



WASTE MANAGEMENT

Innovative Solutions for African Municipalities

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FOREWORD

The management of solid waste in developing countries is an emerging critical issue. With consumption rising in developing areas of the world, and urbanisation continuing at a rapid pace, the sustainable management of waste and re-utilisation of waste as a resource are both important challenges and research areas in the development sphere.

This paper aims to address the main issues surrounding the sustainable management of municipal waste, and propose elements of policy recommendations and local-government-level solutions for improving the sustainability of urban waste management. This policy brief focuses on Sub-Saharan African contexts, where rapid urbanisation is arguably posing the greatest challenges, but offers cross-cutting lessons and best practices for urban waste management in a number of developing country contexts.

Xavier Lemaire and Daniel Kerr, UCL, March 2016



Images front page: Global lights adapted by SEA, waste picker in Jakarta y Jonathan McIntosh (Own work) [CC BY 2.0 (<http://creativecommons.org/licenses/by/2.0>)], via Wikimedia Commons); Mountains of waste in Ga East Municipality, Ghana by Xavier Lemaire. Images on this page: globe adapted by SEA, Child with laptop by Andrew McConnell/Alamy; Mexico City landfill by Eduardo Vedugo/Associated Press.

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SAMSET website: <http://samsetproject.net/>

DEFINING THE PROBLEM

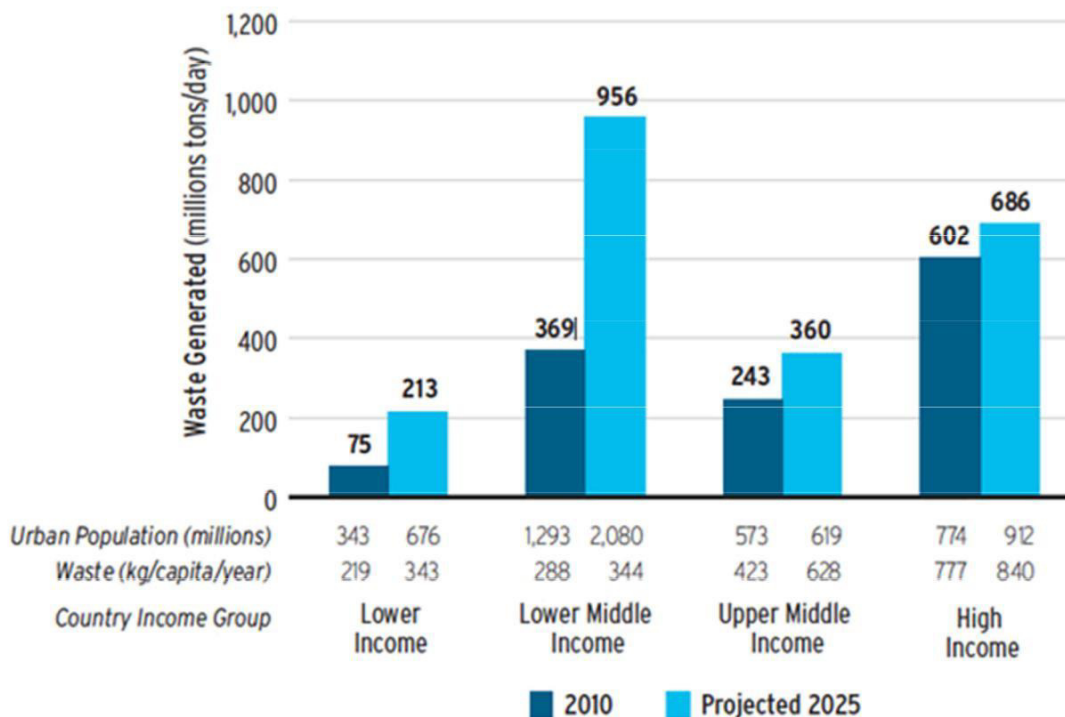
ISSUES WITH SOLID WASTE MANAGEMENT IN DEVELOPING COUNTRIES

Municipal waste management in developing cities is becoming a critical issue, particularly due to the huge increases in urban population growth rates seen in the last 20 years and the access to middle class consumption patterns of segments of the population. Municipal authorities, often facing poor revenue collection and capacity constraints, have struggled to keep up with the demands that an ever-growing urban and peri-urban population places on municipal waste collection provisions. In general, these issues can be grouped into four categories:

- *Issues arising from the volume of waste being produced in municipalities.* Various factors contribute to the problem of too much waste, including a lack of collection of waste leading to illegal dumping and incineration/waste backlog; a lack of capacity for waste storage in landfills, and a lack of incineration/reprocessing capacity for waste in municipalities. Cardboard and plastic packaging wastes, and food/organic waste, are notable examples of the types of waste being produced in large amounts in African countries, as well as developing countries more generally.
- *Issues with constructing new incineration/landfill/reprocessing capacity.* Landfill facilities are a significant space investment, particularly for a rapidly-urbanising space such as a developing city. These space constraints can lead to old landfill sites continuing to be used in an unsustainable fashion, with the associated environmental and health impacts.
- *Constraints in the construction of new waste incineration/landfill/reprocessing include access and transport constraints.* Access constraints may be inability to travel into certain areas (like for example informal settlements) with collection trucks, a lack of adequate road infrastructure for increasing the volume of collection trucks, and difficulties accessing sites for new incinerators or reprocessing plants by waste collection vehicles. These are interlinked with

transport constraints: suitable road infrastructure needs to exist for waste collection vehicles to travel on, and investments in waste collection vehicle fleets can be significant.

- Issues regarding institutional capacity limitations in municipal government.* This can include a lack of human resources capacity (notably understaffing, but also lack of technical/planning capacity) in municipal waste collection departments, and a lack of resourcing for improving the situation, most notably financially. The lack of financial resources for municipal authorities in all sectors is a well-documented phenomenon (such as in the case of Medellin, Colombia [10]). With waste management in particular, degradation of the prevailing situation is closely linked with municipal revenue collection: if revenues are not collected, waste management performance declines, urban inhabitants are less likely to pay their municipal taxes due to service dissatisfaction, performance declines further due to lack of resources, et cetera. [2] [4] [5].



Urban population growth across global country income groups against municipal waste generated. Source: Hoornweg & Bhada-Tata (2012) *What a Waste: A Review of Solid Waste Management in Developing Countries*. Available at: http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf

INNOVATIVE SOLUTIONS FOR SUSTAINABLE WASTE MANAGEMENT

FORMALISING THE INFORMAL

CASE STUDY: ETHEKWINI MUNICIPAL WASTE COLLECTION – PROTECTING THE INFORMAL¹

EThekwini Municipality in South Africa started an innovative program of waste collection reform in 2002. The main strategy of this program was to reduce costs of waste collection whilst still expanding services to informal settlements. The strategy adopted by the municipality, which includes the city of Durban, was in part to “formalise the informal”.

Although informal settlements in the municipality produced thirteen times less waste than the richest households, in 1999 it was estimated only 25% of waste from informal settlements was being managed by the formal waste collection scheme. Various factors contributed to the low waste collection rate, including difficult geography for accessing informal settlements with formal collection vehicles. Prior to the establishment of the program, an informal network of waste pickers and collectors existed in these informal settlements, and the program instituted by the municipality revolved around awarding these local entrepreneurs contracts for formal waste collection activities.

These contracts were constructed so as to be maximally accessible to the existing informal waste collectors. The tender process was designed to be as transparent as possible. In addition, the three-year contracts involved a requirement to hire at least four local workers to assist with waste

¹ This case is extracted from *Towards social inclusion and protection of informal waste pickers and recyclers – waste collection project proposal for and professional support provided to small entrepreneurs by the eThewini municipality*. ENDA – IWPAR Best practices #9 www.iwpar.org

collection, thereby promoting small business and entrepreneurship further in the municipality. In addition, the contracts stipulate that 50% of the workforce hired must be women, and all new hires must live in the contract service area, further promoting local entrepreneurship and the social benefits of the program.

Compared to the extension of formal waste collection services from the municipality, this contracting approach is significantly less-costly per-household as a waste collection service. This has resulted in significant avoided costs for the municipality, as well as an extension in services. Costs fell from approximately 41 Rand (3.2 USD) per household per month with formal services, to 16.5 Rand (1.3 USD) per household per month using this contracting method. Since the beginning of the program, approximately 560,000 poor households now have cleaning and waste collection services.

There are limiting factors in the program: for example, the contracts provided are for three days' waste collection per week. This means the contracts avoid legislature requirements for protective equipment for the waste pickers, and it is unlikely that entrepreneurs will provide protective equipment themselves. In addition, the municipality only directly communicates with the contracted bodies, and not the waste pickers themselves, leading to a potential misrepresentation of interests. Also, there is no incentive for recycling under the program, due to many factors (restricted landfill access for waste pickers, lack of sources for purchasing recycled materials).

Broadly, however, the program has been a great success, and is replicable across other Sub-Saharan Africa contexts where informal networks of waste collectors already exist. For example, the approach has been rolled out at a test scale in many other South African municipalities, including Ekurhuleni, Port Elizabeth and Port Edward. However, the cost implications in start-up capital of implementing such a program on a larger scale can be considerable.

REDUCE-REUSE-RECYCLE

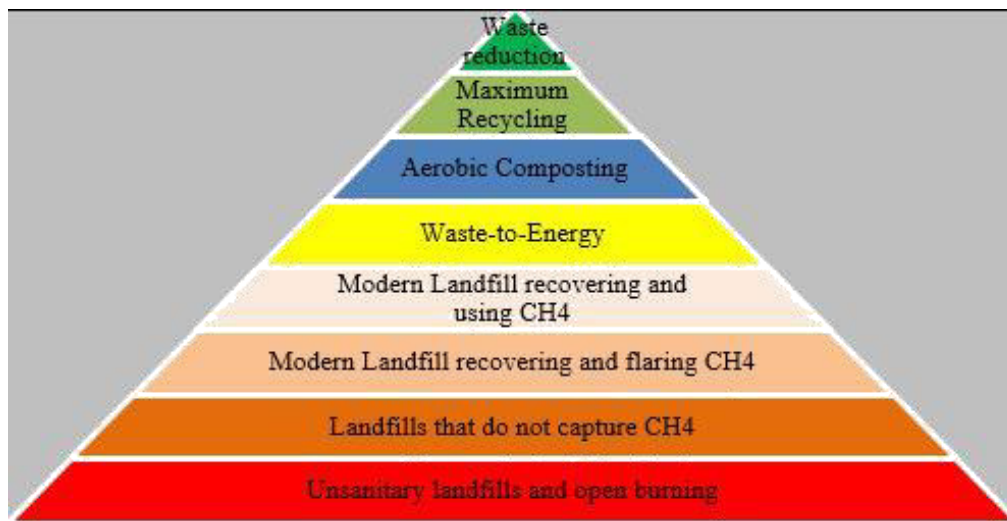
In any sustainable waste management strategy, reducing the amount of waste produced is a key precursor to more effective waste management, reducing the burden on existing infrastructures. Waste collection rates in developing cities are predominantly low (60-80%) and as such reducing the collection burden on urban waste services will lead to more effective waste collection. [4] [11]

The promotion of communities-led recycling and formal recycling services in downstream waste processing is another strategy that can lead to the reduction of waste being sent to landfill, as well as being a source of reusable materials for local and national industries. Experience with communities-led recycling, for example the provision of municipal bins for plastic, metal and organic waste, in South-East Asia has shown that significant reductions in volumes of these types of waste being sent to landfill sites (typically ranging from 15-20% less across Indonesia, PR China, Malaysia etc.). [3] [4]



Participants in the community and recycling-company organised Recycle for South Africa week, held from 15-19 September 2014 in Gauteng municipality. Source: <http://www.reputationmatters.co.za/clean-up-and-recycling-for-south-africa-week/>

Recycling can also be an economic opportunity for municipalities and local private business. Entrepreneurial opportunities in the recycling sector are numerous, for example in waste sorting and transportation to processing sites, as well as in the provision of metal/plastic/paper waste reprocessing for productive re-use.



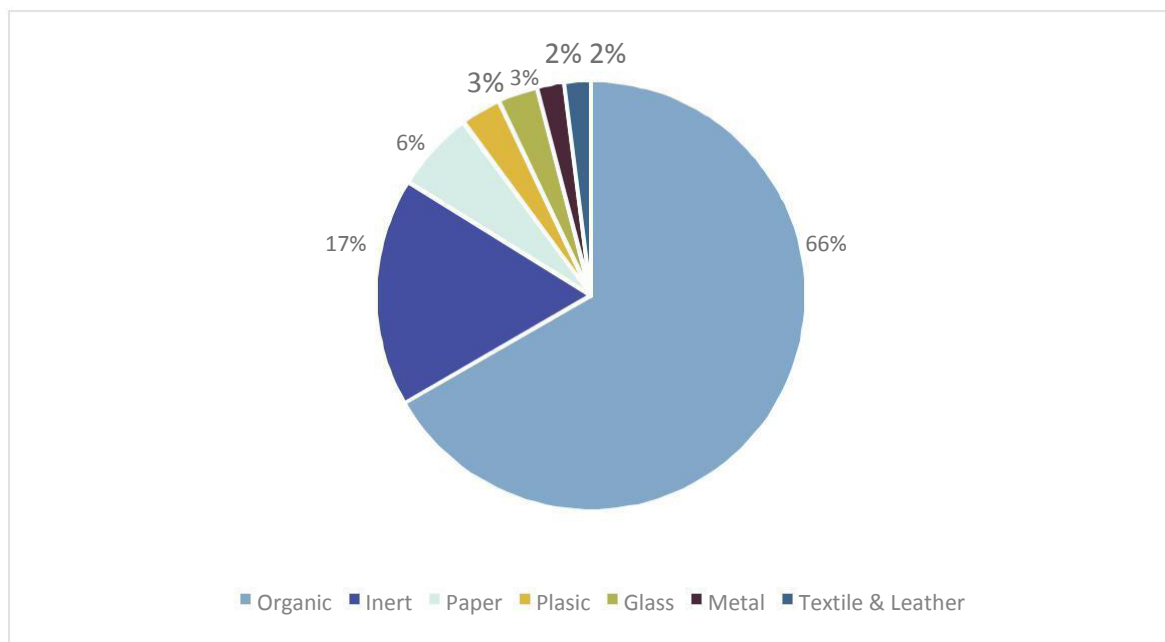
The sustainable waste management pyramid. Adapted from Rodriguez, M.E.D. (2011). Cost-Benefit analysis of Waste to Energy plant for Montevideo; and Waste to Energy in small islands. Available at: http://www.seas.columbia.edu/earth/wtert/sofos/Rodriguez_thesis.pdf

This can include melting down scrap aluminium for processing, palletisation of plastic wastes for re-use, and pulping cardboard/paper wastes to produce other paper/card products. This has been done in larger settlements in Indonesia, where private sector waste management is common, as well as in areas of Malaysia such as Kota Kinabalu and Kajang. [3] [8]

WASTE-TO-ENERGY

The potential for energy generation from municipal waste, through either incineration of solid waste or through composting/processing of solid and liquid wastes for biogas, could be a useful contributor to sustainable municipal waste management strategies. Generating sustainable energy from municipal wastes would lead to a reduction in the amount of waste needed to be dumped in landfill sites, as well as providing electricity/biogas for electricity or heat generation to the municipality. However, successful waste-to-energy strategies require an efficient waste collection process and downstream procedures for separating suitable waste to be used as fuel, and as such are a follow-on activity from improving point-of-service waste collection.

Waste-to-energy activities benefit greatly from economies of scale. Large energy-generating incinerators are more cost-effective in terms of price per unit of energy than smaller-scale installations. Similarly, large-scale organic waste-to-energy plants, such as composting landfills or organic/liquid waste-to-biogas plants benefit in terms of capacity from having large catchment areas to collect feed-stocks from. This can lead to diseconomies of scale linked to the difficulty to organise collection on too large catchment areas or underuse of the incinerator. [6] [7] [11]



Waste composition in SAMSET project partner municipalities in Ghana. Adapted from Zoomlion Ghana Ltd (2013), from Bawakyillenuo & Agbelie (2014) [7]

POLICIES AND PARTNERSHIPS FOR SUSTAINABLE WASTE MANAGEMENT

Municipal waste management can be a complex and expensive problem to solve in a sustainable manner. It is possible to reduce costs whilst still improving sustainability; however due to capacity constraints in municipal waste collection departments, financing and resourcing issues for municipalities more generally, implementing sustainable waste management programs still requires policy support from municipal, and national governments. [4] [5]

Examples of policy support for sustainable waste management include feed-in tariff provision for municipal waste-to-energy projects.² Waste management projects can often be prohibitively expensive for municipalities to invest in directly, but through partnership and incentivising the private sector through tariff regimes, such projects can be brought within reach of municipalities. Examples include Bangkok municipality in Thailand, where 99% of waste is now managed by private companies with monthly tariff structures [1] [3]. Providing a resale tariff for electricity generated through municipal waste incineration, or heat generated from processing waste into biogas and incinerators, can bring projects within cost-effectiveness for the private sector.

In addition, partnership with international development agencies and other NGOs is another route towards improving the sustainability of waste management. Development agencies such as the World Bank, the [UNDP](#), [UNEP](#) and the [African Development Bank](#) have been, and are currently, involved in sustainable waste management projects. Further projects include the [Bordo Poniente Waste-to-Energy Project](#) in Mexico City, the [Singapore Deep Tunnel Sewerage System](#), and the [Gorai Dumping Ground waste-to-energy project](#) in Mumbai, all funded at a government level. In addition, NGOs such as [Practical Action](#) and [GIZ](#), as well as organisation such as the [Global Association of Waste Pickers](#), have previously engaged in projects with municipalities to create better sustainable waste management practices. [4] [9]

² In a feed-in tariff system, governments pay a fixed tariff for a long period to producers based on the provision of an energy resource. Feed-in tariffs have been applied to waste management to encourage private sector operators to operate in the waste management market, paying a tariff based on mass of waste collected. In the example of Bangkok above, where government pays a flat rate to waste collecting companies, tariffs range from ~13 USD/ton for compostable and packaging waste, to 250 USD/ton for combustible waste for incineration. Other more traditional feed-in tariffs also apply to municipal waste incineration electricity generation, for example in the UK, Germany and Indonesia. [12]

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WEBSITES

World Bank Urban Waste Management Portal:

<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTURBANDEVELOPMENT/EXTUSWM/0,,menuPK:463847~pagePK:149018~piPK:149093~theSitePK:463841,00.html>

UNEP Solid Waste Management Portal:

<http://www.unep.org/resourceefficiency/Policy/ResourceEfficientCities/FocusAreas/SolidWasteManagement/tabid/101668/Default.aspx>

GIZ: Concepts for Sustainable Waste Management: <https://www.giz.de/en/worldwide/15109.html>

Practical Action: Sustainable Waste Management in Nepal: <http://practicalaction.org/sustainable-waste-management-nepal>

Georgia Tech Library: Challenges of Sustainable Urban Planning, the case of Municipal Solid Waste Management: <https://smartech.gatech.edu/handle/1853/44926?show=full>

SAMSET PROJECT INFO

ABOUT US:

SAMSET is a 4-year project (2013-2017) supporting Sustainable Energy Transitions in six urban areas in three African countries – Ghana, Uganda and South Africa. A key objective is to improve 'knowledge transfer frameworks' so that research and capacity building efforts are more effective in supporting this challenging area.

The Team

The project team includes a leading university in each of the three Africa countries – University of Ghana, Uganda Martyrs University and University of Cape Town - as well as an NGO in South Africa, Sustainable Energy Africa. In addition, the team includes two leading universities in the UK – Durham University and University College London, and a UK consultancy, Gamos.

Project funders

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SAMSET PARTNERS MUNICIPALITIES

