipment manufacturing at lower cost
- Smart city waste management technologies


**Figure:** Green Dot model for EPR by Germany

Source: Der Grüne Punkt, Consumer Information

# SOLUTION
## REDUCE

I. Pay-As-You-Throw System
- Implement unit-based pricing where households pay variable fees based on waste generated

II. Plastic Tax on Virgin Material
- Impose graduated tax on virgin plastic production to incentivize use of recycled content and discourage overproduction

III. Zero-Waste Educational Campaigns
- Launch nationwide school and community programs teaching waste prevention

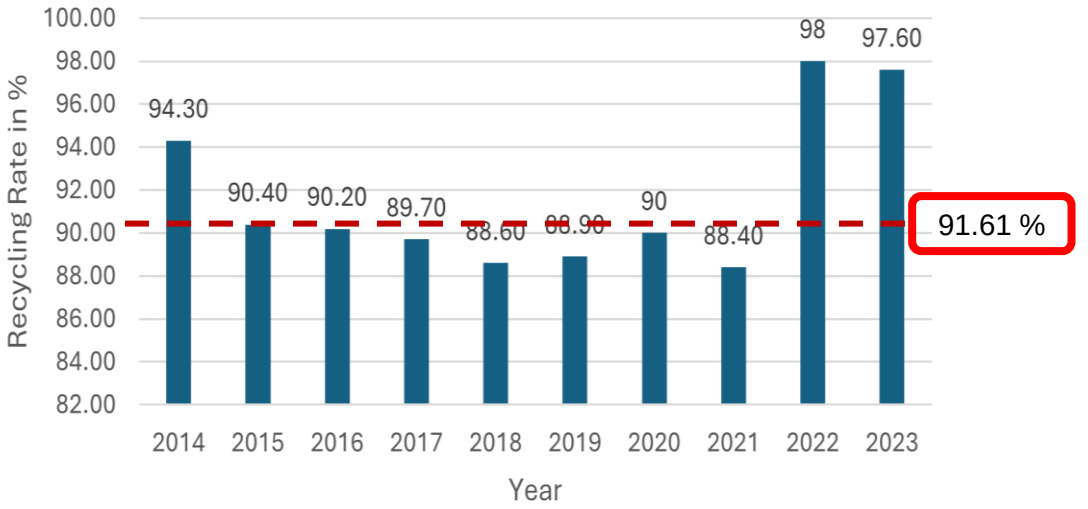



**Figure:** Higher waste recycling rate in Korea due to pay as you throw system

Source: Frost & Sullivan Institute

# SOLUTION
## REUSE

I. Reusable Packaging Infrastructure
- Establish refill stations network in urban markets for beverages, detergents, and personal care products

II. Container Deposit Legislation
- Implement mandatory deposit-refund scheme

III. Construction Material Reuse Markets
- Develop deconstruction protocols and material exchange platforms for salvaging and reusing demolition waste in new construction projects

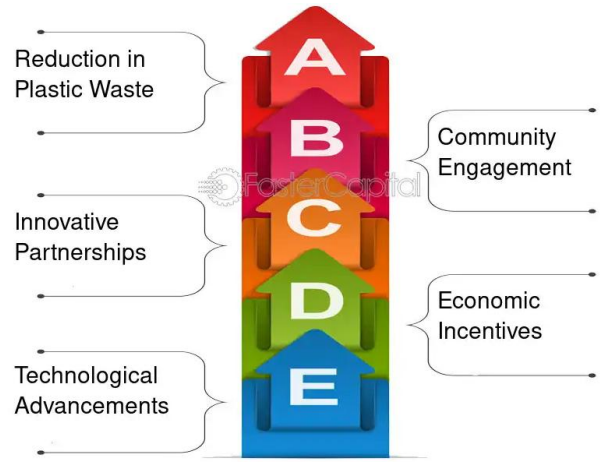



**Figure:** Refill station overview

| Country | PPP-adjusted deposit value | Ratio between deposit value and PIFB | Return rate | Return points to population ratio |
|---|---|---|---|---|
| Germany | 0,34 | 0,32 % | 97 % | 1:639 |
| Lithuania | 0,21 | 0,21 % | 92 % | 1:1117 |
| Norway | 0,23 | 0,16 % | 89 % | 1:356 |
| Estonia | 0,17 | 0,16 % | 87 % | 1:1073 |

**Table:** Comparison between deposit fee value, return rate and number of return points to population ratio

Source: FasterCapital; Picuno, C., Gerassimidou, S., You, W., Martin, O., & Iacovidou, E. (2025). The potential of Deposit Refund Systems in closing the plastic beverage bottle loop: A review. *Resources, Conservation and Recycling*, *212*, 107962.

# SOLUTION
## RECYCLE

I. Extended Producer Responsibility (EPR):
- Mandate manufacturers finance collection and recycling of packaging waste with differentiated fees based on recyclability and market value

II. Digital Waste Tracking System:
- Deploy blockchain-based platform connecting waste generators, collectors, and recyclers with real-time data on material flows

III. Chemical Recycling Plants:
- Invest in advanced pyrolysis and gasification facilities to convert mixed plastics into chemical feedstock and synthetic fuels for industrial sectors with strong control of air pollution

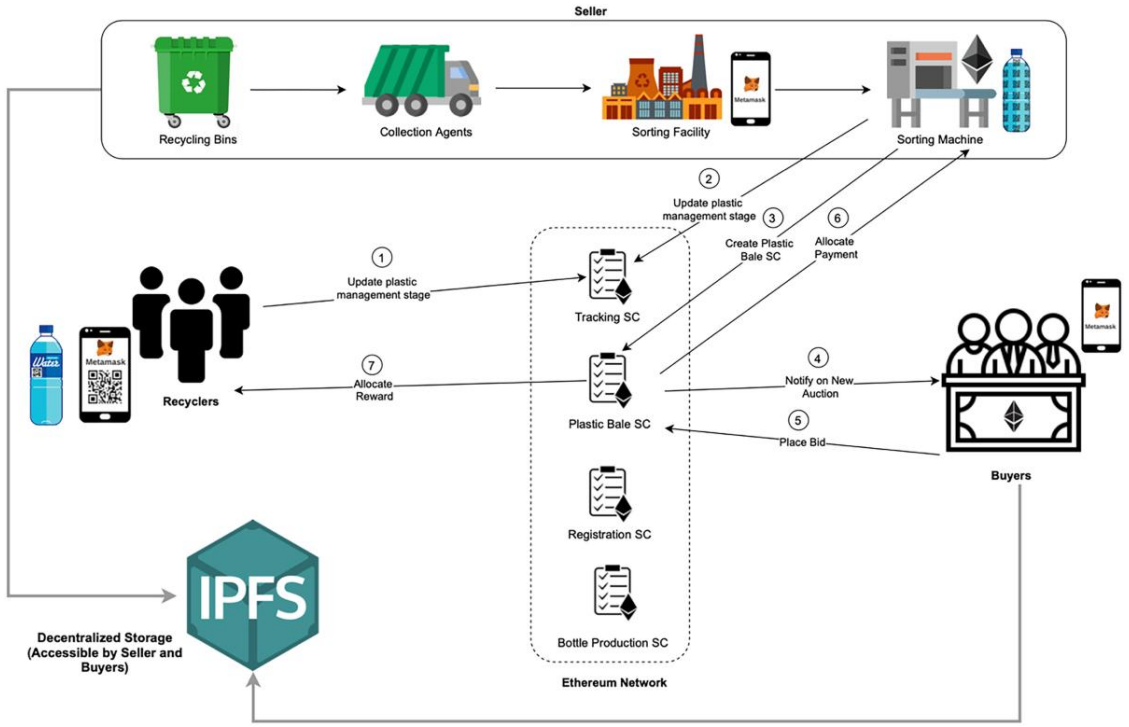



**Figure:** Overview of the proposed blockchain-based system for tracking and rewarding recyclable plastic waste

Source: Alnuaimi, E., Alsafi, M., Alshehhi, M., Debe, M., Salah, K., Yaqoob, I., Zemerly, M. J., & Jayaraman, R. (2022). Blockchain-based system for tracking and rewarding recyclable plastic waste. Peer-to-Peer Networking and Applications, 16(1), 328–346.

# OVERALL SOLUTION

- Modernize education system with specific focus on waste management and engagement of students and young entrepreneurs
- Immediate implementation of ward-based approach (WBA) for solid waste management with public-private partnership
- Implement five pillars of system transformation described before
- Immediately implement pilot scale programs at different levels of 3Rs
- Independent evaluation and piloting of waste treatment technologyfor wider adoption such as:

  ~waste sorting,

  ~composting,

  ~anaerobic digestion and

  ~waste to energy facility

# Thank you!

## Do You Have Any Questions???

Please do not hesitate to contact:

**Hossain M Azam, Ph.D., P.E.**

Associate Professor of Environmental Engineering

Dept. of Civil Engineering, School of Engineering and Applied Science
University of the District of Columbia,

**Phone:** +1 202-274-6293 (Office), +1 919-271-5347 (Cell-Preferred)

**E-Mail:** hossain.azam@udc.edu, hossain.azam@gmail.com

And

**Md. Sahariar Kabir Nion, AMIEB**

Fellow, Bangladesh Environment Network

Research Assistant, Azam Research Group/Water Energy Food Climate Nexus Lab

**Phone:** +8801777123418; **E-Mail:** sknion7@gmail.com

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