



# **Semi-formal Recycling as a Viable Option for Methane Abatement in Developing Countries**

***GMI Methane Expo - Vancouver***

***March 14, 2013***

***Sandra Mazo-Nix– SCS Engineers***

# Discussion Points

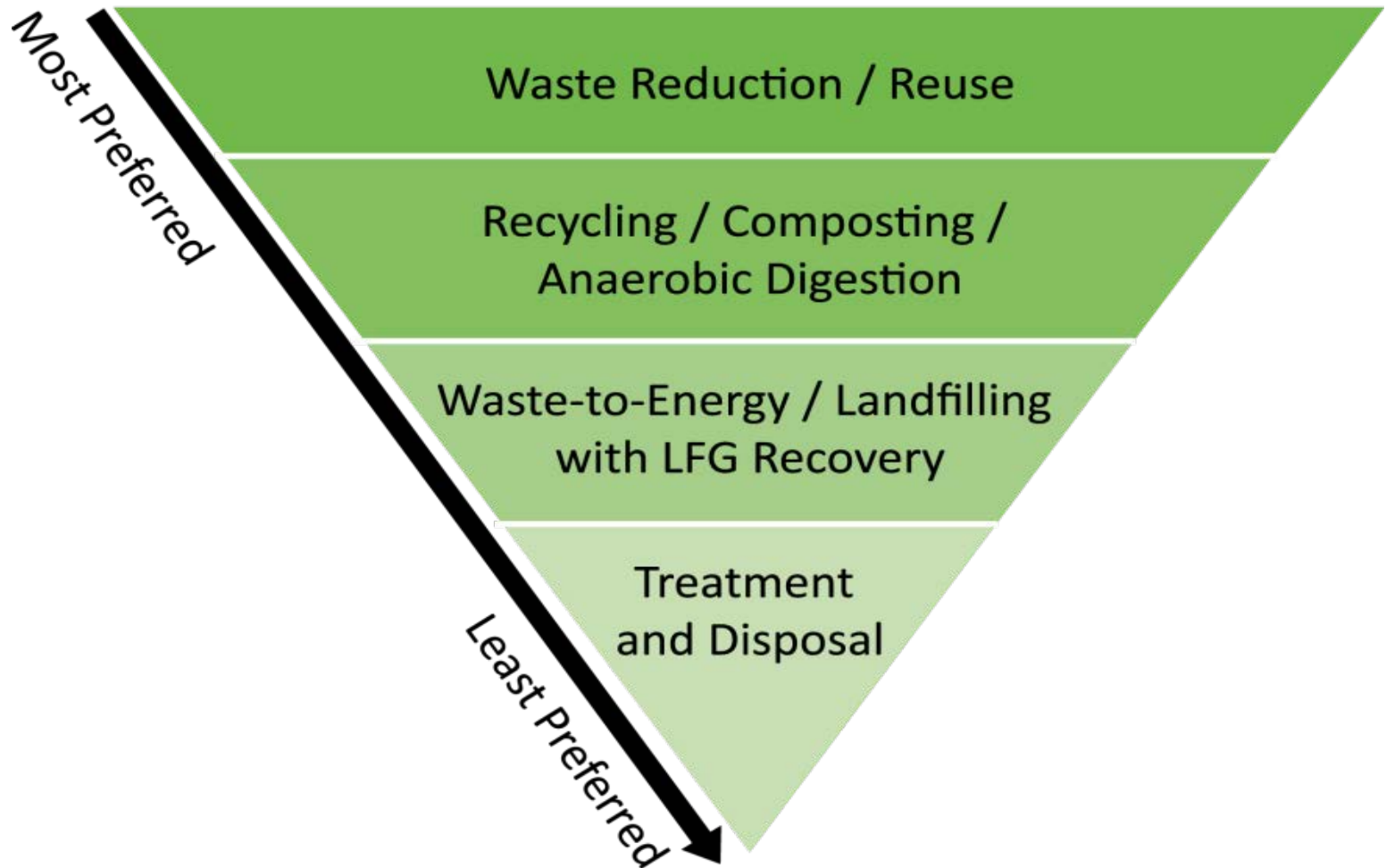
- Methane generation
- Common methane mitigation options for the Municipal Solid Waste (MSW) Sector
  - Organic MSW
  - Inorganic MSW
- MSW management in developing countries
  - Formal
  - Informal
  - Semi-formal
- Case studies
- Estimate methane reductions
- NAMAs

# Organic Waste Generation

<b>Income Level</b>	<b>Waste generation</b>	<b>Organic fraction</b>	<b>Organic waste generation</b>
	Kg /capita / year	%	Kg /capita/ year
High	550	29	160
Upper-middle	370	52	190
Lower-middle	300	67	200
Low	225	71	160

Data source: Scheinberg, A., Wilson, D.C. and Rodic L. (2010)  
*Solid Waste Management in the World's Cities*

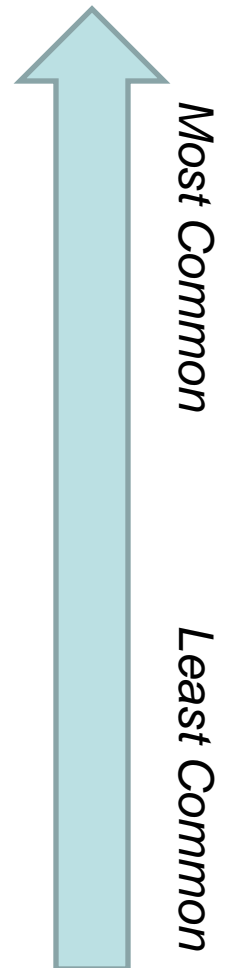
# Solid Waste Management Hierarchy\*



\* Source: [www.epa.gov/osw/nonhaz/municipal/hierarchy.htm](http://www.epa.gov/osw/nonhaz/municipal/hierarchy.htm)

# Common Methane Mitigation Options for the MSW Sector

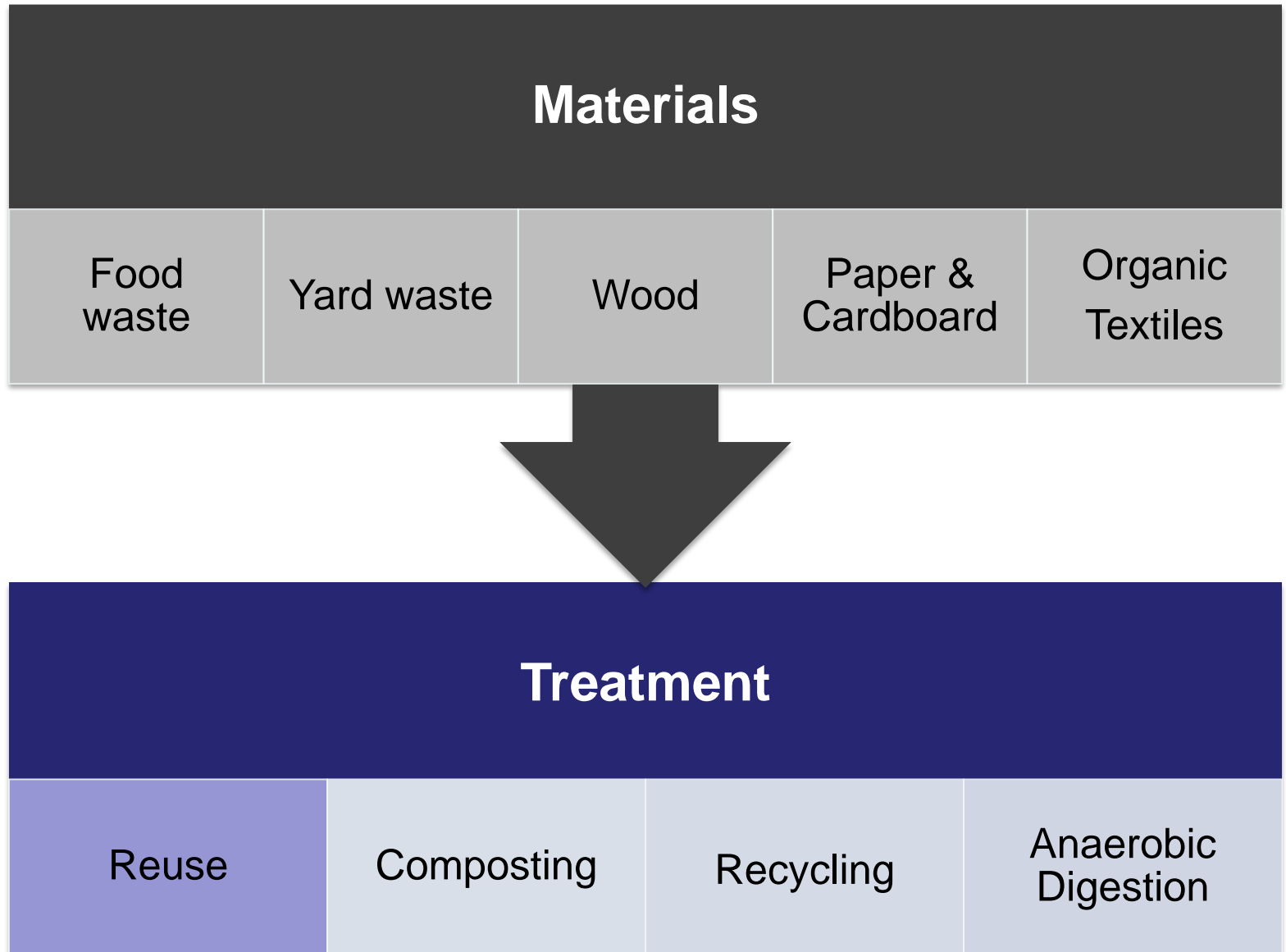
- Sanitary landfills
  - Passive venting
  - Landfill gas (LFG) projects
    - Flaring
    - Utilization: electricity generation or direct use
- Composting
- Anaerobic digestion
- Direct reuse
  - Food banks
  - Animal feeding



# Challenges to the Customary Methane Mitigation Options

- Passive LFG venting
  - Direct emission to the atmosphere
- LFG projects
  - Feasibility dependent on volume, incentives, etc.
- Anaerobic digestion
  - Needs clean raw materials
  - Sensitive procedure
- Composting
  - Contamination
  - Market
- Direct reuse

# Preferred Methane Abatement Options for Organics



# Recycling of Non-Organics and Methane Abatement

- Virgin materials versus secondary materials
- Virgin materials require more fossils
  - Fuel energy
  - Petroleum: produce plastics
- Methane emissions from oil and natural gas systems primarily the result of normal operations and system disruptions



# MSW Management in Developing Countries

- Stakeholders
  - Municipalities
  - Formal Sector
  - Informal Sector
  - “Semi-formal” Sector
- Arrangements
  - Public
  - Private

# Recovery Rates

## Formal vs. Informal

Income Level	Average %	Formal %	Informal %
High	54	54	0
Upper-middle	15	1	15
Lower-middle	27	11	16
Low	27	1	26

Data source: Scheinberg A, Wilson D.C. and Rodic L. (2010). *Solid Waste Management in the World's Cities*. Published for UN-Habitat by Earthscan, London

# Informal Sector – Main Activities

- Recovery
  - Itinerant waste buyer
  - Door-to-door collector
  - Street pickers: bins, dumpsters and piles
  - Garbage trucks
  - Transfer station or landfill
- Processing
- Transporting
- Selling
  - Junk dealers

# Informal Sector - Numbers

- 1988 - World Bank study estimated 1-2% of the world's population ~ 15 million people
- In developing countries about 15% of waste is processed by the IS.
- Save the cities as much as 15-20% of waste management budget

City	% of total population
Bengaluru	0.5
Belo Horizonte	<0.05
Canete	0.4
Delhi	1.3
Dhaka	1.7
Ghorahi	0.1
Lusaka	<0.05
Managua	0.3
Quezon City	0.5
Sousse	0.1
Average	0.5
Total workers in 10 cities	350,000

Table source: 2010 - Scheinberg, A. et al.  
*Solid Waste Management in the World's Cities*

# Informal Sector – Main Characteristics

- Profile
  - Migrants
  - Specific ethnic or social groups
  - Have few or no alternative livelihood options
- Modus operandis
  - Work individually or with spouse and children
  - Ease of entry and exit
  - Sell to middle dealers – no legal bonds
  - Entirely private sector
- Global recycling partner
- Opportunity and challenge

# Semi-Formal Sector

- Organized group of informal sector agents
- Legal organizations: Cooperatives, associations, micro- and small enterprises (MSEs), etc.
- Clear and functional institutional framework
- Sustainable financial system
- Data collection and documentation
- Training
- Rules
- Accountability
- Higher standard of living for the members

# Opportunities and Challenges

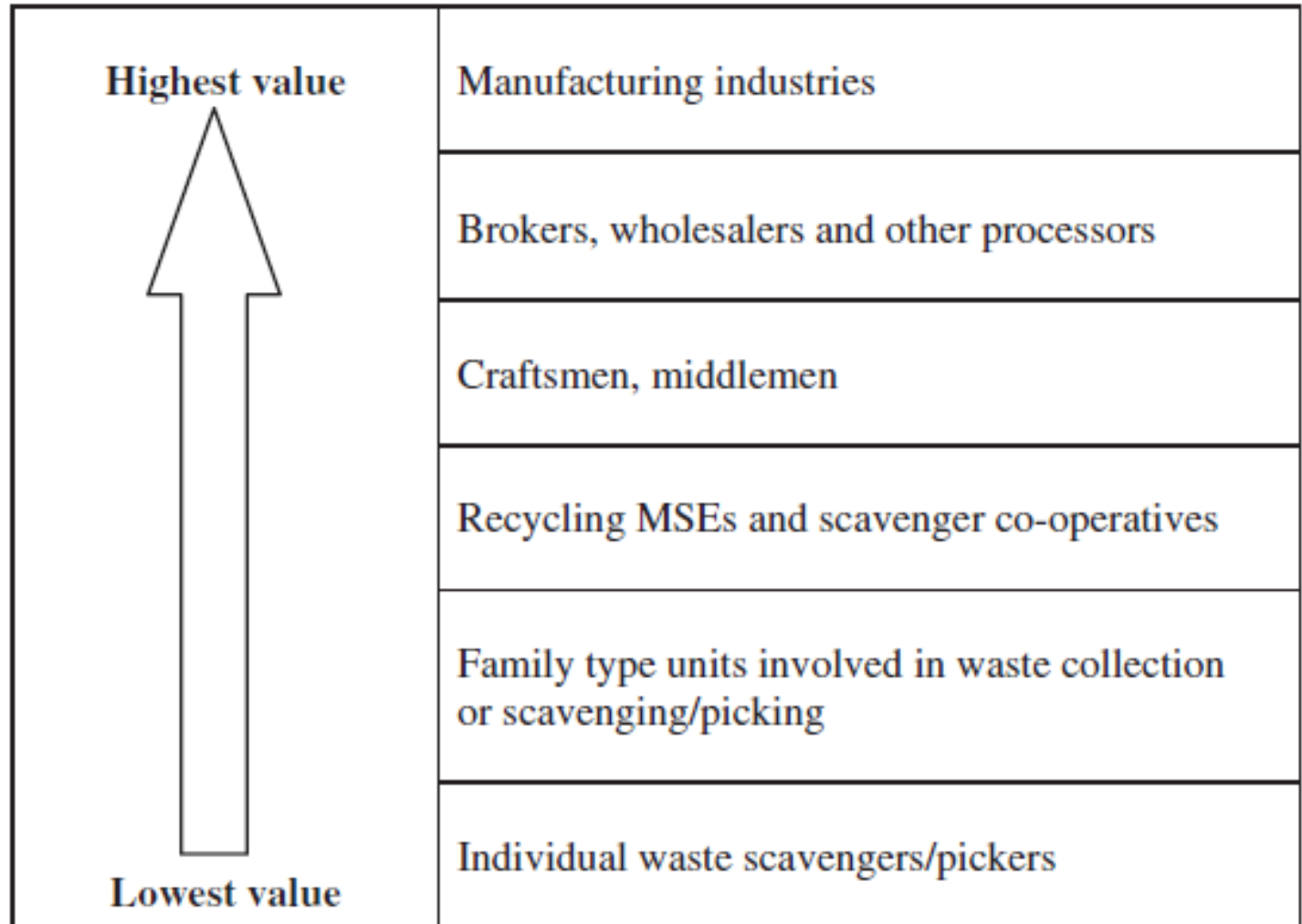
## Opportunities

- Increase recycling rates
- Segregated green waste
- Reduce public sector costs
- More personnel
- Availability of secondary raw materials
- Increase lifetime of landfill and less leachate generation
- Sustain employment
- Improve working conditions

## Challenges

- Contamination
- Heterogeneity of the pickers
- Vices/Criminality
- Logistics
- Quantity and quality of the materials
- Sustainability

# Hierarchy of Recycling



Source: Wilson et al. (2006) Role of informal sector recycling in waste management in developing countries. *Habitat International*



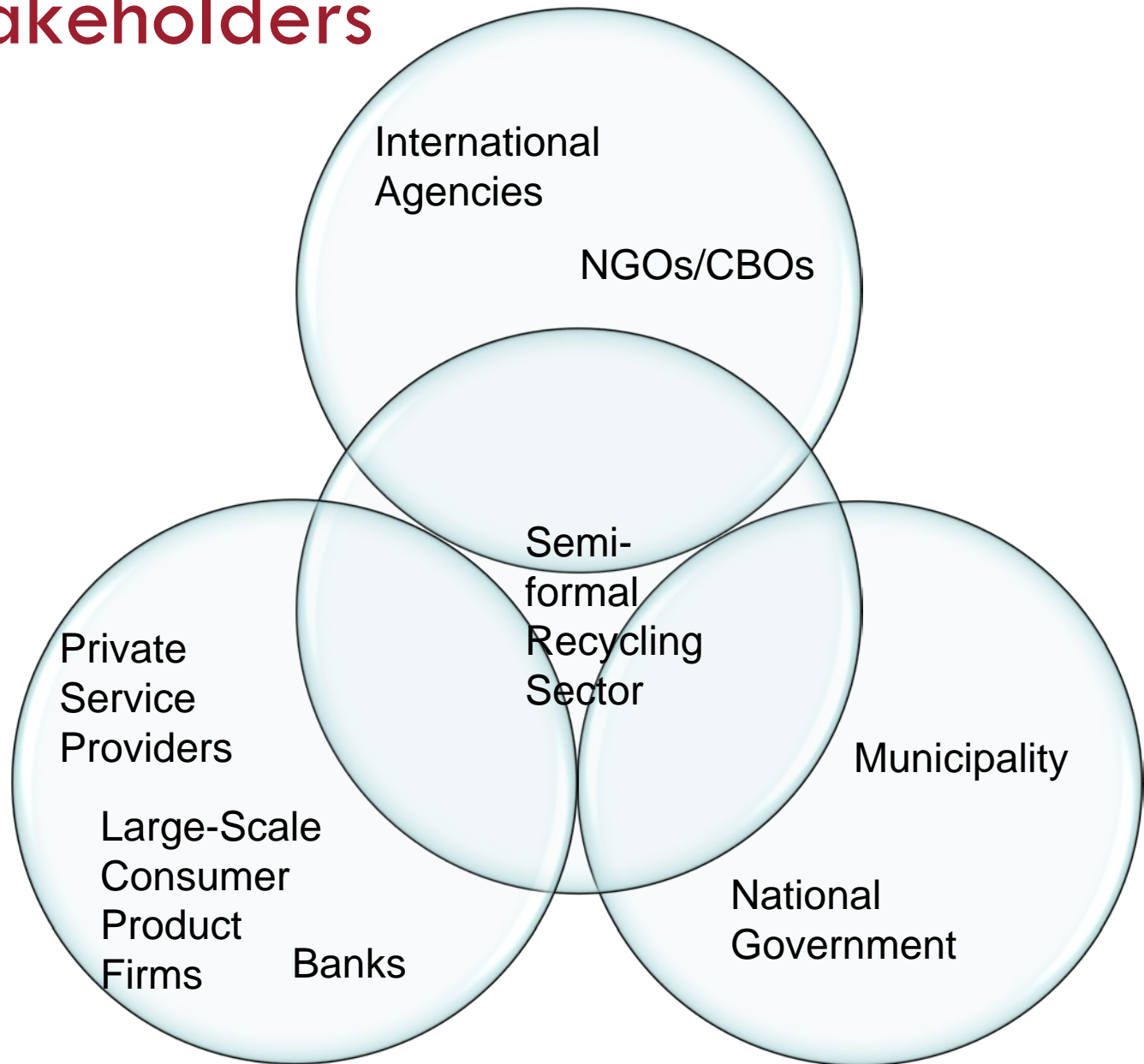
# Issues

- Modernization of the MSWM system
  - Formal participants gain privileged claims to materials
  - Waste pickers are denied access to materials
    - Streets
    - Commercial or industry
    - Transfer stations
- Heterogeneity of individual pickers
- Political time
- Inherent characteristics of organic material - rate of decomposition, heavier and denser

# Improving the Position

- There is broad room for improvement, strengthening, and integration of the informal sector in solid waste, to improve working conditions and secure livelihoods.
- Areas of action
  - Economic
  - Social
  - Public policies
  - Private sector

# Stakeholders



# Economic

- Professionalization: Training and capacity building
  - Costs
  - Technical skills
  - Occupational health and Safety
  - Marketing
  - Information and innovation
  - Business management
  - Legal issues
- Access to information and innovation
- Access to financing
- Legal counseling

## Economic (cont.)

- Improve earnings
  - Access to better materials. i.e. source separation of organics and dry recyclables
  - Transfer stations and collection depots
  - Upgrade materials and meet user specifications
- Potential end users
  - Food banks
  - Animal feed
  - Energy generation
  - Use compost for city green areas, public and/or agriculture/remediation lands

# Social

- Better access to basic services
- Changing public perception of the recyclers
- Capacity building of intermediaries and leaders in the community
  - Political and business leaders
  - Educators
  - Leaders of NGOs and CBOs
  - Media
- Promote environment of cooperation, not competition

# Public Policies

- Source separation
- Regulatory framework
  - Conducive to prioritizing services from semi-formal recycling organizations
  - Encourage production systems that use recovered materials
- Formation of Public- Private Partnerships between public agencies and the semi-formal recycling sector for the provision of MSWM services
- Promote and support networks

# Private Sector

- Source separation
- Buy products made from recovered/recycled materials
- Large consumer products companies: producer responsibility
- Industries: direct sale of secondary raw materials
- Solid waste management service providers



# Case Studies

## Iloilo City, Philippines

- 2009: USWAG Calahunan Livelihood Association Inc (UCLA) ~ 150 members
- 2 mechanical, in-house segregation units
- From September 2008 to mid-2010, 450 tons alternative fuels and raw materials (AFR) were recovered and send to a cement plant
- Efforts to recover organics (60% of the waste)

# Case Study

## Belo Horizonte, Brazil

- 1990 - Creation of ASMARE
- 1990 - City included clause in its Organic Law stating that the collection of recyclables would preferably be the work of the organized informal sector and that they should be the beneficiary of all collected recyclables
- 1993 - Municipality implemented separate collection
  - Drop-off system with recycling containers in public areas
  - Transported to warehouses: Associates are the managers of recycling depots
- Contracts with the commercial sector
- Association organized in committees: Infrastructure, health, religion, social communication, finances, environment, education/culture/entertainment and a Steering committee

# Case Study

## Phnom Penh, Cambodia

- Raw food market: organic waste is separated
- Windrow compost facility
  - Operated by former waste pickers
- Municipality: provides free space for the facility
- Compost user: farmer
- Waste is transported by the waste collection company
  - Landfill tipping fee is less

# Estimating Methane Reductions

- SWM GHG Calculator – GIZ and *KfW-Entwicklungsbank*
- Waste Reduction Model (WARM) – US EPA
- CDM Methodologies Composting & Anaerobic Digestion: AM0025 (large scale) & AMS-IIIIF (small scale) - IPCC
- Other:
  - IWM
  - ORWARE
  - LCA - IWM
  - WASTED
  - EASEWASTE
  - WISARD
  - WRATE
  - MSW-DST

# National Appropriate Mitigation Actions (NAMAs) - MSW

- Conduct assessment to understand waste quantities generated and recovered, waste composition, and trends
- Conduct an analysis of current waste policies and regulations
- **Evaluate existing informal waste recycling sector**
- Create a Public Awareness Programme and provide awareness training to change behaviour
- **Develop / modify national waste management and recycling strategy**
- **Establish plans to improve waste collection rates**
- Define strategy to improve energy and material recovery

# Thanks

Sandra Mazo-Nix  
SCS Engineers  
smazo@scsengineers.com

“...if problems in society are to get better it is not enough that a few experts discuss these things. Every individual has to change and the only way to do this is for ordinary people to have greater awareness of bigger problems, and understanding of what creates the problem and desire to change things person by person. So as a member of society you are as qualified as anyone else and the only way to change is through education.”- The Dalai Lama