MATALE

RESOURCE RECOVERY OPTIONS BASELINE SURVEY

WASTE CONCERN

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

DISCLAIMER

> Acknowledgements

The study reflected in this report was a collaborative product of ESCAP, Waste Concern and Sevanatha Urban Resource Center. The study was carried out by a team from Sevanatha.

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> Content

1 Introduction

Managing and disposing of municipal solid waste is a common problem for all local authorities and municipal, urban and district (pradeshiya shabhas) councils in Sri Lanka. The growth of urban populations and economies has resulted in a corresponding growth of solid waste that municipal governments are finding difficult to dispose. Existing dumpsites are filling up, and obtaining land for new dumpsites is becoming increasingly difficult. The traditional approach to solid waste management focuses on end-of-line solutions that are capital and technology intensive and thus costly to build and operate. Hence, many local governments devote a substantial portion of their annual budgets to collecting, transporting and disposing of solid waste. Despite that outlay, collection is often insufficient; in Sri Lanka the common practice is the open dumping of waste. This causes severe pollution to the soil, air and water sources locally as well as globally. The 3R concept (reduce, reuse, recycle) is missing in current practices.

Some of Sri Lanka's critical problems of urban solid waste management are:

- More than 80 per cent of solid waste is currently managed through open landfills, which contribute to environmental problems and are insufficient to cater to the growing amount of waste.
- Finding suitable land for the disposal of solid waste is a problem for the majority of local authorities due to the scarcity of land, problems of land acquisition, high land cost and lack of public support.
- Most of the urban local authorities are not in a position to allocate sufficient funds and do not have trained human resources and equipment to manage the volume of existing solid waste in their cities.
- There is a lack of community support and awareness of municipal waste management initiatives.
- There is a lack of private sector involvement in urban solid waste management.

The solution lies in improving waste collection services and treatment and in reducing the amount of waste that reaches the dumpsite. This can be achieved by treating wastes as a resource. Beyond recycling, the focus of any sustainable approach has to be on organic waste because it constitutes as much as 85 per cent of all municipal waste in Sri Lanka.

STRUCTURE FOR SOLID WASTE MANAGEMENT

Matale is a medium-sized urban centre in central Sri Lanka, with a population of 36,331 and a large population commuting into the city each work day. The city is surrounded by large plantations and is famous for its spice gardens. In addition to agriculture, the city's economic activities also include tourism and trade.

According to data from the municipality, the city generates 21 metric tons of waste per day, of which 17 tons are disposed at an open dumpsite. Although 20 per cent of the Matale Municipal Council's budget is spent on solid waste management, there is no city-wide collection; in a survey carried out by the NGO Sevanatha Urban Resource Centre in 2011, household respondents described the service as poor. They cited unclean drains, poor waste management practices and insufficient sanitation services as priority issues. The Matale Municipal Council has prioritized the provision of a more cost-efficient solid waste management system that will also improve the service to households.


WP 6

The composition of the household waste in Matale is ideal for eco-efficient solutions: 70 per cent of the waste is organic and can be used for composting and producing biogas, while 10 per cent of the waste is recyclable and can be sold after processing. Only 10 per cent of the waste needs to be sent to the landfill. Because Matale is relatively small, a decentralized approach to managing sanitation that minimizes the transporting of waste is suitable and can further increase the eco-efficiency.

MATALE'S IRRC EXPERIENCE

Since 2007, the Sevanatha Urban Resource Centre has operated an integrated resource recovery centre (IRRC) in Matale. Sevanatha is a pioneer in solid waste management in Sri Lanka and has been working in the field since 1989.

Sevanatha and the Matale Municipal Council in 2006 jointly initiated the project, Community-Based Decentralized Solid Waste Management, funded by the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). The project established a composting plant with low-cost technology for recovering resources from urban solid waste. The plant began operating within a year, collecting waste from the Gongawela ward, one of 13 municipal wards in Matale. The plant has a capacity of composting 2 tons of organic waste per day.

Due to the strong community involvement in the service (and in willingness to separate their organic and inorganic waste), the Municipal Council constructed a second composting plant using the same technology and with funds from the national Pilisaru solid waste management programme but which Sevanatha also manages. The two IRRCs have a total capacity to handle 5 tons of waste a day.

By treating the organic and recyclable waste in a decentralized manner, the municipality of Matale saves costs on transportation and disposal while improving collection services and the local environment.

2 Objetive and Methodology of the Baseline Study

The scope of the baseline study was to collect data and other useful information to produce a comprehensive picture relating to the generation and management of domestic and institutional waste in Matale city. It did not include an analysis of hazardous waste generation and management from industries and hospitals. The information gathered in the study was to form the basis for expanding the IRRC project in Matale.

The household survey targeted 100 households and 25 non-residential properties for questionnaire-based interview. There are 13 municipal wards in the Matale Municipal Council Area. The representative sample for each ward was based on the population size. Because there are no proper databases on different income groups in Matale, it was not possible to disaggregate the households by income (low, middle and high). Instead, the physical appearance of the household was used as a proxy to ensure some equal level of different income group representation. The non-residential samples were selected from the central business area of the city. With 60 per cent of the total land in the municipal council area used for residential activity (the proportion of residential use to non-residential use is around 4:1), only 25 samples were needed for the non-residential waste generation and composition survey.

For the purpose of this study, the total waste generation rate was considered to be the rate from residential sources plus non-residential sources. The existing population of the city was calculated using the linear population growth model to determine a post-census population estimate.

3 Findings

WASTE GENERATION AND COMPOSITION OF WASTE IN MATALE CITY

The results of eight days sample survey were used for calculating the per capita waste generation rate. Existing waste generation of the city was then calculated with the post-census population estimates, as follows;

Residential waste generation rate (kg/person/day)	=	1083.3/ 476 x 7
	=	**0.33 (kg/cap/day)**
Non-residential waste generation rate (kg/person/day)	=	1615.8/ 1296 x 7
	=	**0.18(kg/m2/day)**
Total waste generation rate of Matale city	=	0.33 + 0.18
	=	**0.51 kg/cap/day**
Estimate of the current population of Matale city (P_t)	=	$P_o (1+r)^n$
	=	40271(1+1/100)1
	=	**40674**
Total quantity of waste generated in the city	=	40674 x 0.51
	=	20743.74 kg/day
	=	**21 tons per day**

COMPOSITION OF THE MUNICIPAL WASTE

Vegetables and kitchen waste	Paper	Grass	Plastic	Others
71%	6%	14%	1%	8%

Others includes bone, textile, metal, rubber, leather, glass and ceramic /
Source: Public Health Department, Matale Municipal Council, 2010

FORMAL WASTE COLLECTION SYSTEM (MUNICIPAL COLLECTION)

Daily waste collection	24 tons	
Staff employed on waste collection	85 permanent, 30 temporary	
Total staff on waste management	132	
Type of equipment used	Tractors, hand cart, compactors	
Waste transportation system	By tractors and compactors	
Availability of transfer stations	No	
User fee on waste collection	Wedding halls	1000 rupees per month
	Paltry farms/shops	1500 rupees per month
Hazardous waste collection system	- Hospital has its own system with incineration and biogas plants - Municipality collects separately from private clinics, pharmacies and clinics and incinerates in the hospital incineration plant	

Source: Source: Public Health Department, Matale Municipal Council, 2010

Waste is collected on five routes and is either collected daily or every other day, depending on the community.

ANALYSIS OF OPERATIONS OF CURRENT LANDFILL SITE

Location of the landfill site	Wariyapola watta (Ukuvela Pradeshiya Sabha area)	
Distance from the city centre	1 km	
Duration of operation	6 years	
Type	Open landfill with compaction	
Disposal system	Mix of sandwich and cell system	
Area	Total land area	2 acres (0.008 km2)
	Depth	-
	Height	4 m
Amount of waste brought to the land fill daily	24 tons (10–12 tractor loads)	
Management	The landfill is not managed. There is no leachate treatment system or gas recovery.	

Source: Source: Public Health Department, Matale Municipal Council, 2010

MUNICIPAL ANNUAL BUDGET ALLOCATION ON SOLID WASTE MANAGEMENT

Stage	Cost item	Annual expenditure breakdown (LKR)		
		2008	2009	2010
Collection	Labour	8518339	14267169	14651102
	Equipment	216568	458692	471036
	Other	137160	210999	216677
Subtotal		8 872 066	14936860	15338815
Transport	Labour	3176330	5137355	5275603
	Vehicle hire	2050244	3986397	4093672
	Fuel	747087	3577801	3674080
	Other	5775	13761	14131
Subtotal		5979436	12715314	13057486
Recycling	Sorting centre	12877	21847	22435
	Labour	55947	41466	42582
	Other	2029	-	-
Subtotal		70852	63312	65016
Disposal	Labour	577514	1009123	1036279
	Equipment	32485	58713	60293
	Site rental	-	458692	471036
	Other	341938	-	-
Subtotal		951937	1526528	1567608
Miscellaneous	Labour	505325	550431	565243
	Equipment	180473	77060	79134
	Fuel	180473	45869	47104
	Other	6497	6422	6595
Subtotal		872769	679782	698075
Total expenditure		16747061	29921797	30727000

Source: Budget Report of Matale Municipal Council, 2010

INFORMAL WASTE COLLECTION SYSTEM

The informal waste collection system was analysed through a reconnaissance survey within the central business area of Matale city.

KEY FINDINGS FOR THE BUSINESS PLAN

Factors	Positive factors	Negative factors
Waste generation	• As much as 85% (18 tons per day) of generated waste are in organic form (71% fruit, vegetable and kitchen waste, 14% grass), which can be used for composting and generating biogas. • Around 14% (3 tons per day) of generated waste can be recycled. • Industrial waste generation was at a significantly low level.	• High moisture conditions due to large quantity of perishable waste
Waste collection	• Around 2.5 tons of 3 tons of recyclable material daily are collected by informal collectors. • MEC plant collects source-separated waste from the Gongawela ward. • Municipality separately collects waste from poultry shops, reception halls and fish stalls, which can be used for generating biogas.	• Municipality collects about 17 tons of mixed waste per day • Poorly managed primary collection points are spread throughout the city
Waste management	• Hospital manages its daily waste generation thorough a biogas plant and an incineration plant. • Some 0.1 ton of organic waste is daily managed through the MEC plant • Some 0.2 ton of organic waste is daily managed through home composting and bio composting • Some 2.5 tons of recyclable waste is daily managed by the recycling industry.	• Some 17 tons of waste is dumped daily into the open landfill by the municipality. • Operations of the current landfill site is not up to standard (no leachate collection system or monitoring system is used) • Output of the MEC plant is at 10–15% • MEC plant runs at a low capacity – 50%

INSTITUCIONAL CAPACITY AND ONGOING INITIATIVES ON WASTE MANAGEMENT

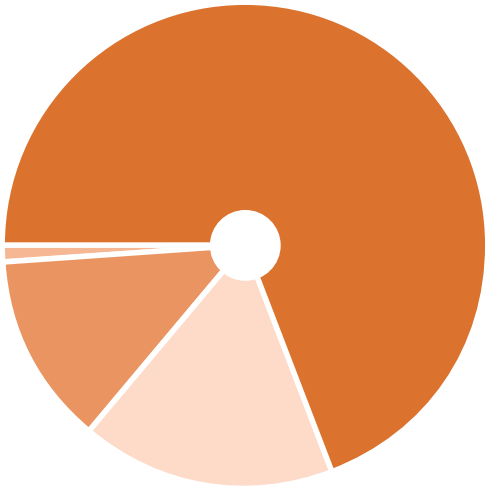
WASTE MANAGEMENT CAPACITY OF MATALE MUNICIPAL COUNCIL

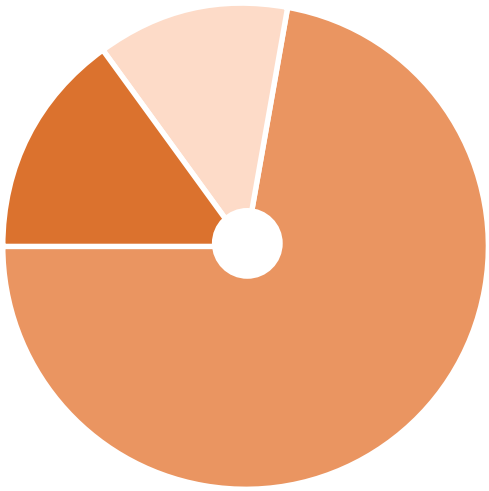
Main category	Subcategory	Required numbers	Existing capacity	Gap
Labour force	PHIs	4	4	0
	Overseers	3	3	0
	Waste collectors	102	95	7
	Drivers	8	3	5
	Minor Supervisors	4	4	0
	CDOs	8	11	+3
	Market care Takers	2	2	0
Equipment and machinery	Trucks	2	0	0
	Compactors	2	1	1
	Tractors	6	3	3
	Hand carts	30	8	22
	Excavators	1	1	0
	JCB	2	1	1
IRRCs		3	2	1

PHI – public health inspector
CDO – community development officer

COMMUNITY NEEDS AND DEMAND ON WASTE MANAGEMENT AND RECYCLING

All the sample households prefer the door-to-door collection. The bins at the primary collection points set up by the Municipal Council have created many environmental and social problems, and people in those areas do not like common waste bins. The survey results found that the best time to collect waste is from 9 a.m. to 11 a.m. The Matale Municipal Council does not have a daily waste collection system for more than 60 per cent of the Municipal Council area. People complained about unreliable collection days and times. In the Gongawala ward, where Sevanatha has operated the IRRC project, with daily door-to-door collection, all sampled household respondents expressed satisfaction with the waste collection system. A majority of the household respondents indicated that they were willing to pay a collection fee. Those who were not willing to pay a user fee stated that they were paying assessment tax, which ought to cover such service because it is the responsibility of the municipality to collect their waste.





COMMUNITY WASTE MANAGEMENT PRACTICE

Door to door collection	Giving waste to a collector at a specific time and place	Households dispose waste in a dustbin	Waste is collected by the roads
70%	17%	13%	1%

COMMUNITY SATISFACTION ON EXISTING WASTE COLLECTION SYSTEM

Fully satisfied	Somewhat satisfied	Not satisfied
15%	13%	72%

The household respondents were asked about their knowledge of composting. Only 7 per cent of the community was aware of the possibility of home composting from organic waste. But that 7 per cent also was not aware of how to make home compost effectively using a bin. They were not aware of what can and cannot be used for composting, how to control the moisture or how to control the odour.

To determine the feasibility of a biodiesel plant in the IRRC, household respondents were asked about their disposal of cooking oil. Households dispose 1 litre on average of vegetable and coconut oil per month in the Matale Municipal Council area. However, people usually dispose the oil after use and do not have a bulk collection of used vegetable oil. Oil is commonly disposed by using it with fire wood for cooking, washing it down a drain or using it for lighting lamps. Because there is no used-oil collection practice in households, it will be a little difficult to begin community participation for collecting used oil without a proper awareness programme.

MARKETING ANALYSIS OF COMPOST USAGE POTENTIAL

The existing demand for compost in and around Matale city constitutes about 1 per cent of the market for fertilizers. However, there is potential to increase the market share of compost, in particular in the spice gardens and horticulture, for which chemical fertilizers are not subsidized.

There are three compost producers within the Matale Municipal Council area:

Producer	Composting method	Quantity of waste managed daily	Monthly compost production
MEC plant	Box method	1.5 tons	2.5 tons
Individual families	Bin method	150 kg	675 kg
Institutions	Cage method	50 kg	165 kg

The study did not find any large-scale compost producers in the Matale Municipal Council area. There are also no biogas plants other than the one in the Matale Hospital. However, the research team found large-scale compost and biogas-producing farmers in the surrounding farming areas of Naula and Dambulla.

Demand for compost and sale of compost:

Five compost products are available in the fertilizer shops of Matale city and surrounding urban centres. Sales records of fertilizers in the selected fertilizer shops are presented in the following table. Compost sales are around 1–2 per cent of the market, compared with the sale of other major fertilizer types, such as carbamide (urea), muriate of potash (MOP) and Triple superphosphate (TSP).

FERTILIZER SALES

Urban centre	Urea	%	MOP	%	TSP	%	Compost	%
Galewela	45000	99	0	0	0	0	300	1
Dambulla	2245748	61	629184	17	773516	21	24000	1
Naula	1200	29	1200	29	1200	29	500	12
Pallepola	2400	53	1000	22	1000	22	100	2
Yatawatta	3600	63	1000	18	1000	18	100	2
Raththota	4000	47	2000	23	2500	29	100	1
Ukuwela	0	0	0	0	0	0	2000	100
Matale	12000	41	8000	27	9000	31	200	1
Total	2313948	61	642384	17	788216	21	27300	1

Fertilizer sales vary with the cultivation season in Matale:

- February to March – small peak after Maha season (excessive rainfall)
- June to July – highest peak at last two months of Yala season (drier)
- September to November – moderate level peak before Maha season.

The highest compost sales period is during the months of August and September, which is the monsoon season when vegetables are cultivated.

The MEC plant currently markets its production of around 11 tons per year mainly on the basis of retail trade. As MEC expands and the IRRC operations cover the whole city, it is expected that the three IRRCs will produce 985 tons of compost per year. Given the increased amount of compost that will be produced by the IRRCs in Matale, a new marketing strategy focusing on bulk buyers and new distribution channels has been developed. Establishment of channels of distribution, guaranteed quality, attractive terms of trade, quick dispatch and effective control of credit and collection are of paramount importance for the success of the IRRCs. A key element of the market and distribution plan is to reduce costs for packaging and transportation.

The price of the compost will vary, depending on production costs. The market will be divided into segments, and different prices will apply for wholesale and retail trade. Average prices are estimated at 10 rupees per kg for wholesale and 20 rupees per kg for retail. The retail market will have high- and low-purchasing groups, with prices from 12 to 25 rupees, depending on the packaging and transportation costs.

There are seasonal variations of compost sales during a year, with three major sales peaks that follow the same pattern as the fertilizer sales.

The compost price is very low when compared with the general prices of other fertilizers. However, urea, MOP and TSP sales fall under the Government's farmer subsidy policy and thus sell at 7 rupees per kg, which poses a significant challenge to the compost market.

When considering the factors affecting the sales of compost, the study found the following positive and negative factors that could affect the sale of compost:

Positive factors	Negative factors
Increased long-term soil fertility and stability	Less effective for short-term cultivation
Increased price of chemical fertilizers	Absence of competitive marketing approaches (advertising)
Increased awareness of advantages of using compost	Presence of low-quality products
Government policy, which states the use of organic fertilizers as a pre-requirement to be qualified for fertilizer subsidy	High production costs and difficulties in offering high commissions for the sellers
Growth of horticulture activities	Some farmers produce their own compost
Growth of urban agriculture and home gardening	Government subsidy on chemical fertilizer
Does not have the negative side effects for heatlh and environment that chemical fertilizers have.	Low level of civil society knowledge or movements to promote compost

> Annex: Sri Lanka compost standards

PRODUCT REQUIREMENTS

The following specifications for producing compost from municipal solid waste and agricultural waste were introduced within the Sri Lanka Standards Institution in 2003 (Sri Lanka Standard 1246: 2003, UDC 628.477.4).

PHYSICAL REQUIREMENTS

Character	Requirement
Colour	Colour of the material shall be brown/grey to dark black.
Keeping properties	The material shall be packed in sound, strong and moisture proof packages or containers. The material shall comply with the requirements for storage at room temperature for not less than 12 months from the date of production.
Moisture content	The material shall not contain more than 25 per cent moisture by dry mass, when tested as prescribed in SLS 645: Part 2.
Odour	The material shall not have any unpleasant odour.
Particle size	The material shall not leave a residue of more than 2 per cent by mass when tested as prescribed below: • Apparatus: Sieve of aperture 4 mm • Procedure: Weigh, to the nearest milligram, 100 g of the sample and transfer to a sieve of 4 mm aperture size (conforming to CS 124) with the lower receiver attached. Shake the sieve for 5 minutes, frequently tapping the sides.
Sand content	The material shall not contain more than 10 per cent sand when tested as prescribed below: • Apparatus: Measuring cylinder – 1000 ml, Oven - maintained at 103 ą 2 °C • Procedure: Weigh to the nearest milligram, 100 g of the sample. Transfer into a 1,000-ml measuring cylinder with a stopper. Add distilled water up to the mark and shake well. Leave to settle. • Decant the water and the floating particles, leaving the sand at the bottom. Wash the residue thoroughly with water. Repeat washings until all the other particles are removed. • Transfer the sand into a petri dish and dry in an oven, maintained at 103 ą 2 °C for 1 hour. Cool in a desiccator and weigh to the nearest milligram. Repeat the process of heating, cooling and weighing, at 30 minute intervals until the difference between two consecutive readings does not exceed 0.002 g. Record the final mass.

NUTRIENTS REQUIREMENTS

Characteristic	Requirement	Method of test
Ph	6.5 -8.5	ISO 10390
Organic carbon, % by mass, min.	20	Appendix D
Nitrogen content, % by mass, min.	1	SLS 645: Part 1
Phosphorous content, as P2O5 % by mass, min.	0.5	SLS 645: Part 5
Potassium content, as K2O % by mass, min.	1	SLS 645: Part 4, section 1
Magnesium content, as MgO % by mass, min.	0.5	SLS 645: Part 6
Calcium content, as CaO % by mass, min.	0.7	SLS 645: Part 6

CARBON TO NITROGEN RATIO

The carbon to nitrogen ratio of the material shall be in the range 10–25.

Limits for heavy metals:

Characteristic	Requirement	Method of test
Cadmium content, ppm, max.	10	AOAC (975.03) (digestion)
Chromium content, ppm, max.	1000	-
Copper content, ppm, max.	400	Suitable atomic
Lead content, ppm, max.	250	Absorption, spectrophotometer,
(detection)	1	SLS 645: Part 4, section 1
Mercury content, ppm, max.	2	-
Nickel content, ppm, max	100	-
Zinc content, ppm, max.	1000	-

BIOLOGICAL REQUIREMENTS

The material shall not contain more than 16 viable weed seeds per square metre.

MICROBIOLOGICAL REQUIREMENTS

The material shall also comply with the requirements in the following table:

Characteristic	Limit	Method of test
Faecal coliforms per g	Free	SLS 516 : Part 3
Salmonella per 25 g	Free	SLS 516 : Part 5

PACKAGING

The material shall be packed in sound, strong and moisture-proof packages or containers. Suitable packages include polypropylene or jute bags with an inner lining of low-density polyethylene, with a minimum thickness 37.5 m or any other material with barrier properties superior (high-density polyethylene) or equal to low-density polyethylene of 37.5 m thickness. It shall be of mass 1 kg, 2 kg, 5 kg, 10 kg, 20 kg or 25 kg. The material may also be supplied in bulk containers as agreed between the purchaser and the supplier.

MARKING

The bags shall be legibly and indelibly marked with the following information:

- Name of the material as "Compost from municipal solid waste and agricultural waste"
- Name and address of the manufacturer, including country of origin
- Brand name and/or trademark, if any
- Date of production
- Net mass in kilogrammes
- Instructions for storage and use
- Main ingredients used
- Date of expiry
- Moisture content
- N-P2 O5 N_K2 O per cent
- Organic carbon per cent

No hooks are to be used.

Annex: Sri Lanka compost standards

Sri Lanka

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For more information please contact ESCAP's Sustainable Urban Development Section
Email: escap-edd-suds@un.org