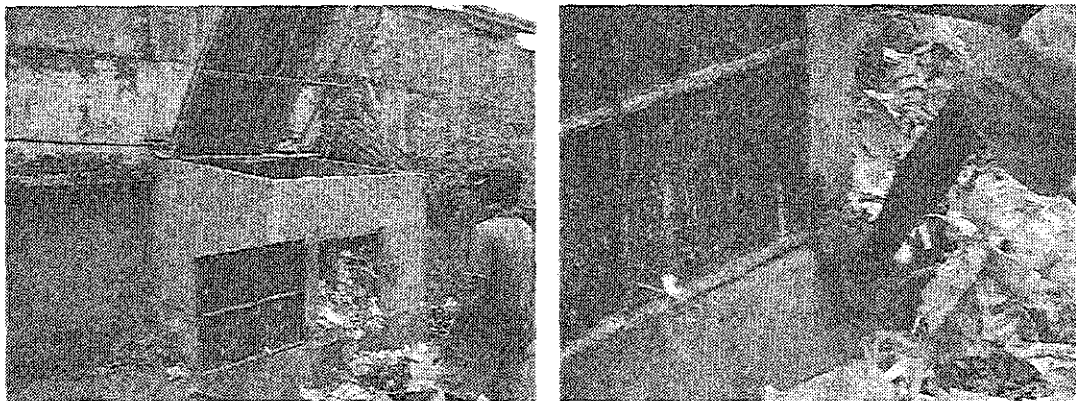


*Base Hospital: Top and bottom left – stationary trailer; bottom right – sharps and clinical waste burning area*



*Ave Maria Hospital – note syringe by labourers foot in photo on right.*

#### **1.4.5 Prison**

The Negombo Prison has 250 workers and 115 inmates. It generates around 1 tractor load of garbage per day, equivalent to 536kg/d, assuming a small trailer. This equates to a waste generation rate of 1.47kg/(staff+inmates).d. All of this waste is given away to a farmer.

#### **1.4.6 Government Offices and Police**

There are approximately 20 central and provincial government departments/ministries/authorities with offices in the NMA area. Together with two Police stations (Negombo and Kochchikade) and NMC (Negombo, Kochchikade and Thaladena offices), these offices employ approximately 1,966 workers.

Interview and telephone surveys were conducted with seven of these offices, including the Police and NMC.

Four offices surveyed have most (5) or some of their garbage collected by NMC, while six burn some (2), most (1) or all (3) of their garbage on-site. The Kochchikade police station gives its food/kitchen waste to a piggery.

Based on this data, the government office waste generation rate was estimated to be 0.151kg/worker.d giving a total waste generation amount of 0.30T/d, with 45.5% of this waste collected by NMC, 52.2% burned/buried on site and 2.3% recycled.

#### 1.4.7 Religious Places

The total number of religious places within NMA is approximately 35, comprising 22 churches, six buddhist temples and other institutes, four mosques and three hindu temples (kovils). The associated number of religious workers is estimated to be 137.

Adopting a religious places waste generation rate of 1.01kg/clergy.d, based on Kandy and Matale data, this gives a total waste generation amount of 0.14T/d, of which 80% is assumed to be collected by NMC and 20% disposed of on-site. Several NMC Supervisors commented that church waste generation is only significant on festival occasions.

#### 1.5 Industries

According to UDA data, industrial land use constituted 0.57% (13.0ha) of total land use within Negombo/Kochchikade in 1998. NMC data suggests industrial activity is on a larger scale than this, with a total of 139 "business centres" being classified as industries for the purposes of this study, as set out below. 27 of these were surveyed.

Table 1-8: NMA Industry Breakdown

Industry Type	No of Industries	No surveyed
Agriculture equipment manufacture	1	1
Bag/glove production	3	2
Boat production	3	1
Cement brick production	1	0
Charcoal production	1	1
Chocolate production	1	0
Coconut oil production	3	0
Coir processing	1	1
Confectionery manufacture	1	0
Electronic components manufacture	3	2
Fertiliser production	1	1
Fibreglass production	2	0
Fish Exporters	1	0
Frozen Foods	2	0
Garment factories	6	2
Icecream manufacture	4	0
Ice production	4	1
Mirror production	1	0

Industry Type	No of Industries	No surveyed
Plastic items production	4	3
Packaging manufacture	1	1
Plastics recycling	1	1
Sawmills	10	7
Shrimp breeding farm	3	1
Shrimp/lobster imports/exports	2	0
Soap production	1	0
Spice export/import	2	0
Tile manufacture	2	1
Vegetable, fruit, meat and seafood production	1	0
Welding/lathe works	72	1
Unidentified	1	0
<b>Total</b>	<b>139</b>	<b>27</b>

### 1.5.1 Elsuma

Elsuma is by far the largest industry, with 750 workers. They manufacture electrical circuits and generate two tractor loads of waste per day, equivalent to 1.07T/d, assuming a small trailer. This comprises mainly paper and plastic waste followed by food/kitchen waste. They discharge most of this waste for collection by NMC, while recycling ~756kg of cardboard/mth, 400kg/mth of food/kitchen waste for animal feed, small quantities of metals and composting ~5kg/d of garden/other waste. Elsuma have been specified separately from other industries due to the large amount of waste generated by them.

### 1.5.2 Sawmills

Interview surveys were conducted with seven of the 10 sawmills within Negombo to find out about their waste disposal practices and their willingness to co-operate with NMC in giving/selling their sawmill wastes for use in composting as an amendment/bulking agent. The results of these interview surveys are set out in the following table and summarized here:

- All seven sawmills produce significant quantities of wood wastes, comprising around 22.2T/mth of sawdust, 18T/mth of woodchips and 1.4T/mth of bark.
- Six of these sawmills give away or sell most (1) to all (5) of their sawdust, woodchips and bark wastes, with one of these sawmills burning some of its sawdust.
- The other sawmill burns its sawdust, sells its woodchips or uses them as furnace fuel for tile making and composts most of its bark waste.

Table 1-9: Sawmills Interview Survey Results

Timber Industry Name and Location (Respondent)	Waste Quantities (T/mth)			Waste disposal	Willing to give /sell to NMC for Composting	Comments
	Saw-dust	Wood-chips	Bark			
St. Saviour's Sawmill, 1079 Daluwakotuwa Kochchikade	1.5	2.7		Sawdust is sold at 5Rs/10kg and woodchips at Rs100/50kg.	Willing to sell all sawdust at Rs5/10kg and 67% of woodchips at Rs100/50kg	
Jayakodi Sawmill, 140 Chilaw Rd, Kottuwa	3.0	5.4		Sawdust is sold at 5Rs/10-15kg and woodchips at Rs1200/ELF lorry load.	Willing to sell all sawdust at Rs125/TL; not willing to give/sell woodchips	
St. Anthony's Sawmill, 225 Chilaw Rd, Kottuwa	2.25	2.7	0.9	Sawdust/bark is given to neighbours; wood chips are sold at Rs100/50kg.	Willing to give sawdust and bark for free and woodchips at Rs100/50kg.	Some sawdust and bark are poisonous to plants (e.g. pau, mee) and therefore not suitable for composting.
City Timber Dealers 16 Juma Masjid Rd, Periyamulla	2.25			Give to anyone free of charge	Willing to give free but have to come and collect.	Supports recycling of sawmill wastes.
St. Anne's Sawmill 610, 2 Kurana, Colombo Rd, Negombo	2.25	1.8		Sawdust is burnt or sold at Rs5/15kg; woodchips are sold at Rs1500/TL.	Willing to sell sawdust at Rs150/TL and woodchips at Rs1500/TL.	Sawdust can be used for mushroom cultivation.
S.N. Sawmill, 145 St Joseph St, Negombo	3.4	0.9		Sawdust is given to anyone; woodchips are given to labourers.	Willing to give all sawdust free of charge; not willing to give/sell woodchips.	
Rani Sawmill, 2 Mirigama Rd, Negombo	7.5	4.5	0.45	Sawdust is sold at 250Rs/TL; woodchips are used as tile furnace fuel or sold (120Rs/50kg); bark is composted	Willing to sell all sawdust at 250Rs/TL; not willing to give/sell woodchips/bark.	They also produce ash which could be used by NMC.
Total	22.2	18.0	1.35			

**Notes:** TL (tractor loads) refers to four wheel tractor loads unless otherwise stated. Loads data was converted to tonnes for tractors based on information supplied by survey respondents, with one load of sawdust being equivalent to 0.75T and one load of woodchips/bark to 0.9-1.0 T.

- All seven sawmills were willing to give (3) or sell (4) all their sawdust, while only three were willing to sell 67% (1) – 100% (2) of their woodchips. One of the two sawmills producing bark waste was willing to give it away.
- Quantities available for free amounted to 7.9T/mth of sawdust and 0.9T/mth of bark. Another 12.75T/mth of sawdust was available at 125-250 Rs/tractor load and an additional 1.5T/mth at 5-10Rs/kg. 5.7T/mth of woodchips was available at 1.5Rs/kg.

Total sawmill waste generation within NMA was estimated to be 2.8T/d, or 0.28T/sawmill, with 96.2% of it being recycled, 2.7% disposed of on-site and 1.1% composted.

### 1.5.3 Other Industries

The other 128 industries within NMA referred to previously cover a wide range of manufacturing and industrial operations. 19 surveys were undertaken with a representative cross-section of these industries, yielding the following information.

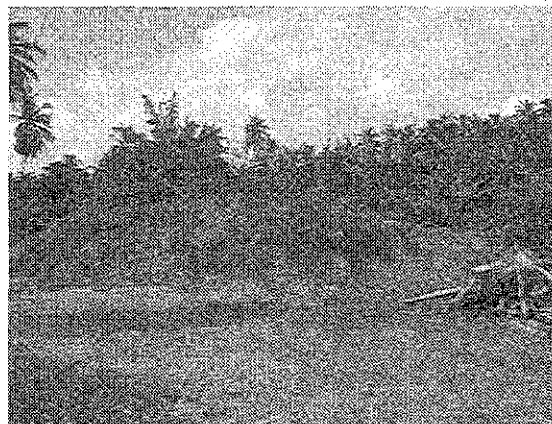
Several of the industries surveyed process waste materials, including Speed Pallets (plastic recycling), Jerod International (manufacture of charcoal from coconuts) and Silva Land Coir Mill (coconut fibre processing), while most industries produce a high proportion of recyclable materials. Many expressed dissatisfaction with their present system of waste disposal, and 13 were willing to pay for improved waste collection and disposal, ranging from 200-4,000Rs/mth.

Neil Marine Boatyard produces approximately 100kg/d of waste, mainly comprising fibreglass, which NMC will not accept for collection. They recycle about 16kg/d, with the remaining waste being stored on site. A contract is let about every six months for the collection and disposal of this waste. They have a small on-site incinerator but this is no longer working.

B.R. Engineering store most of their waste on site (83kg/d), with it being collected at approximately five year intervals by a private contractor for disposal.

Both of these places do not know where their waste is ultimately disposed to, but they believe it is not to the NMC disposal site. For the purposes of this study, these practices have been classified as on-site disposal.

The Monara tile factory generates a significant amount of furnace ash, which it has been stockpiling on site, creating what is now a large pile, while one of the sawmills, which also makes tiles, offered its ash to NMC for use. There are many large tile factories located within close proximity of Negombo who may have similar ash stockpiles.



*Left – Some of St Regis Packaging Factory's waste; Right – stockpile of ash at Monara Tile Factory*

Overall, recycling is the most common method of waste disposal, accounting for 50.0% of generated waste. 11 of the surveyed industries recycle some (9) to all (2) of their garbage. Significant quantities of recycled materials by various industries include:

- 2000kg/mth of paper by the St Regis Packaging Factory (paper bag manufacture).
- 3,000kg/mth of textile/rubber waste and 240kg/mth of food/kitchen waste for animal feed by Viva Lanka Pvt Ltd (bag manufacturer)
- 3,000kg/mth of metals by Metro Industries (spare parts manufacture).
- 275kg/mth of metals, 100kg/mth of cardboard and 100kg/mth of polythene bags by Neil Marine Boatyard.
- 300kg/mth of leather and 45kg/mth of polythene bags by Belden Industry (gloves manufacture).
- Other materials recycled in smaller quantities by various industries include plastic/metal (containers, barrels, etc.) and food/kitchen waste for animal feed.

On-site disposal is the second most common method, accounting for 40.5% of generated waste, with 11 industries using on-site disposal for some (6) to all (5) of their garbage.

Five industries use the NMC garbage collection service for some (3) to all (2) of their waste, with NMC collection accounting for 5.2% of generated waste. Two other industries compost some of their waste (1.8%), while Drycast Co. burns their waste at another place outside their property (assumed to be illegal dumping (2.6%)).

Waste generation from all 128 industries was estimated to be 6.6T/d (51.5kg/industry.d), with the above percentages being applied to the entire industrial waste stream. The one welding/lathe works surveyed indicated it recycles all its waste, which is mainly metal. The industry list includes a large number (72) of lathe/welding works, which are also likely to recycle most of their waste. However, the waste stream percentages have not been modified to account for this, which may mean that total recycling is underestimated.

## 1.6 Other Waste

Other waste accounts for waste collected from public places such as parks, beaches, streets, drains and canals and from other “informal” sources that are not registered with the relevant authorities and hence not included in official statistics. It may also include some of the waste that is illegally dumped around the city and subsequently collected by NMC.

Parks, playgrounds and sportsgrounds are the responsibility of the Works Department. Park waste generation was estimated to comprise 3 handcart loads/day (0.37T/d), based on two handcart loads being collected from Rajapaksha Udyanaya (2ha park in Negombo town) and one handcart load from the Beach Park (0.2ha in Ethukala). All of this waste is assumed to be taken to the NMC disposal site.

An additional handcart load (0.12T/d) of beach litter has been assumed to be collected by the Hotel Association tractor.

Based on the NMC Roads, Drains and Bridges Inventory for Negombo and Kochchikade and allowing for additional drains and roads in Thaladena, the total length of roads and drains within the NMA area is estimated to be 116km and 105km respectively.

Most road sweeping, drain cleaning and weeding is undertaken by SWM handcart labourers, with handcarts being assigned three labourers for main roads and two labourers for by-roads. Special instructions are given to four wheel tractor drivers to call at specific locations to collect road sweepings/drain cleanings as required.

Road/drain cleaning waste is estimated to be 2.3T/d, based on comparative data from Kandy, typical road sweeping waste generation estimates from other JICA studies, and considering the average length of roads/drains that can be cleaned by a handcart per day.

The two wheel tractor also collects small quantities of drain cleanings, particularly from markets, which it disposes of to low lying, marshy land rather than the final disposal site at Ovitiyawatta. This waste has not been included in the waste stream.

## 1.7 Recycling

### 1.7.1 General

Informal reuse and recycling is relatively active in Negombo, with there being many shops in the city selling used items and/or recyclables for a wide range of purposes, while there are also some micro-enterprises operating using recyclables as their raw materials. These include:

- Shops selling used newspapers/exercise books, bottles, containers, tins, shoes, bags, bikes, umbrellas, books, etc.
- Waste paper is used to make paper bags for wrapping purposes (e.g. medicines, food, small goods, etc.).

- Glass and PET bottles are sold as containers for local products (e.g. sauce).
- Empty metal tins are used to make the metal support that secures broom bristles to the broomstick (ekel broom) or for making toys and other items (e.g buckets).

### 1.7.2 At Source

This section focuses on household recycling at source, as recycling at source from other waste generators has previously been described. Household at source recycling was estimated from the household survey results (150 households), with the relevant results being summarized below. These indicate that 60% of households have recyclables collected from them by individual collectors, 28% take some recyclables to shops for refund/sale, and 6.7% compost kitchen and garden waste.

Table 1-10: Household Survey Recycling Results Summary

Waste Type	Composting	Individual collects from house	Resident takes to shop
Yes	10	90	42
No	140	60	108
Food/kitchen	10	1	0
Garden/wood	10	0	0
Paper/cardboard	0	34	8
Plastic	N/a	0	1
Glass	N/a	57	38
Metal	N/a	24	1
Textile	N/a	12	0
Tyres	N/a	2	0

Note: N/a = not applicable.

The total amount of materials recycled or composted from households at source was estimated using this data together with estimated household waste composition data, 69% average NMA garbage collection service coverage and assuming a 90% recycling/86% composting rate. This gives household home composting and recycling quantities of 5.5T/d (6.0% of total household waste generation) and 3.1T/d (3.4%) respectively. It is difficult to verify how realistic these values are, particularly in the case of home composting.

However, the middleman survey indicated around 1.1T/d of recyclable materials purchased by them originate directly from households. As many recyclable materials collected from homes are expected to be taken to other places (e.g. paper bag making enterprises) rather than just middlemen, the recycling quantity estimate is considered reasonable.

### 1.7.3 During Collection

Both handcart and collection vehicle workers collect recyclable materials in Negombo, which they generally sell to middlemen within Negombo. The collection worker survey found that 14 out of 33 labourers interviewed are involved in recycling. These 14 labourers collect an estimated total of 210kg/mth, comprising mainly bottles (145kg, 220 in number<sup>9</sup>), paper (30kg) and various other metals,

<sup>9</sup> Average bottle weight = 0.66kg, obtained by measuring a mixture of 10 arrack and beer bottles, th185se being the most common bottles recycled.



earning an average of 130Rs/mth, as set out in the following table. Total quantities of recyclables recovered during collection by all SWM labourers are estimated to be 1,459kg/mth.

Table 1-11: Recyclable Materials Recovered by Collection Workers

Item	No of labourers collecting	Quantity (kg/mth)	Price	Estimated Total Quantity (kg/mth)
Bottles	9	145	0.5-2.0Rs ea	988
Paper	2	30	5Rs/kg	184
Ferrous metal	3	6	5Rs/kg	110
Metal can	4	14	4-6Rs/kg	86
Aluminium	3	11	3-6Rs/kg	67
Copper	1	4	80Rs/kg	24
Total	14	210		1,459
Average earnings	130Rs/mth			
No of labourers interviewed	33			

**Notes:**

NMC labourers + drivers = 202 (excluding 2 at final disposal site).

Survey collection quantity/mth amended to take into account some non-responses, giving a revised collection amount of 238kg/mth.

Estimated total quantity/mth = 202/33 x revised quantity.

#### 1.7.4 At Supermarket Collection Point<sup>10</sup>

Approximately 20 scavengers collect various recyclable materials from the supermarket collection point located in the Negombo commercial area. One of these scavengers collects cardboard, which he takes to Colombo by train, where he can sell it for 3.5Rs/kg, compared with 1.5Rs/kg in Negombo. Another person collects around 50kg/d of cardboard, which he sells to a middleman in Munnakkaraya, earning around 100-150Rs/day. The total quantity of recyclable materials recovered at this point is estimated to be 250kg/d, assuming each scavenger collects an average of 12.5kg/d. This is considered conservative.

#### 1.7.5 At Final Disposal

Neither of the two NMC labourers working at the landfill site are believed to collect recyclable materials. During the landfill residents' survey, only one other person was identified who collects recyclable materials from the landfill, comprising about 50kg/d of organic wastes for his five pigs, three cows and five goats. The CPHI estimates that there are an additional seven adult outsiders and 4-6 children who collect recyclable materials from the landfill. Some of these were approached but refused to be interviewed. Considering the seven adults only and adopting an average collection quantity of 12.5kg/d, as at the transfer station, gives an additional 88kg/d of materials recovered at this point. This gives an overall recycling rate of 138kg/d at the final disposal site.

<sup>10</sup> Information obtained from informal discussions with two of these scavengers.

## 1.8 Disposal Quantities and Composition

### 1.8.1 Disposal Quantities

Current trips data and disposal quantities over the five month period January – May 2002 and from Aug 13-19, 2002 (JICA survey) are set out in the attached spreadsheet and summarized in the next table. Monthly tonnage data is illustrated below.

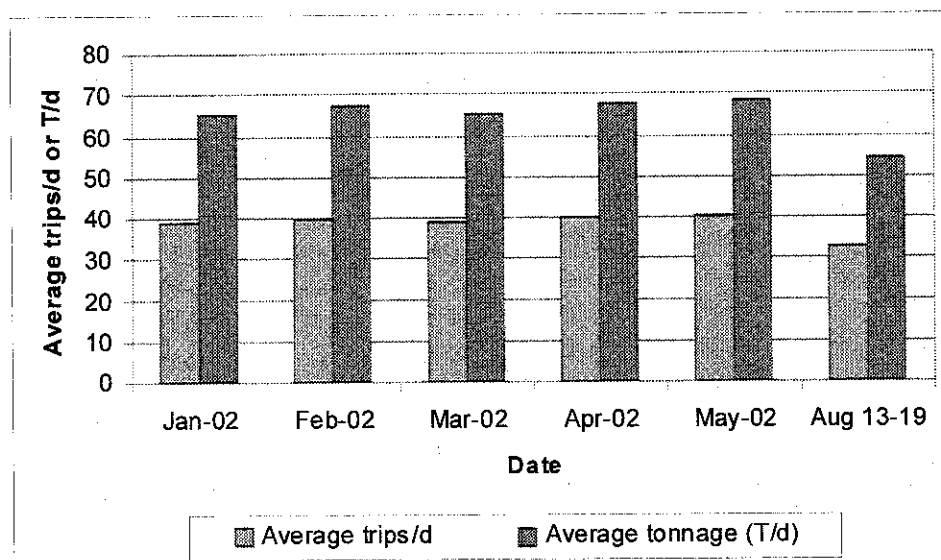


Figure 1-1: Ovitiyawwatta Landfill – Final Disposal Quantities

Some key points from this data are summarized below:

- The average number of trips during Jan-May 2002 was 39.6, which is 1.22 times the average number of 32.6 trips measured during the JICA survey. January-February and August are all dry months where waste generation is typically lower than normal. Hence, this difference is not believed to be due to seasonal factors, but instead is attributed to the August data being based on actual recorded trips to the landfill while the Jan-May data is based on individual Supervisors' records which are considered to be less accurate<sup>11</sup>. For these reasons, the August data has been adopted for use in this Study.

<sup>11</sup> According to the CPHI, workers do not get paid overtime unless three trips/d are recorded on the zone sheets, which tends to result in an inflated number of trips.

Table 1-12: NMC SWM Waste Disposal Average Trip and Tonnage Data

Tractor	Trailer	Average Number of Trips						Average Tonnage					
		Jan 02	Feb	Mar	Apr	May	Aug 13-19	Jan 02	Feb	Mar	Apr	May	Aug 13-19
270-3228	T-19563 & T-5082	3.4	3.6	3.5	3.5	3.4	3.7	6.3	6.8	6.6	6.5	6.5	7.4
49-8545	T-1661 & CCC	2.3	2.3	2.3	2.3	2.2	1.3	4.3	4.2	4.2	4.2	4.0	1.9
270-3151	T-17027	3.4	3.3	3.5	3.4	3.4	2.0	5.2	5.0	5.4	5.3	5.3	3.1
GB-4094	T-10809	2.3	2.1	2.5	2.5	2.6	1.1	3.3	3.1	3.7	3.6	3.8	1.7
37-4509	T-19564	2.5	2.4	2.4	2.6	2.5		5.5	5.3	5.3	5.7	5.5	
49-8542	T-9662 & AAA	2.4	2.6	2.5	2.5	2.6	1.1	3.3	3.6	3.4	3.4	3.5	1.6
270-3152	T-13929 & DDD	2.4	2.4	2.4	2.4	2.5	3.6	4.6	4.7	4.6	4.7	4.9	6.9
49-8544	T-17025	2.7	2.7	2.5	2.5	2.5	1.6	4.1	4.2	3.9	3.9	4.0	2.4
49-6733	T-10808	2.6	2.4	2.3	2.4	2.5	1.9	3.0	2.9	2.7	2.8	3.0	2.1
37-5105	T-16615,67-806, EEE	2.5	2.6	2.5	2.6	2.5	3.3	3.5	3.7	3.6	3.8	3.6	5.9
37-4543	Large trailer	2.5	2.6	2.5	2.7	2.4		5.3	5.8	5.3	5.9	5.1	
49-6734	T-16615	2.7	3.1	2.8	3.4	3.4		4.4	5.2	4.7	5.6	5.6	
37-1234	T-17026	2.3	2.4	2.2	2.3	2.3	2.0	3.4	3.7	3.3	3.5	3.5	3.0
270-3150	T-10806	2.3	2.3	2.4	2.3	2.4	2.3	2.9	2.9	2.9	2.8	2.9	2.9
270-3227	T-19680	2.7	2.8	2.6	2.8	3.3	4.0	5.7	6.0	5.7	6.0	7.1	8.6
36-0099	T-10807						0.6						0.5
	T-9661						2.9						4.3
	44-2802						0.3						0.3
	43-2806						0.1						0.3
67-2727	Hotel Association						0.9						1.4
Total		38.7	39.8	38.7	40.1	40.5	32.6	65.1	66.9	65.1	67.7	68.2	54.3

Notes: The ownership of trailers 44-2802 and 43-2806 has not been identified.

- Individual tractor trips data shows:
  - The overall average number of daily trips per tractor during August 13-19 is 2.4.
  - Two tractors, which swap trailers during their collection round, collecting a filled stationary trailer and replacing it with an empty or partially filled trailer are able to achieve an average of 3.6-3.7 trips/d.
  - Five tractors did less than 2 trips/d on average<sup>12</sup>.
  - The hotel association tractor does an average of 0.9 trips/d.

The average daily tonnage of waste brought to the disposal site is 54.3T/d, of which 52.9T/d is brought by NMC tractors and 1.4T/d by the Hotel Association tractor, the latter including 0.2T/d of garbage from hotels outside NMA.

### 1.8.2 Waste Composition at Final Disposal Site

The results of the waste composition survey conducted at the final disposal site are summarised below. The waste sample used for the composition analysis was taken from five different collection trailers.

Table 1-13: Composition and Physical Properties (Wet base)

Category	Percentage	Compostability		Recyclability	
		Compostable	Non-compostable	Inorganic Recyclable	Inorganic Non-Recyclable
Kitchen waste	45.6%	x			x
Grass & wood	24.7%	x			x
Paper	8.9%		x	x	
Textile	3.5%		x	x	
Soft plastic	4.0%		x	x	
Hard plastic	0.8%		x	xx	
Leather & rubber	0.9%		x		x
Metal	0.5%		x	xx	
Glass	0.8%		x	xx	
Ceramic & stone	8.4%		x		x
Other	2.0%		x		x
Total	100.0%	70.3%	29.7%	18.4% (2.1%)	81.6%
Bulk density	0.26 kg/l	-	-	-	-

Notes: "x" means applicable. "xx" in the column "in-organic recyclables" means profitable recyclables. "()" in the column "in-organic recyclables" means the percentage of profitable in-organic recyclables. Some paper can be composted but has been excluded from the compostables in the above table.

The composition results show that the waste reaching the final disposal site in Negombo:

- Is suitable for composting as the percentage of compostable materials is relatively high (70%).
- Contains relatively few inorganic recyclables (18%), with the proportion of profitable inorganic recyclables being very small (only 2%).

<sup>12</sup> Excluding data for trailers T-10807, 44-2802 and 43-2806, which is considered abnormally low and may be due to other reasons than poor performance.

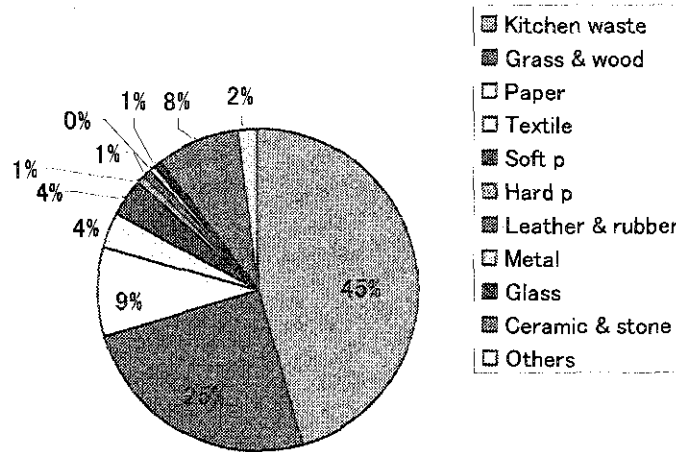
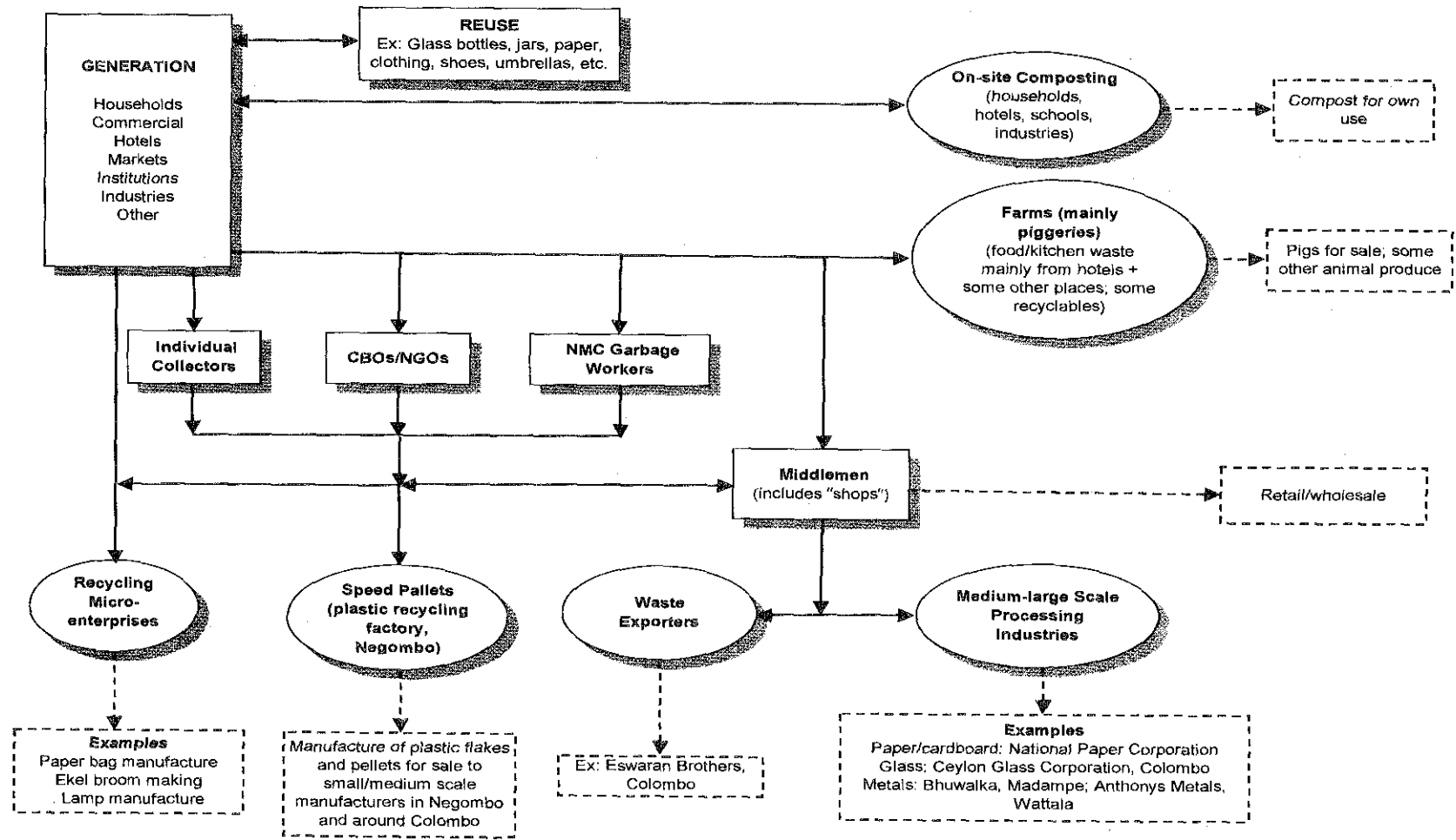


Figure 1-2: Physical Composition of Waste taken from Collection Vehicles

## 1.9 Resource Recovery

The NMA recycling/on-site composting system is illustrated below, while recycling quantities have previously been summarised. As there are currently no centralised composting facilities within Negombo, this section provides a summary of the recycling sector within NMA in relation to home composting, middlemen, NGOs, piggeries and Speed Pallets (plastic recycling factory).



**Note:** Some NGOs (e.g. Arthacharya Foundation) are working in some low income areas of the city encouraging the formation of CBOs and people to do home composting and recycling, based on the source separation of waste. Hence, the "CBOs/NGOs" link has been included above.

Figure 1-3: KMA Recycling/Composting System

### 1.9.1 Home Composting Barrels

NMC has distributed compost barrels to various parts of NMA over the last few years, mainly free of charge, with distribution being undertaken by Grama Nilidari officers. More recently in early 2002, NMC in collaboration with Negombo Lions and Lion Orient distributed about 100 compost barrels to residents in three areas of the city (Saunders Pl, Thaladuwa and Kurana). Recipient residents were selected by NMC Council members, without any consideration being given to their income. These barrels were old tar barrels (metal construction) and cost 700Rs each. Residents were required to pay 100Rs, while the Lion Clubs paid 300Rs and NMC 300Rs. NMC have not been monitoring the success of this or earlier compost barrel distribution programmes.

Hence, JICA conducted a compost barrel survey in August 2002, using a list of households that had received compost barrels prior to 2002 obtained from the NMC Divisional Environment Officer in NMC. However, during the survey, it was found that some of the listed households had never received compost barrels or even requested them. Such households were eliminated from the survey, with a total of 80 households being surveyed who had received compost barrels. The key survey results are summarized below.

- Surveyed households (respondents) received the compost barrels 3.9 years ago on average (range = 2.5-6.5 years).
- 67 (84%) of respondents received some education/information on how to use the barrels.
- 6 (7.5%) of respondents are still using the compost barrels, while 69 (86.3%) have stopped using them and 5 (6.2%) never used them (see figure below).

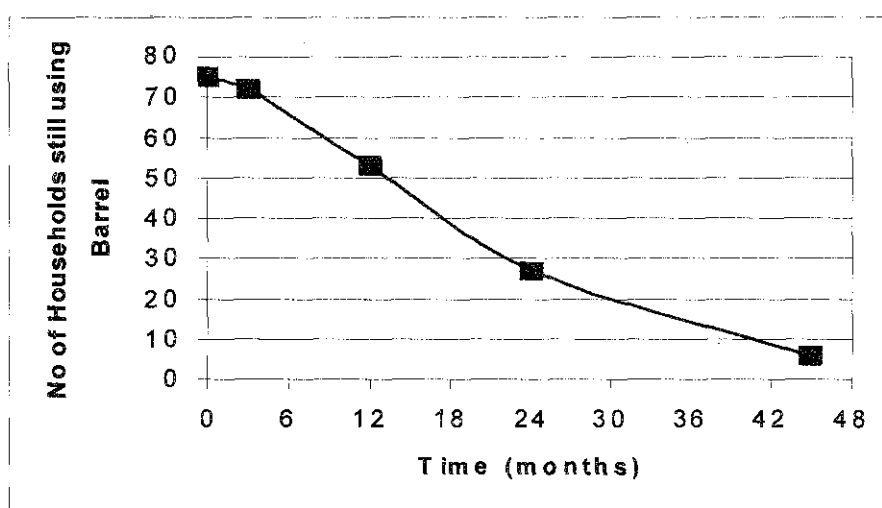


Figure 1-4: Compost Barrel Usage

Of the households who have stopped using the barrel, three (5%) stopped within the first three months (i.e. before first compost produced), 19 (32%) within the next nine months, 26 within the next year, and 21 after that (. This shows that the dropout rate was relatively low over the first three months, remaining approximately constant over the next 21 months, and has reduced slightly since then.

The following figure shows the main reasons why households decided to get a compost barrel. This data shows that 4-5 of the six households still using the barrel had either an initial personal interest in composting or some concern for the environment. However, only two of the households to whom composting was recommended by NMC Officers/workers are still using the compost barrel.

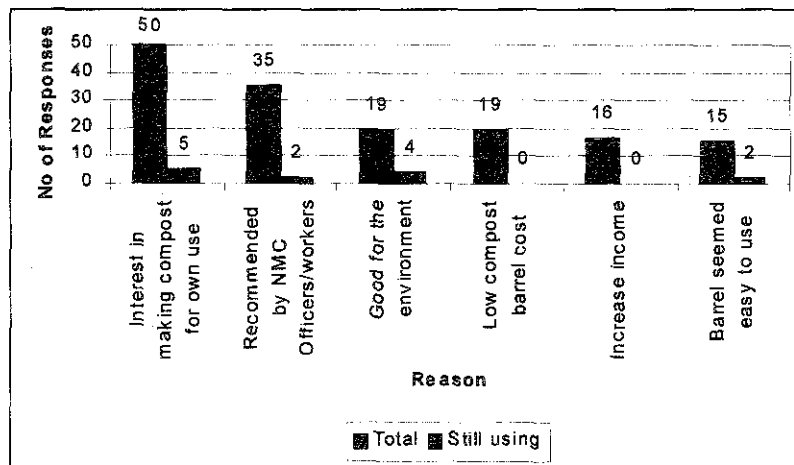


Figure I-5: Main Reasons for Getting Compost Barrel

The 74 households who have never used or stopped using the barrel indicated that the main reasons for this were:

- Barrel has rusted badly (59).
- Pest problems (17).
- Odour problems (15).
- Too much water gets into the barrel (8).
- Lost interest (6).
- Composting takes too much time (5).

Rusting is by far the main problem, this being due to the barrel being made out of ungalvanised metal while the organic waste added to it, water which readily enters the barrel and Negombo's proximity to the sea create a highly corrosive environment.

Average household compost production per month amounted to 3.9kg/mth for those still using the barrels, while those who have stopped were producing only around 3.7kg/mth (overall compost production rate = 3.8kg/mth).

Assuming a 66% weight reduction on composting<sup>13</sup>, 11.5kg/mth of food/kitchen waste would produce 3.9kg/mth. Household monthly waste generation is estimated to be 88kg/month (0.624kg/person.d x 4.7 people/household x 30d), meaning that households still using their compost barrels are achieving an average reduction in waste to disposal of 13% (see figure below).

<sup>13</sup> Dr Basanyake, Peradeniya University, informal communication



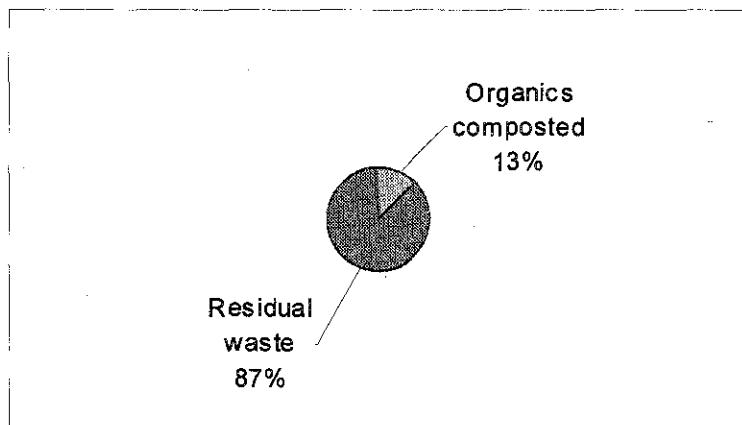


Figure 1-6: Waste Reduction through home composting

The main improvements suggested by household members to NMC’s home composting programme are shown below.

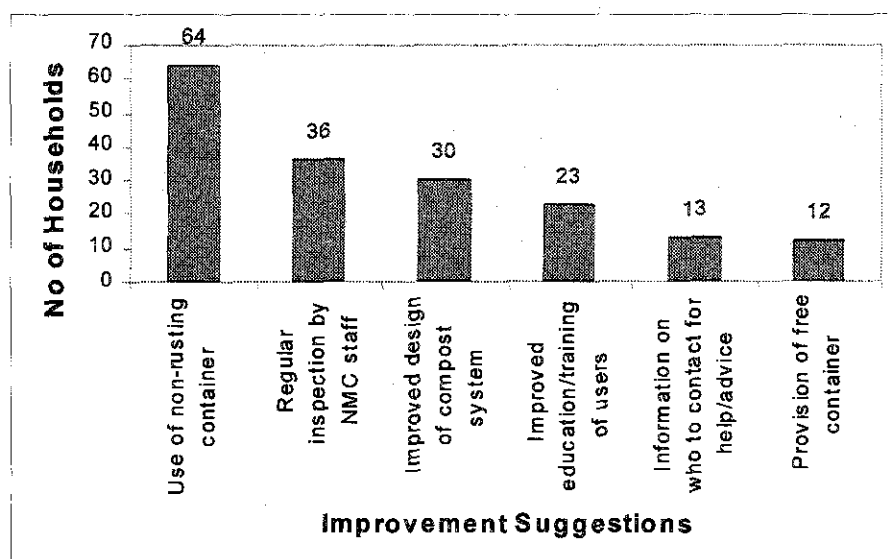


Figure 1-7: Reduction in Households using Compost Barrels with Time

Overall, these results indicate that the home composting programme has not been very successful with only 7.5% of compost barrel recipients still using the barrels after 3.9years. However, some important lessons can be learned from this survey for any future home compost barrel programme. Most importantly, any future programme should:

- Use a longer life (ideally non-rusting) composting container (e.g. plastic barrel or concrete bin).
- Modify the design of the compost barrel so as to minimize water infiltration.
- Focus on residents with a strong personal interest in composting or concern for the environment, or try to develop such an interest in residents through education/awareness raising. Experience from Matale also shows that residents should not be coerced into getting a compost barrel unless they actually want one.

- Provide education/training to households, followed by regular inspections, with ongoing support being available to households requesting it. This is considered to be particularly important during the first 3-6 months, before compost is first produced and when residents are most likely to experience “teething” problems.
- Consider providing compost barrels to households at a subsidized rate, rather than for free, thus requiring households to make some conscious decision to buy-in to the composting programme, rather than just being given a free gift.

### **1.9.2 Middlemen**

Twelve middlemen operating within the NMA were identified and interviewed as part of this study. General information on these businesses is tabulated below and summarised here.

All of them are primarily involved in the collection and selling of recyclable materials, with three having been in business for 10 or more years, four for 5-9 years and four for 3-4 years old (no details obtained for one enterprise). At least 33 people (managers/owners, full and part-time workers) are employed by these businesses, representing 24.6 full-time equivalent jobs.

Their estimated monthly expenditure on purchasing recyclable materials is over 890,300Rs/mth, which shows that the scale of these operations is significant. Corresponding estimated monthly income from the sale of recyclable materials is over 1,132,400Rs/mth, representing a markup of 27%. Respondents were generally reluctant to give total expenditure and income information, with one business not supplying these details, while other data obtained is not considered very reliable, particularly in seven cases where stated income and expenditure were less than the corresponding recyclable purchases and sales figures. The overall net income quoted by businesses ranged from 5,000-15,000 Rs/mth. This is considered a minimum value, for the reasons explained here.

Table 1-14: Middlemen General Information

Business Name	Manager/Owner, Address	Years of operation	Total Employees		Recyclables (Rs/mth)	
			Total	FTE	Purchases	Sales
MM1: Weerasiri Stores	HR Kaldera, 168 Periyamulla, Negombo	5	> 1	1.7	40,786	48,874
MM2: Rasic Stores	Mr Rasic, 218 Alawaththa Rd, Negombo	10	9	5.5	161,600	247,120
MM3: Tushana Traders	FM Fonseka, 18/2 St Joseph St, Negombo	8	> 1	1.0	>62,046	>76,175
MM4: U Sandanam	V Sandanam, 10 Visgirin Pl, Negombo	3	1	1.3	26,193	28,670
MM5: T Thirumani	T Thirumani, 10 Regina Rd, Negombo	3	5	3.5	75,311	96,214
MM7: Quick Search	G Mohandas, Aluth Kurana, Pitipana, Negombo	7	5	2.5	277,020	345,703
MM8: Murugan Stores	A Chandrakala, 45A St Joseph St, Negombo	9	2	2.5	42,942	52,120
MM9: Chandrika Stores	M Unnadure, 729 Colombo Rd, Kurana, Negombo	10	2	1.2	65,500	76,100
MM10: Raja Stores	AA Raja, 220/1 Halawatha Rd, Kotuwa, Kochchikade	NA	1	1.2	23,361	27,761
MM11: Salaman Raja	S Raja, 2 Sisira Building, Daluwakotuwa	15	1	1.4	34,003	39,339
MM12: Jeasuwadian	Jeasuwadian, 180 Halawatha Rd, Kochchikade	3	4	2.6	50,400	56,000
MM13: Ananda Kumara	A Kumara, 153 Halawatha Rd, Manaweriya, Kochchikade	4	1	0.2	31,130	38,340
Total			> 33	24.6	890,292	1,132,415

**Notes:**

MM6 (Speed Pellets) is discussed separately, being a plastics recycling factory.

The number of full-time equivalent (FTE) staff is based on a normal working month in the private sector of 8h/d x 26d/mth = 208h/mth.

Recyclable materials purchases and sales costs were calculated based on the average quantity of each item collected and sold per month and the average purchase and sales prices. In one case, purchases and sales data was incomplete as indicated by ">" above. This means that actual purchases and sales will be slightly higher than indicated above for these middlemen.

NA = no answer.

Most of the recyclable materials are brought to them by individuals (11), other middlemen (3) or by NMC garbage collection workers (1). Their demand for glass bottles, metals and batteries is generally stable, while the demand for plastics, polythene, paper/cardboard and broken glass varies between middlemen. The supply is greater than the demand for most materials.

The main sources of most materials is set out in the following table and summarised below:

- Households are the main source of plastic, paper/cardboard, broken glass, glass bottles, metals and batteries.
- Hotels are important sources of plastics, broken glass and glass bottles.
- Commercial enterprises are the main source of bags/sacks and also an important source of paper/cardboard.
- Industries are the main source of polythene and a significant source of plastics, paper/ cardboard, metals and batteries.
- Garages ("other" response) are a significant source of plastics, metals and batteries.

Table 1-15: Main Sources of Recyclable Materials

Item	Plastic	Poly-thene	Bags/sacks	Paper / cardboard	Broken glass	Glass Bottles	Metal	Batteries	Overall (within NMA)
No collecting these items	4	1	3	9	8	9	12	12	
No of responses	4	1	3	9	8	9	12	12	
<b>Main Sources (%)</b>									
Households	41.0	10	16.5	51.2	63	62.7	55.0	50.4	59.0
Hotels	24.4	0	0	0	27	26.8	1.1	0	11.9
Hospitals	0	0	0	0	6	6.4	0	0	1.7
Commercial enterprises	3.0	0	78.4	12.8	2	1.7	7.2	3.3	7.8
Schools	0	0	0	4.1	0	0	0	0	0.6
Industries	15.2	90	0	24.5	0	0	21.8	14.8	6.1
Other (mainly garages)	16.4	0	5.1	7.6	2	2.4	15.0	31.6	12.8
Total	100	100	100	100	100	100	100	100	71

**Notes:**

Above values are average percentages calculated from the survey data, taking into account the relative quantities of materials purchased by different middlemen.

The final column estimates the proportion of recyclable materials collected from different sources within NMA only, assuming 90%, 75%, 90%, 100%, 25% and 80% of materials from hotels, hospitals, other commercial enterprises, schools, industries and garages are obtained from inside NMA respectively, with the proportion of materials being obtained from households being calculated by difference so as to get an overall rate of 71% for materials collected within NMA.

One middlemen also collects large tyres, which has not been included in this table.

Around 71% of these materials are collected from within the NMA, 18% within the Gampaha district, 8% within the Western Province, and 3% from other areas<sup>14</sup>.

The total quantities of materials recycled by these middlemen<sup>15</sup> are summarised below in terms of the material types adopted for this Study, amounting to 2.5T/d, while the table after that provides further details, including purchase and sale prices. Adjusting this total to allow for an estimated total of 13 middlemen within NMA and 71% of these materials being collected from within NMA gives a recycling amount of 1.9T/d. The household survey indicated that 3.4% of household waste is recycled, which amounts to 3.1T/d, of which 1.1T/d is estimated to come from households.

<sup>14</sup> %s are weighted averages, accounting for the relative quantities collected by different middlemen.

<sup>15</sup> Data from survey interviews. No independent check was made on the accuracy of these quantities.

Table 1-16: Total Quantities of Different Materials Recycled

Materials	Minimum Monthly Quantity	Daily Amount (kg/d)	Comments
Plastics	368 containers/ chairs + 225kg plastics + 3,425 bags (mainly polysacks) = 568 kg	18.7	Containers/chairs are generally sold for reuse – hence, not included in daily recycling amount. Bags are either sold for reuse or transported to factories for re-processing – hence, they are included in recycling amount ; measured weight of 1 polysack = 0.1kg => 343kg.
Polythene	2,000kg	65.8	
Paper/ cardboard	7,430kg	244	2,460kg old newspaper, 2,100kg old exercise books, 2,870kg cardboard.
Glass	4.1T broken glass + 25,910 bottles = 21,200kg	697	Whole bottles are usually beer or arrack bottles; average measured weight = 0.66kg; 25,910 bottles = 17,100kg.
Metals	>40,100kg	>1,318	>33.8T ferrous + 2.95T copper/brass + 2.97T aluminium +0.38T beer cans
Old battery cases	4,560kg	150	Battery cases are drained and then weighed, being recycled primarily for their lead content.
Total	>75,848kg	>2,494	
Revised total	>82,168	>2,701	13 middlemen in NMA (x13/12)
Total from NMA	>57,936	>1,905	71% of recyclable materials collected from within the NMA, according to survey results.

**Notes:**

Refer next table for further details.

Above quantities are minimum quantities, due to the survey purchases data being incomplete in one case. They are expected to be approximately correct.

Daily quantities calculated from monthly data by multiplying by 12/365.

Most enterprises act mainly as retail/wholesale outlets, onselling the recycled materials directly from their shops, although three transport paper, four transport glass and five transport metals to factories for further processing, mainly in Wattala (Anthonys Metals), Colombo and Moratuwa (not specified) and Bhuwalka, an Indian owned scrap steel processing factory in Madampe, 25km away.

Table 1-17: Quantities of Recyclable Materials collected by Middlemen and Corresponding Purchase and Sales Prices

Material	Units	MM 1	MM 2	MM 3	MM 4	MM 5	MM 7	MM 8	MM 9	MM 10	MM 11	MM 12	MM 13	Total			Units
														Quantity	Purchase price	Sales price	
<b>Plastics</b>																	
Mixed, unwashed	Kg/mth						225							225	4	9	Rs/kg
Containers/chairs	No/mth			200			100	56					12	368	10-165	16-189	Rs ea
<b>Polythene</b>																	
Mixed, unwashed	Kg/mth						1,000							1,000	1.5	7.0	Rs/kg
Clean, sorted	Kg/mth						1,000							1,000	5.0	7.0	Rs/kg
Various bags	No/mth	400					2,800			225				3,425	1-5	1.7-6	Rs ea
<b>Paper</b>																	
Old newspaper	Kg/mth	1,100	350	75	150	60	500	100		25			100	2,460	8-20	9-22	Rs/kg
Old exercise books	Kg/mth		750	25	100	150	1,000	50		25				2,100	4-6	6-12	Rs/kg
Cardboard	Kg/mth					70	2,000			300			500	2,870	2.5-4	3.5-5	Rs/kg
<b>Bottles</b>																	
Broken glass	No/mth		1,500	50		350	1,000	200		300	400		300	4,100	1-2	1.5-3	Rs ea
Arrack, beer other bottles	Kg/mth	670	16,000	600	900	300	5,600	900		500	440			25,910	2.2-4.6	2.9-6.1	Rs/kg
<b>Metals</b>																	
Aluminium	Kg/mth	80	950	100	150	200	840	250	200	50	100		50	2,970	60-65	70-75	Rs/kg
Beer cans	Kg/mth			100		5	200	50		10	10			375	20-35	25-42	Rs/kg
Copper/brass	Kg/mth	50	500	150	50	400	1,000	110	450	100	40		100	2,950	70-90	90-100	Rs/kg
Ferrous	Kg/mth	1,700	2,000	NA	600	4,000	8,000	2,000	2,000	1,000	2,500	8,000	2,000	33,800	6-7	7-9	Rs/kg
Old battery cases	Kg/mth	160	300	100	75	400	2,240	100	100	80	500	300	200	4,555	8-10	8.5-12	Rs/kg
Tyres	No/mth			NA										NA	NA	NA	

Note: NA = no answer

The main costs incurred by these businesses in their recycling activities and the associated main problems are summarised in the following two tables.

Table 1-18: Main Costs

Main Costs	Rank				Weighted average
	1	2	3	4	
Buying recyclable materials	12	0	0	0	30.0
Land/building rental	0	6	1	1	14.5
Utilities	0	3	5	0	13.5
Transportation	0	2	3	4	12.5
Labour	0	2	0	2	7.0

Table 1-19: Main Problems

Main Problems	Rank				Weighted average
	1	2	3	4	
Shortage of Recyclable Materials	5	2	0	3	19.5
High land/building rental costs	2	2	1	2	13.5
Utilities problems	2	0	3	0	9.5
Other (political problems, bank interest)	1	1	2	0	7.5
High transportation costs	0	0	4	1	7.0

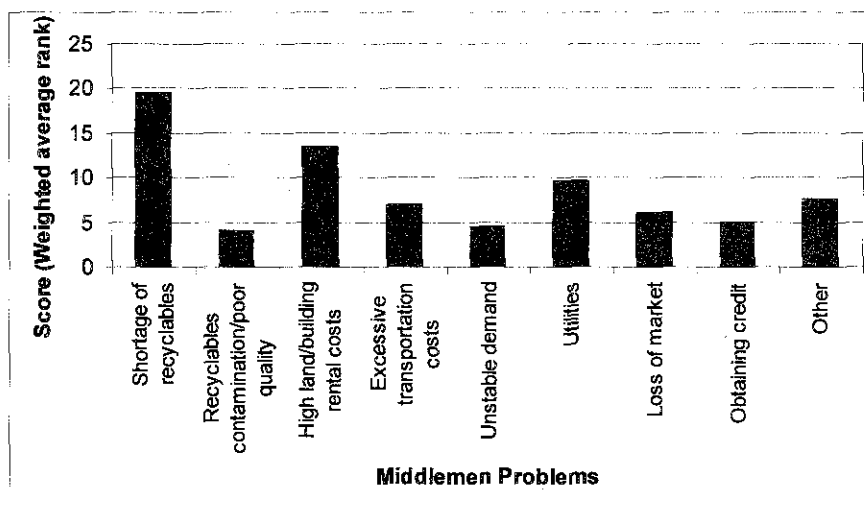
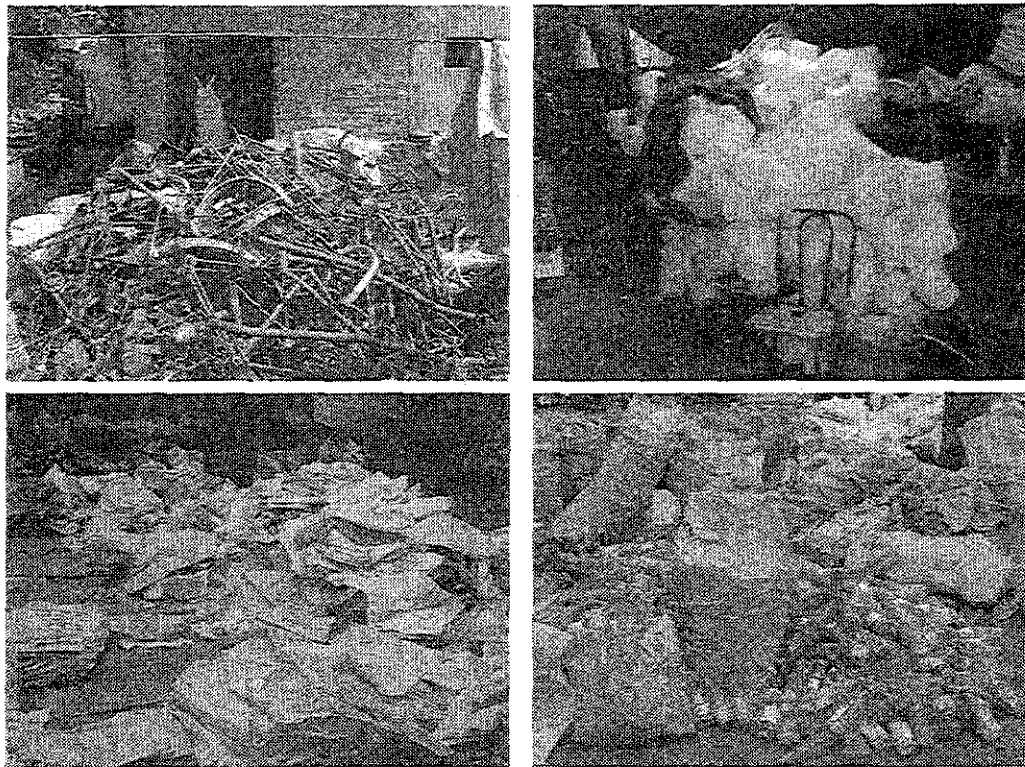


Figure 1-8: Main Problems Faced by Middlemen in Negombo



*Various middlemen shops in Negombo*

### **1.9.3 NGOs and Other Organisations**

The Arthacharya Foundation, Urban Settlement Improvement Programme (USIP) and Sustainable Cities Programme (SCP) are all involved in SWM related activities within Negombo. Their activities have already been summarised in the main report.

### **1.9.4 Piggeries**

There are estimated to be 10-12 piggeries within NMA. Three of the larger piggeries were surveyed as part of this study. Two of these collect food/kitchen waste from tourist hotels, located mainly within Negombo, while the third collects food/kitchen waste from the Katunayake Free Trade Zone for itself and three other smaller piggeries in Kurana. Key results for the first two piggeries, which are relevant to this study are summarised below, while the complete results are set out in the following table.



Table 1-20: Negombo Piggeries

Name	Dilini Farm	Mr Kosta piggery farm
Operation years	18	19
No of workers	8	5 (previously 8)
Farm area	4 acres	Not stated
Address	Near Jeyaraja Punandapuli Sportsground, Daluwakotuwa	Palangathure
Location	10m west of house; other houses within 30m of piggery.	10m east of house; ~40m to nearest adjacent house
No of pigs	190 (according to owner, but 200-300 based on observation)	400
Other animals	2 ducks, 50 hens, 4 turkeys	Some chickens and turkeys
Food Sources	Hotels (Negombo), garment factories (Katana P.S.)	Hotels (Negombo)
Food sources	Seashells; Goldi Sands; Browns Beach - 100kg/d each	Dolphin - 200kg/d @ cost of 1,000Rs/mth
Food details	Royal Oceanic; Blue Oceanic - 150kg/d Camelot (not confirmed), Sunflower, Sunset Beach - 50kg/d each Total = 750kg/d (sells them meat at a reduced price in exchange for pig food)	Catamaran - 5kg/d for free Golden Star - 10kg/d for free Airport Garden - 150kg/d @ cost of 1,000Rs/mth Total = 365kg/d
Recyclables collection	Glass bottles - 1000 bottles/mth; free Plastic cans - 300 cans/mth; free Various individuals collect from house for free	Not applicable.
Pig food collection system	Hotels separate their garbage into different categories, at the piggery's request in exchange for the piggery taking all of the hotels' garbage. They collect hotel waste twice daily, taking the food/kitchen waste and some recyclables by vehicle to their farm, while other garbage is discharged at a NMC collection point.	Collects mixed hotel garbage in black polythene bags from hotels' "garbage rooms" around 5:30am and transports to piggery using own vehicle. Workers then spread out the hotel waste on trays and remove contaminating materials (e.g. polythene), following which it is fed to the pigs. He has not requested hotels to separate their food/kitchen waste from other garbage, as he is afraid that if he does, they will give their food/kitchen waste to another piggery instead (strong competition for hotel waste).
Monthly expenditure	Pig food = 60,000 Vehicle (fuel, maintenance, etc.) = 30,000 Labour = 30,000 Electricity = not specified Medicine = not specified Total = 150,000 Rs/mth	Pig food/medicine = not specified Labour = not specified Vehicle = 14,000 Electricity = not specified Total = 140,000 - 160,000Rs/mth
Sales	Sell 15 pigs/mth (70-80kg) @ 5,500-6,000 Rs/pig to Keels and an unspecified number of pigs to hotels within Negombo @ 90Rs/kg.	Sell 30 pigs/mth (50-60kg) to Keels.
Income	Total income = 200,000 Rs/mth Net income = 50,000 Rs/mth	Total income = 150,000 - 175,000Rs/mth Net income = 10,000 - 25,000Rs/mth ~35,000Rs/mth.
Savings by hotel collecting	The owner believes these to be minor, because he must go to the hotels every day to satisfy them and sometimes there is no or very little pig food	

Name	Dilini Farm	Mr Kosta piggery farm
waste	in their waste. In addition, the incidence of disease increases when he feeds hotel waste to his pigs and he must use more medicine.	
Survival without hotel waste?	Yes – somehow.	Difficult – hotel food/kitchen waste amounts to 350-400kg/d of pig food that he would otherwise need to purchase.
Reject Materials	Dispose to NMC collection point for free.	Four half barrels/d, mainly comprising polythene, paper and pineapple leaves, is collected by NMC once every 2-3 days and taken to the disposal site. He pays labourers Rs162.50/tractor load.
Piggery wastes	Two biogas tanks, which produce enough electricity to satisfy his requirements, saving around 9,000Rs/mth. Could supply ~3 houses with biogas, but they are not in favour of receiving it.	Biogas used for cooking only in 5 houses. Personal savings (1 house only) amount to ~400Rs/mth. Excess piggery waste is bunt in a pit.
Main problems	Neighbours attributing all their illnesses to the piggery. Additional pig food price is high. Thieves. Political attacks. No government support and no guidance.	NMC has informed him that he is not complying with the 50m minimum buffer zone requirement between him and the nearest house. However, none of his neighbours have complained about the piggery. He is afraid NMC may force him to relocate outside the city.
Other comments	This is an industry with established forward and backward linkages. It can generate a large number of direct and indirect employment opportunities. The government should pay attention to it and help improve it.	If he has to relocate, this would increase his transportation distance for collecting hotel waste from only a few km to around 20km. He would also diversify into other areas as a piggery is a risky business – in Ja Ela, neighbours destroyed the assets of one piggery farm, which they attributed to being the cause of a dengues outbreak in the area.

**Notes:** Another piggery was visited in the Kurana area. This has been operating for 10 years and has 70 pigs, 10 goats, 25 chickens and 1 cow. Piggery food is collected from the Katunayake Free Trade Zone (FTZ). This piggery also collects piggery food from the FTZ for about 3 other small piggeries in the same area. As the FTZ lies outside the NMA limits, these piggeries have not been included in this study.

Dilini Farm in Daluwakotuwa has around 200-300 pigs and collects ~750kg/d of food/kitchen waste from eight<sup>16</sup> tourist hotels (Seashells, Goldi Sands, Browns Beach, Royal Oceanic, Blue Oceanic, Sunflower, Sunset Beach hotels) within NMA and some additional pig food from garment factories in Katana PS. They sell pork to these hotels at a reduced price in exchange for their food/kitchen waste, while the hotels also separate their waste for them, provided they take all hotel waste. They collect the hotel waste twice daily taking the food/kitchen waste and some recyclables (1,000bottles and 300cans per month) to their farm, while disposing of the residual waste at a NMC collection point.

Total income is ~200,000Rs/mth, while total expenditure amounts to ~150,000Rs/mth, with additional pig food (Rs60,000), transportation (Rs30,000) and labour (Rs30,000) being the major cost items. The owner considers relatively minor savings are achieved from using hotel food/kitchen waste as pig food, as he is required to collect all these hotels' waste in order to maintain their patronage, while hotel food seems to increase the incidence of disease amongst his pigs, meaning he must spend more money on medicine. Nevertheless, it is considered that the savings must be relatively significant, as otherwise he would collect pig food from elsewhere.

Mr Kosta's farm in Palungature has 400 pigs and collects around 15kg/d of mixed waste from two tourist hotels (Catamaran, Golden Star) in NMA for free, while obtaining an additional 350kg/d of food/kitchen waste at a cost of 1,000Rs/mth each, from Club Dolphin and the Airport Garden Hotel, both outside NMA. They collect the hotel garbage around 5:30am every morning and transport it to their farm, where they remove contaminant material (e.g. polythene) before feeding it to their pigs. Reject materials (mainly polythene, paper and pineapple leaves are collected from his farm by NMC once every 2-3 days, at a cost of 162.50Rs/tractor load (informal payment).

Total income is around 150,000-175,000Rs/mth, while monthly expenditure amounts to 140,000-160,000Rs/mth, with pig food/medicines, labour and transportation being the major cost items. Mr Kosta estimates that collecting hotel waste reduces his monthly expenditure by ~35,000Rs/mth and is critical to the viability of his business.

Biogas is generated from piggery wastes on both farms and used for electricity/cooking purposes.

Other survey results indicate that the total amount of food/kitchen waste given away for animal food (primarily pig food) by various waste generators is much higher than the quantities indicated above, and comprises:

- An approximate total of 893kg/d from tourist hotels.
- 14.7kg/d from two of the nine cafes/restaurants surveyed (123 such enterprises within NMA in total) and ~1.7kg/d of fish waste from the Bandula market.

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<sup>16</sup> Seven hotels listed; eight is possibly Camelot although this has not been confirmed.

- 8kg/d from Viva Lanka Pvt Ltd, 1.2kg/d from Asfa Garment and 13.3kg/d from Elsuma (three of the 20 industries surveyed out of a total of 129 industries).
- 10kg/d from Don Bosco Technical College, ~4kg/d from Kochchikade police station, and possibly 250-350kg/d of Prison waste, which is “given to a farmer”.

This gives a total of 0.95T/d (1.2-1.4T/d if prison waste is included), which is highly significant.

However, the future of all piggeries within NMA limits is currently under threat, as they are all believed to have recently received letters from NMC, informing them that they are not complying with a 50m buffer requirement to the nearest household, this largely being a result of residential development gradually encroaching on the piggeries, most of which were built over 10 years ago, in what then were rural areas. This may force them to relocate to outside the municipal limits, which would significantly increase their transportation costs for collecting hotel waste.

It is considered that the piggeries are providing a valuable service to the city of benefit to all parties – the hotels and other waste generators, piggeries and NMC – in the following ways:

- Diverting at least 0.95T/d of food/kitchen waste from landfill, thus reducing NMC’s garbage collection and disposal costs.
- Providing a valuable “eco-friendly” and reliable garbage collection service to tourist hotels and other waste generators, with associated small financial benefits (e.g. income earned by selling waste to piggeries; pork provided to them in-kind or at a reduced price).
- Providing piggeries with a large volume, low cost, locally available pig food supply, that enables them to significantly reduce their monthly expenditure (reduced pig food costs outweighs increased transportation and possible increased medicine costs) and improve the viability of their businesses.
- Generating biogas from piggery waste, which can be used for domestic purposes within the piggery and in nearby houses, reducing electricity costs.

However, non-compliance with the 50m buffer zone rule is a serious issue that must be resolved at some stage in the future.

### **1.9.5 Speed Pallets**

Speed Pallets are located at No 50 Archbishop Nicholas Marcus Mw, Negombo. The factory started operation in 2001, primarily due to the initiative of the former mayor who wanted to start plastic recycling within Negombo. Full-time staff include the owner, manager and 17 workers.

They recycle around 15T/mth of plastics and polythene (mixed @ 10-15Rs/kg and clean sorted @ 10-30Rs/kg; the higher price being paid for clean, clear plastics). These plastics are mainly low density polyethylene (LDPE), high density polyethylene (HDPE) or polypropylene (PP).

Waste plastics were initially collected for them mainly by NMC garbage collection labourers<sup>17</sup>, again on the instruction of the former mayor. Now, NMC labourers are mainly bringing them saline bottles from the Base Hospital, while most waste plastics are brought to them by individuals, including refugees/beggars living in the city centre, or middlemen. Some waste plastics are also brought to them each month from Chilaw Hospital through a personal contact.

The main sources of waste plastics are commercial enterprises (40%), industries (garment factories; plastics manufacturers - 40%), households (7%), hospitals (6.5%) and oil containers from garages (6.5%). About 75% of the waste plastics are collected from within NMA, the remaining 25% being collected from within the Gampaha District. They also collect waste cardboard (yarn reels, etc.) from the garment factories at their request and are presently stockpiling this on site.

Their recycling factory was built at a cost of three million Rs and comprises a roofed sorting and washing area and main processing building. A new office is currently under construction. They have their own "granulator"<sup>18</sup> for shredding/melting soft plastics, a grinder (Italian) for hard plastics and a pelletiser (Indian).

Incoming plastics are first sorted, washed and cut into small pieces (as required), following which they are processed into flakes or pellets using the appropriate machinery. A team of 15 women undertake the sorting, washing and cutting operations. They rotate between the different tasks and are paid on a per kg basis – 5Rs/kg for sorting, 3Rs/kg for washing and 5Rs/kg for cutting. Each woman can earn 150-200Rs/d (4000-5000Rs/mth). In addition, there are two male machine operators who are paid 7,000-7,500Rs/mth. Workers are provided with half face masks.

They manufacture about 12-15T of plastic flakes ("crush") (23%) and pellets (77%) per month, which they sell at an average price of 35-40Rs/kg and 45-55Rs/kg respectively<sup>19</sup>. The "crush" is used by plastics manufacturers for making lower quality items, such as gas cylinder caps, where the cap is primarily a safety feature.

The crush and pellets are sold to individuals and factories, including Mr Justin (Negombo) and Kings Plastics (Negombo) and Rodrigo & Sons (Moratuwa, 55km away). These are mainly small-medium scale plastics manufacturers. For example, Rodrigo & Sons makes LPG gas cylinder lids for BP and rabies vaccine release collars for dogs.

<sup>17</sup> NMC labourers confirmed this, indicating that they have stopped taking waste plastics to Speed Pallets because the recycling factory has cut the price they pay for waste plastics from 10Rs/kg to 5Rs/kg (note that this is a slightly lower price than advised by Speed Pallets during the survey).

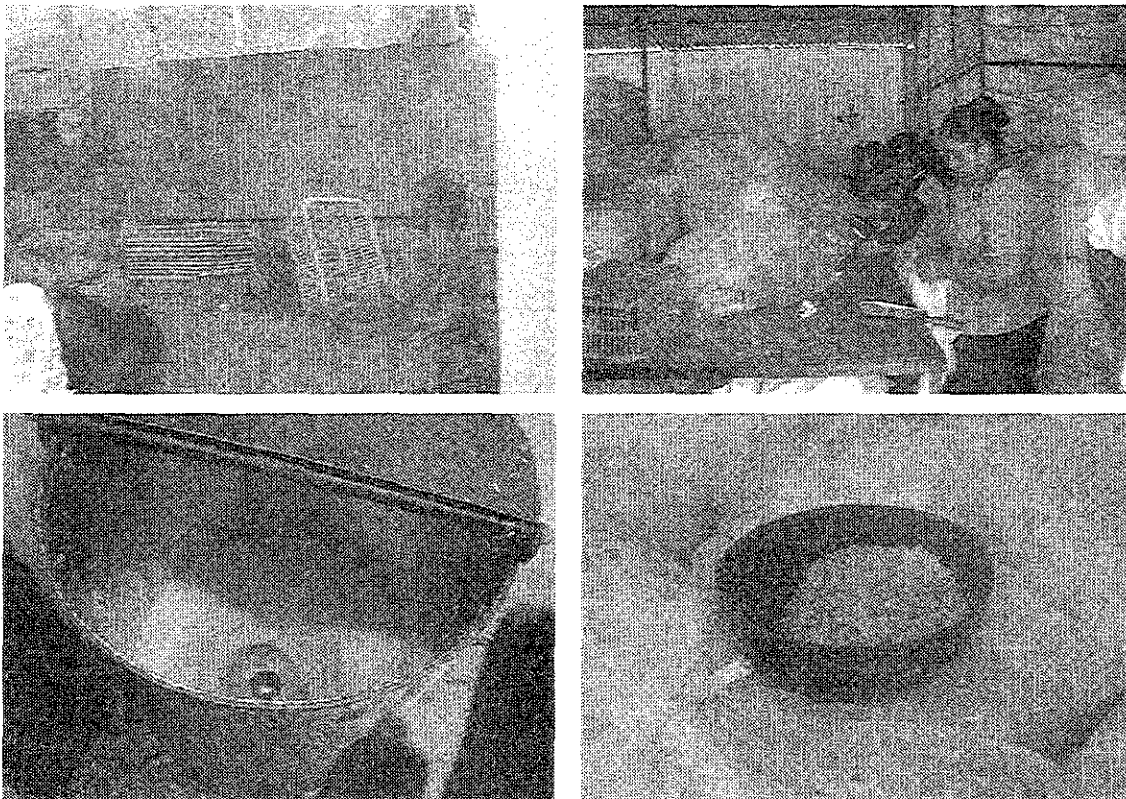
<sup>18</sup> The granulator comprises a cylindrical container with rotor, which rotates at high speed, generating a lot of heat. Polythene bags are fed into it from the top, with a small quantity of water being added periodically, with the polythene bags being shredded and melted, forming flakes or granules. According to the owner, granulation results in higher quality plastic pellets being produced compared with feeding soft plastics directly into a pelletiser. It can process around 90kg/h and was built from information and advice received via the internet.

<sup>19</sup> Compared with 75-90Rs/kg or even 110Rs/kg (PP) for virgin pellets (including taxes).

Total monthly expenditure and income are around Rs0.54 million and Rs0.8 million, giving a net income of Rs0.26 million per month. These figures are consistent with their purchases and sales data. Their main costs are for raw materials (e.g. waste plastics, pigments) and transport (400,000 Rs/mth), followed by labour, utility costs (mainly electricity and water) and machinery maintenance (140,000 Rs/mth).

They produce about 150kg/mth of waste materials (mainly reject plastics and some waste paper) which they burn or bury on site.

Their main problem relates to cash flow, as they have a bank overdraft with a 30-32% interest rate, while some of their customers may take 2-3 months to pay them. They would also like to make some improvements to their facility, including installing a steam washing process and underground tank for storage/treatment of their washwater. However, they currently lack the necessary capital to do this. They consider that recycling could benefit from more government support and education/awareness raising programmes, especially in schools. Three schools have actually invited them to educate their students about recycling and source separation.



*Speed Pallets: Top left – washing; top right – cutting; bottom left – granulator; bottom right – plastic flakes*