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40 Years of Waste Management in Nepal: Where We Stand, What We Professed but Did Not Implement, and What We Can Learn from Others?

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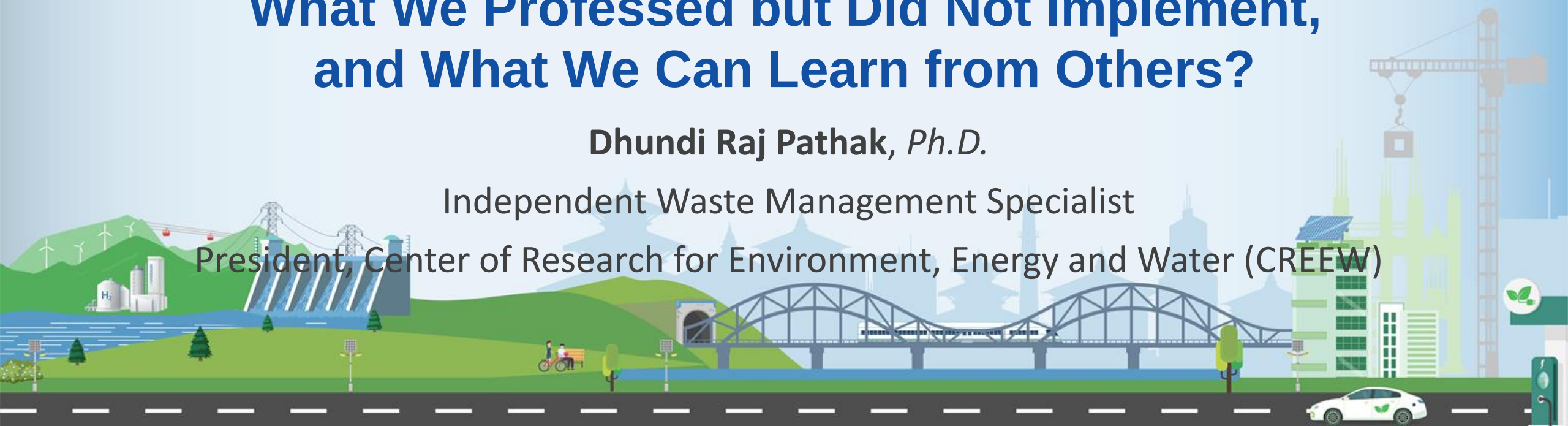

OVERVIEW

Primary objective of waste management is to Protect Public Health & the environment

10,00,000 deaths per year due to poor waste management

Solid waste contributes 5% GHG/ Dioxin, Furan

About US$ 30 – US$ 62 is spent on collection and dumping of wastes, however collection ratio is only 85% in Kathmandu valley and less than 50% in other many municipalities

"Clean Environment" as a fundamental right - but it provisioned no federal and provincial SWM unit in place at present- all responsibilities go to local government

Are municipalities ready to bear to bear the **constitutional responsibilities** and a **paradigm shift** in waste management to make system financially sustainable.

WHERE WE STAND- CURRENT STATUS AND TREND

293 municipalities of Nepal generates more than 5000 tons/day MSW (0.3 kg/capita/day), where Kathmandu Valley only generates more than 25% of total MSW in Nepal

Material	MSW composition in 58 old municipalities (ADB, 2013)	MSW composition in new municipalités(Pathak et al., 2020)
Biodegradable waste	56	61
Paper/Cardboard	16	11
Plastics	16	12
Metal	2	2
Glass	3	6
Textiles		1
Rubber/leather		1
Others	7	6

- Per capita waste generation increased by 10% over last 10 years in KTMV,
- Large waste fraction is organic in municipalities of Nepal
- Increase of plastic waste(For example, 12% to 17% in Biratnagar in 10 years) and other contaminated waste (Sanitary pads, dippers)- needs high cost, advanced technology

Accurate SW generation data is important for design of any ISWM infrastructures, including deciding either centralized or decentralized plant. SW characterization data is very crucial for selection of treatment/disposal techniques.

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BRIEF HISTORY OF WASTE MANAGEMENT IN NEPAL

1919

KMC Established on 1919 as a road cleaning office for streets, later evolved into a municipality

Before 1980s-

- Almost all organic waste and manage at Saaga to make compost
- Waste collection was handled by lower-caste

1980-2000

GTZ project- investment in waste collection, transportation and landfill site

2000-2004

Waste dumping was permitted along the banks of Bagmati River

Until Sisdol Landfill site was

2000

Involved NGOs, private companies, informal sector formally for collection and collecting recycling materials

2004- 2024

JICA, Chinese Assistance in KTMV, Pokhara LFS, UIEP, STIUP, IUDP, RUDP- ADB), World Bank, other different Das in SWM – more focus either only in soft components or in LFS construction

2005, 2009-2024

Initiated ISWM in PPP model but yet to be concluded

FINANCIAL ASPECTS, EXISTING POLICIES, LEGISLATION, AND INSTITUTIONAL ARRANGEMENT

Financially sufficient for the operation of improved ISWM system; SWMTSC, a central unit was in place prior to new constitution, no federal and provincial unit at present

Typical Solid Waste management Costs – Operation cost associated with service provision and equipment maintenance.	**Total Expenditure for MSW (/ton)**	**Average expenditures in low income countries (US$/ton)**
Collection, Transfer, Transportation and open dump **-Current scenario**	US$ 30- US$ 62 (24+38)	US$ 40
Collection, Transfer, Transportation, Composting, Recycling and Engineered Landfilling -**Improved scenario**	US$ 82	US$ 80

- SWM Act, 2011 (Now under revision to define roles of three tiers governments and address different new waste streams)
- Environment Protection Act, 2019 (EPA)
- SWM Policy 2022
- The updated Healthcare Waste Management Standard Operating Procedures (2020)

Several legislation, standard and guidelines are in place but contradicted to each other, very generalize and not implementable, not address emerging issues and not friendly for adopting new technology and address emerging issues

KEY ISSUES AND CHALLENGES – PERCEPTION VS. BEHAVIOUR

FIRST THOUGHT: WASTE is RESOURCE
Bring one bag of WASTE …Give you one bag of MONEY

SECOND THOUGHT:
WASTE is WASTE- Dump somewhere but NOT IN MY BACKYARD ! It's municipality's job….

Municipality thinks

WASTE is a main problematic sector but it is not acknowledged as an essential urban infrastructure. Spent huge amount for just COLLECT and DUMP

Key Issue/problem

- Perception ≠ Behavior
- NIMBY Syndrome
- NATO (Not Action, Talking Only) Behavior
- Shifting problem- Crisis management

KEY ISSUES, CHALLENGES AND LESSON LEARNED

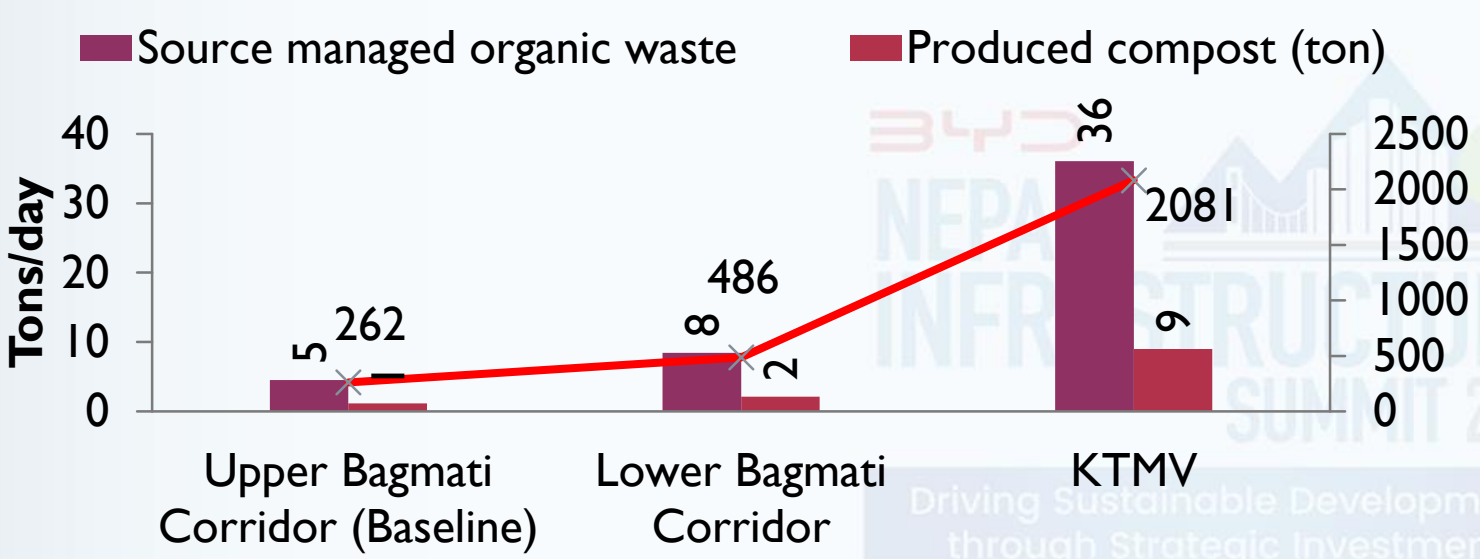
- Nepal received major foreign assistance, but failed
  - "Copy and Paste" but not site-specific solutions,
  - overlooked at the capacity of the recipients,
  - Not followed integrated approaches
- KMC installed smart solar dustbins in different places of the on PPP model. But, neither fulfill the requirements nor sustainable,
- Piloted 3 t/d biomethanation plant in Teku transfer station but yet to be scaled up.

So-called smart bin

Biomethanation plant (3t/d) at Teku transfer station

- Enforcing waste collection fees and collection of waste from sources- the positive changes by existing private companies but just following collect and dump as municipalities do.,
- The competent private companies should be either among from existing or new with broader business vision is required for paradigm shift – **modernization of SWM system,**
- The ISWM project for KTMV was initiated in 2009 under BOT model, but is yet to be concluded.

OPPORTUNITIES AND BEST PRACTICES: ORGANIC WASTE MANAGEMENT



Waste segregation and composting in Teku

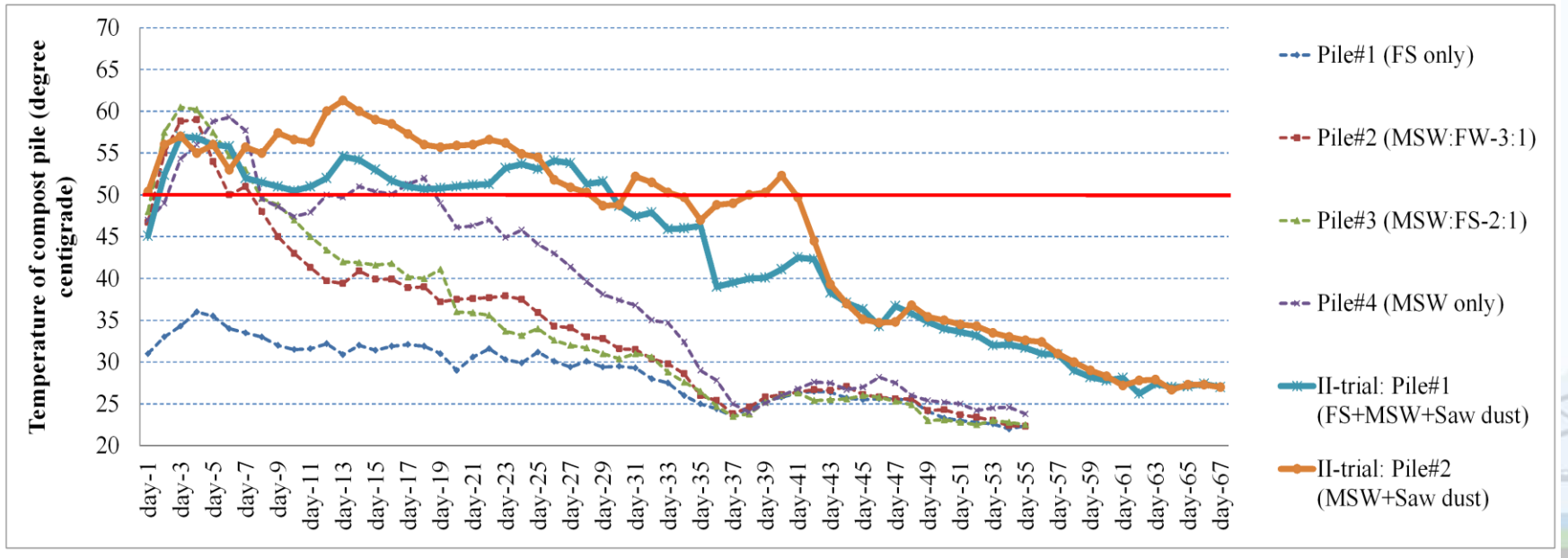
- **Based on this study on 400 HHs,** waste reduction at source by at least 5% HHs of KTMV through HH composting but more in rural municipalities, As result, **40 tons of organic waste** could be managed daily, saving **USD 2,232** in waste management costs

- In Nepal's 293 municipalities, over 1m tons of MSOW and a significant volume of dewatered FS can be treated and transformed into more than **250,000 tons of compost fertilizers**

OPPORTUNITIES AND BEST PRACTICES: WASTE to BROWN GOLD

Experiments trials to explore the composting process to compare quality parameters

Source: Pathak et al., 2024; Brown gold project



Co-composting proved the better solution for organic waste and fecal sludge, making the end-product safer for use as a fertilizer but standardization and subsidy should be.

PRIVATE SECTOR PARTICIPATION AND SCALING UP TECHNOLOGY -ORGANIC WASTE RECOVERY (WtE) PLANT

- **Scaling up and commercialization of Biogas plant** - about a dozen large scale biogas (30-50 ton/day input capacity) with subsidy from AEPC in Nepal but issue of sustainability due to poor **feasibility study-** most of the existing plants running in under capacity

4000 cu m WtE plant at Pokhara by Gandaki Urja P.Ltd

3700 cu m plant at Parasi, Nepal

Gaushala, Biratnagar, Nepal

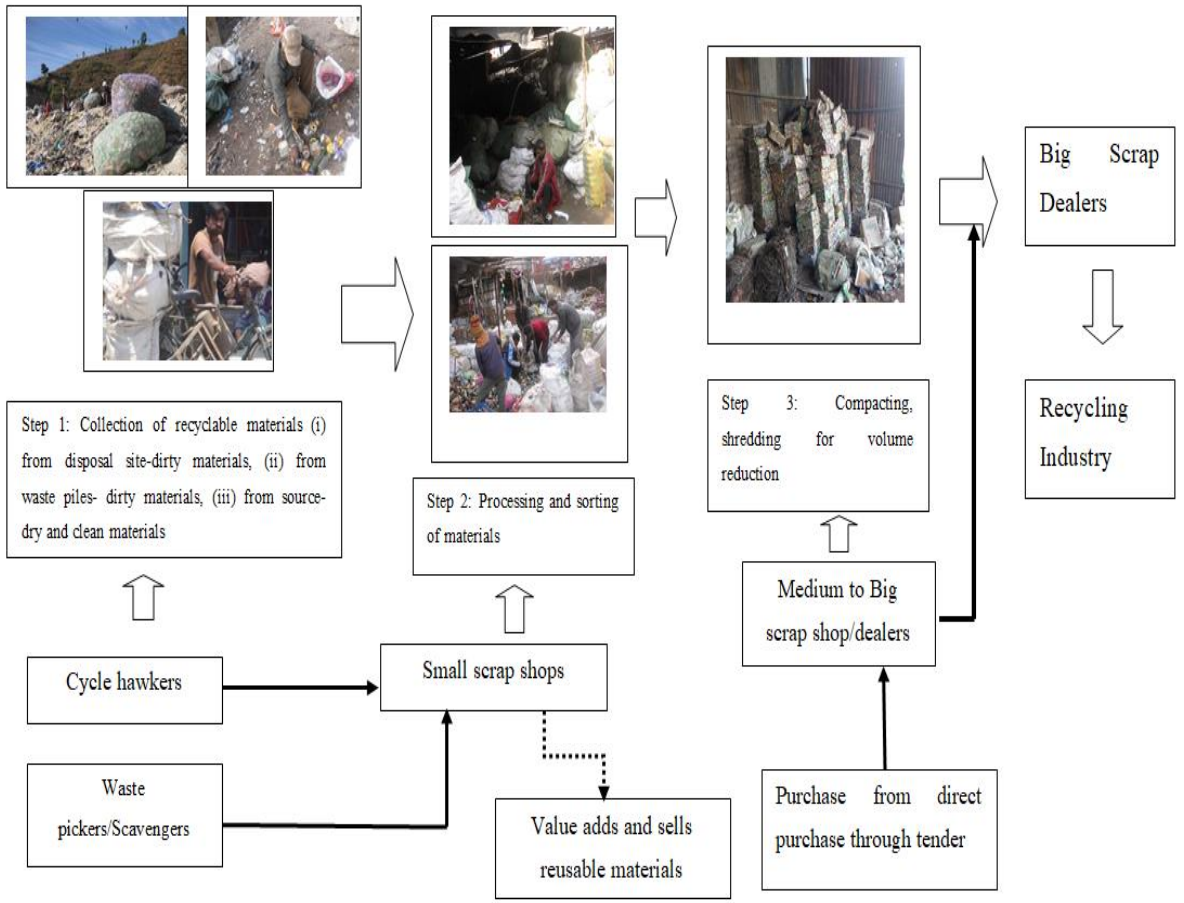
- Lacks municipal support for providing quality MSW and policy for the optimum use of recovered products,
- Limited R&D for co-digestion for the proper feeding of different organic waste for the optimum yield of outputs

BEST PRACTICES: MATERIAL RECOVERY THROUGH INFORMAL SECTOR

- Recycling materials recovery rate in KTMV is about 20% of total MSW by informal sector but very low in other cities
- Increasing trend of material recovery rate in KTMV, from 100 t/d in 2005 to 140 t/d in 2013, and further increased to 250 t/d in 2017 and 350 t/d in 2021

Source: Pathak, 2013, Unpublished Report, SWMTSC/GoN; Pathak & Mainali (2017), World Bank, 2022 –forthcoming publication

INFORMAL collection is like "CHERRY PICKING" – need formal efforts by formalizing current work force, developing recycling-friendly policy to encourage private sector for investment in recycling industries

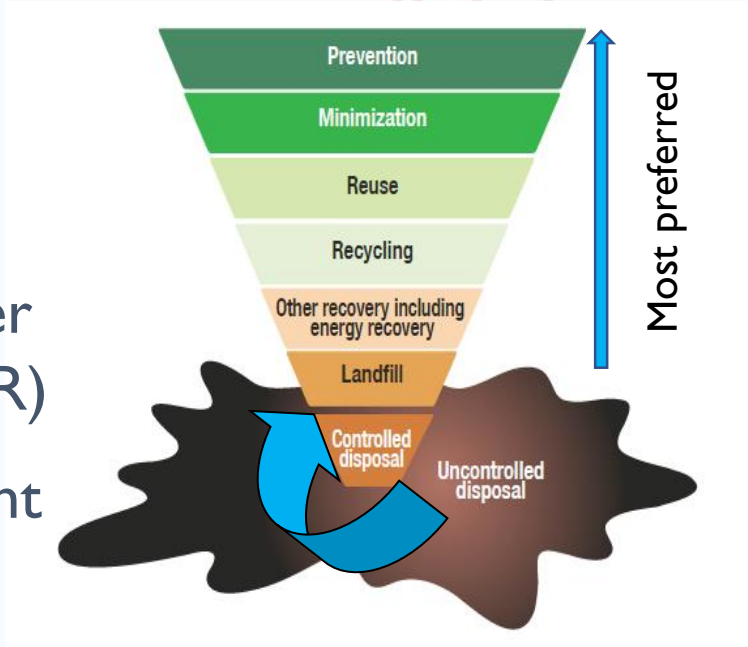


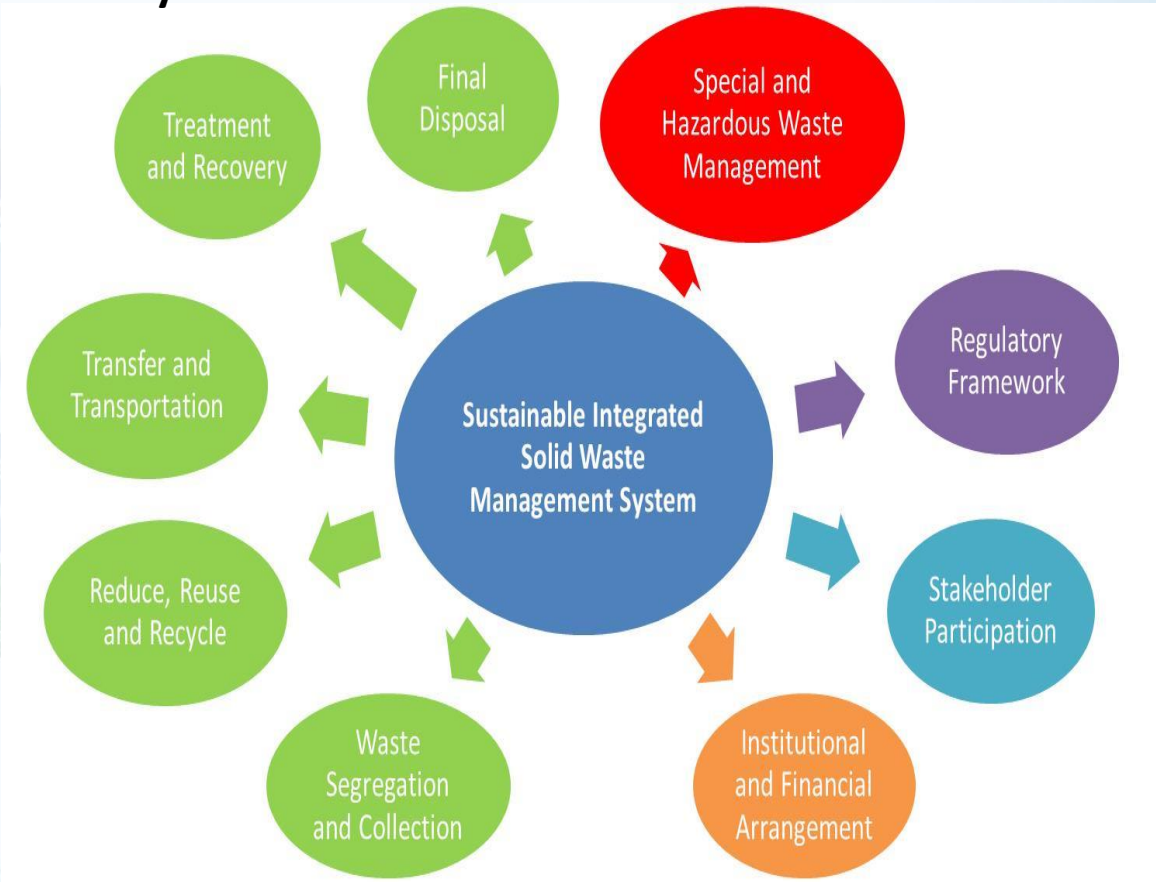
A generic diagram representing the flow of reusable and recyclable materials in cities of Nepal

THE WAY FORWARD: NEED FOR WM SECTOR IMPROVEMENT

- Your Waste, Your Responsibility
- Polluter Pays Principle
- Extended Producer Responsibility (EPR)
- Waste management hierarchy

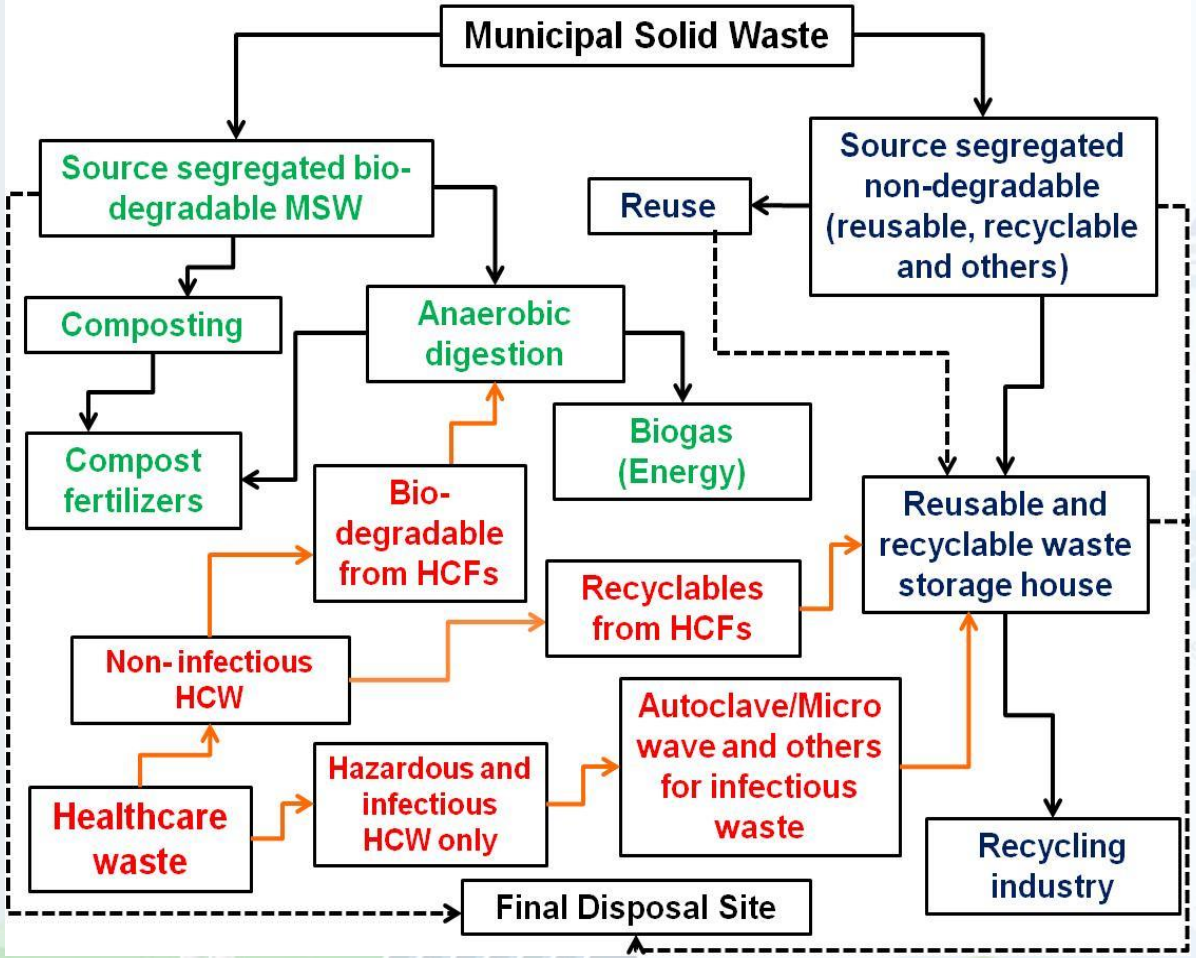
Guiding principles, Waste management Hierarchy and ISWM Components





Waste Management Hierarchy and planned transformation of open dump to sanitary landfill site for gradual improvement in waste management for Nepalese context

THE WAY FORWARDS: TECHNOLOGICAL ISSUES- WHAT WORKS, WHAT DOESN'T WORK?



- Waste-to-energy via incineration is feasible in advanced systems with 100,000+ tons of MSW/year and a calorific value of 7 MJ/kg. In Nepal, this is challenging due to low calorific value, high organic and moisture content and needs pre-treatment.
- High capital and operational cost- the capital investment for the process of mixed MSW by incineration seems around NRs. 600 – 800 million to generate 1 MW of electricity based on several projects in developing countries.
- In Indonesia and China, the regulation has mandated the central government to provide an incentive/ subsidy to local government
- However, in case of absence of such a mandatory legal provision and low price of electricity from other sources in Nepal, it will be difficult to purchase the electricity generated from WtE plant using incineration technology, which may almost 4-5 times higher than current electricity from hydroelectricity power plant.

Source segregation is mandatory for use of any technology for its sustainability. For selection of technology, waste management hierarchy and sustainability principles should be equally considered.

THE WAY FORWARD: SUMMARY AND RECOMMENDATIONS

- Sustainable WM in Nepal requires **Political will/vision/confident** and **site-specific solutions and customized technologies**.
- Effective WM requires simultaneous investment in **processing infrastructure and capacity-building initiatives.**
- An ISWM system should start with **source segregation** and include 100% collection, resource recovery, treatment, and safe disposal (engineered landfill site for residual waste), following the **5R principles:** Refuse, Reduce, Reuse, Recycle and Recovery.
- Implementing Waste-to-Energy (WtE) through incineration and advanced technologies will require significant **investment, systemic reforms, people- public-private partnerships, and increased public awareness.**
- Anaerobic digestion of source-sorted biodegradable waste is a **suitable WtE option**, generating methane gas and quality fertilizers.
- Establishment of a centralized Material Recovery Facility **(MRF)** with semi-automatic sorting for sorting, processing, and recycling of **non-degradable dry waste** and enabling policy for investment in recycling technologies is mandatory.
- The **polluter-pays principle** and extended producer responsibility **(EPR)** laws are essential for managing emerging wastes, including plastic waste.
- Policy and institutional reforms across **all government tiers** are needed to support and monitor private sector

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Thank You!

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