

PART 7

SURVEYS PROCEDURE AND RESULTS

7.1 Survey on Waste Generation/Composition and Questionnaire of Households in Major Cities

1. The Objectives of the Survey

- To estimate the amount and composition of waste generated from households with identification of recyclable and currently recycled materials
- To identify and understand the existing storage and collection manner of waste and recyclables from households.

2. Study Areas

In order to meet the survey objective, a fieldwork was carried out from 26 September 2004 to 4 November 2004. The fieldwork involved the actual collection, weighing and sorting of waste samples, followed by direct interviewing with the selected household.

In this survey, the survey areas were selected according to the income level of the house, which is assumed here to be manifested through their house.

Table 1-1 Survey Area

Area	Type of House	Income level
Bangsar	Bungalow	High
Subang Jaya	Condominium	High
Bangsar	Apartment	Medium
Subang Jaya	Terrace	Medium
Kampung Haji Abdullah Hukum	Squatters	Low
San Peng, Kuala Lumpur	Flats	Low

3. Results

The surveys were carried out for 8 days continuously, and at the end the total number of sample collected were 100.

From the surveys, we have found that the overall major components of the wastes generated are as follows:

Table 1-2 Major Components of the Waste Generated

Categories		High income	Medium income	Low income	Average
Combustible					
1	Food waste	40.47	48.62	55.02	48.04
2	Bones	1.69	0.52	1.57	1.26
3	Mix paper	16.34	20.09	14.84	17.09
4	Plastics (F)	4.46	5.33	6.25	5.35
5	Plastics (R)	3.53	4.18	3.47	3.73
6	Polystyrene	0.41	0.85	0.47	0.58
7	Textile	0.92	0.92	3.70	1.85
8	Rubber & Leather	4.75	0.25	0.47	1.82
9	Wood	0.09	0.34	0.23	0.22
10	Yard waste	14.20	5.40	0.15	6.58
11	Diapers	6.36	2.06	6.75	5.06
Sub-total for combustible		93.19	88.53	92.90	91.57
Incombustible					
12	Glass	3.40	4.33	3.41	3.71
13	Ferrous	1.25	1.81	1.76	1.61
14	Non-ferrous	0.01	0.05	0.00	0.02
15	Aluminium	0.52	0.47	0.13	0.37
16	Batteries*	0.00	0.04	0.06	0.03
17	Electrical & Electronics	0.08	0.02	0.43	0.18
18	Others	1.57	4.75	1.32	2.55
Sub-total for Incombustible		6.81	11.47	7.11	8.47
Total		100.00	100.00	100.00	100.00

Food waste constitute the highest amount in all three income categories i.e. 55.02% for low income areas, 48.62% for medium income areas and 40.47% for high income area and this finding was similar to those carried out previously.

The average food waste from the three different income areas was 48.04%. Beside the food wastes, bones were also sorted from the waste samples and the results show that the average amount of bones in the wastes is 1.26%.

In addition, the overall average combustible waste generated was 91.57% and non-combustible waste was 8.47%. The percentage of combustible to non-combustible wastes was found quite similar at different income areas, i.e. 93.19% combustible and 6.81% of non-combustible wastes for high income areas, 88.53% combustible and 11.47% of non-combustible wastes for medium income areas, 92.90% combustible and 8.47% of non-combustible wastes for high income areas

In terms of recyclable materials, it was found that in overall about 31.86% of major recyclable materials were disposed of from the households, this includes mainly mixed papers, mixed plastics, glass, ferrous metals, non-ferrous metals including some aluminium. Some other special wastes recorded were waste batteries (0.03%) and electronic wastes (0.18%).

However, it should be noted that some recyclable materials were being retained in the households instead of disposing it into the waste bins, especially the old newspapers and aluminium cans etc.

The waste generation rates from households were also determined in this study in terms of per capita rate. It was found that the per capita rates from households in this study ranged from 0.26 to 0.58kg/capita/day with an average of 0.45 kg/capita/day. It should be noted that this generation rate is taking consideration of only wastes that were being disposed of from the households, excluding some recyclable materials that were being retained in the households. When taking into account the retained recyclable materials (14.1%), the average per capita generation rate has increased to about 0.53kg/capita/day.

This survey also found out that big portions of the recyclable materials were not being separated and disposed of into the waste bins (53.10%). Besides, more common practice of disposing the recyclable materials is to sell or give the materials to the door-to-door collectors (16.6%). Only small portions of the recyclable materials were being sent to the recycling centres (6.10%).

In this survey, 12 food waste samples were sent for laboratory analysis in order to determine the moisture contents. The results show that the moisture contents ranged from 58.25% to 69.70% with an average of 64.82%.

In summary, this survey provides important results that were generated primarily from various categories of households in Kuala Lumpur and nearby areas. The findings obtained in this survey serves as basic and important data for planning and designing an effective solid waste management system. However, it should be noted that even though this survey was done focusing on different income areas and types of households (condominium, apartment, terrace, squatters, flats and bungalow), the results from other areas of the country may be different due to the differences in terms of standard of living, lifestyle as well as other local conditions.

Summarised Results and Data:

Table 1: Sampling locations and number of samples collected

No.	Location	No. samples	Category
1	Bangsar (Bungalow)	10	High income
2	Subang (Condominium)	15	High income
3	Subang Jaya (Terrace)	25	Medium income
4	Bangsar (Apartment)	20	Medium income
5	Kg. Abdullah Hukum (Squatter)	10	Low income
6	San Peng (Flat)	20	Low income
	Total	100	

Table 3: Waste Composition for Medium Income Group

Study Area	Menara Bangsar Apartment		Subang Jaya Terrace Houses		Average
	Unit in %		Unit in %		
<i>Organic</i>					
1	Food waste	45.03	52.21	48.62	48.62
2	Bones	0.24	0.80	0.52	0.52
3	Mix paper	26.00	14.18	20.09	20.09
4	Plastics (F)	6.08	4.58	5.33	5.33
5	Plastics (R)	4.29	4.07	4.18	4.18
6	Polystyrene	0.76	0.93	0.85	0.85
7	Textile	0.97	0.87	0.92	0.92
8	Rubber & Leather	0.22	0.27	0.25	0.25
9	Wood	0.44	0.23	0.34	0.34
10	Yard waste	2.76	8.03	5.40	5.40
11	Diapers	3.46	0.66	2.06	2.06
	Sub-total (Organic)	90.24	86.82	88.53	88.53
<i>Inorganic</i>					
12	Glass	6.48	2.18	4.33	4.33
13	Ferrous	1.97	1.65	1.81	1.81
14	Non-ferrous	0.03	0.06	0.05	0.05
15	Aluminium	0.67	0.27	0.47	0.47
16	Batteries	0.06	0.02	0.04	0.04
17	Electrical & Electronics	0.00	0.04	0.02	0.02
18	Others	0.54	8.95	4.75	4.75
	Sub-total (Inorganic)	9.76	13.18	11.47	11.47
TOTAL		100	100	100	100

Table 2: Waste Compositions of High Income Areas

Study Area	Bungalows Bangsar		Condominium Subang		Average
	Unit in %		Unit in %		
<i>Organic</i>					
1	Food waste	36.30	44.64	40.47	40.47
2	Bones	0.17	3.21	1.69	1.69
3	Mix paper	14.45	18.22	16.34	16.34
4	Plastics (F)	4.53	4.38	4.46	4.46
5	Plastics (R)	3.95	3.10	3.53	3.53
6	Polystyrene	0.42	0.39	0.41	0.41
7	Textile	0.53	1.30	0.92	0.92
8	Rubber & Leather	7.82	1.68	4.75	4.75
9	Wood	0.08	0.10	0.09	0.09
10	Yard waste	28.14	0.26	14.20	14.20
11	Diapers	0.15	12.56	6.36	6.36
	Sub-total (Organic)	96.55	89.83	93.19	93.19
<i>Inorganic</i>					
12	Glass	1.76	5.04	3.40	3.40
13	Ferrous	1.17	1.32	1.25	1.25
14	Non-ferrous	0.00	0.01	0.01	0.01
15	Aluminium	0.51	0.52	0.52	0.52
16	Batteries	0.00	0.00	0.00	0.00
17	Electrical & Electronics	0.00	0.16	0.08	0.08
18	Others	0.01	3.13	1.57	1.57
	Sub-total (Inorganic)	3.45	10.17	6.81	6.81
TOTAL		100	100	100	100

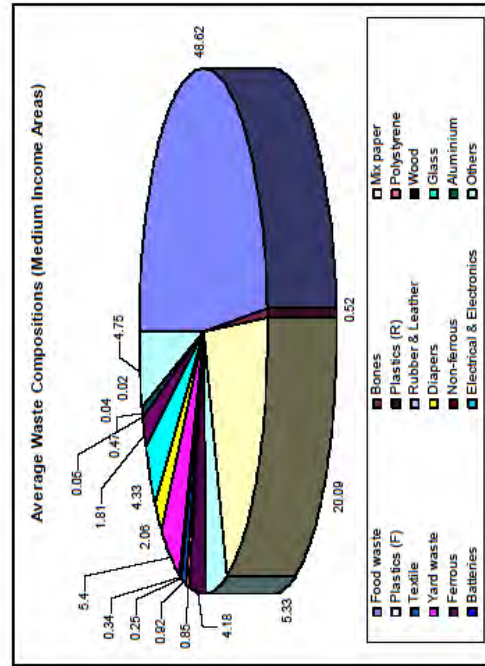


Figure 2: Average Waste Composition for Medium Income Areas

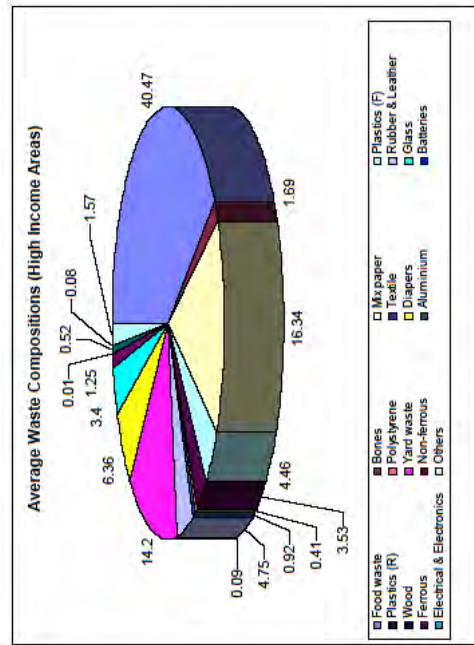


Figure 1: Average Waste Composition for High Income Areas

Table 5: Overall Waste Compositions for the Study

Categories	Unit in %				Average
	High income	Medium income	Low income	Average	
<i>Organic</i>					
1 Food waste	40.47	48.62	55.02	48.04	
2 Bones	1.69	0.52	1.57	1.26	
3 waste papers	16.34	20.09	14.84	17.09	
4 Plastics (F)	4.46	5.33	6.25	5.35	
5 Plastics (R)	3.53	4.18	3.47	3.73	
6 Polystyrene	0.41	0.85	0.47	0.58	
7 Textile	0.92	0.92	3.70	1.85	
8 Rubber & Leather	4.75	0.25	0.47	1.82	
9 Wood	0.09	0.34	0.23	0.22	
10 Yard waste	14.20	5.40	0.15	6.58	
11 Diapers	6.36	2.06	6.75	5.06	
Sub-total for organic	93.19	88.53	92.90	91.57	
<i>Inorganic</i>					
12 Glass	3.40	4.33	3.41	3.71	
13 Ferrous	1.25	1.81	1.76	1.61	
14 Non-ferrous	0.01	0.05	0.00	0.02	
15 Aluminium	0.52	0.47	0.13	0.37	
16 Batteries*	0.00	0.04	0.06	0.03	
17 Electrical & Electronics	0.08	0.02	0.43	0.18	
18 Others	1.57	4.75	1.32	2.55	
Sub-total for inorganic	6.81	11.47	7.11	8.47	
TOTAL	100	100	100	100	

Table 4: Waste Composition for Low Income Residential Area

Study Area	Unit in %		Average
	Squatters Hj. Abd. Hukum	Sam Peng Flats	
<i>Organic</i>			
1 Food waste	53.79	56.25	55.02
2 Bones	2.23	0.91	1.57
3 Mix paper	15.77	13.91	14.84
4 Plastics (F)	6.63	5.87	6.25
5 Plastics (R)	3.21	3.72	3.47
6 Polystyrene	0.61	0.32	0.47
7 Textile	0.58	6.81	3.70
8 Rubber & Leather	0.14	0.79	0.47
9 Wood	0.20	0.25	0.23
10 Yard waste	0.08	0.22	0.15
11 Diapers	10.01	3.48	6.75
Sub-total (organic)	93.25	92.54	92.90
<i>Inorganic</i>			
12 Glass	4.67	2.15	3.41
13 Ferrous	1.96	1.55	1.76
14 Non-ferrous	0.00	0.00	0.00
15 Aluminium	0.04	0.21	0.13
16 Batteries	0.03	0.09	0.06
17 Electrical & Electronics	0.04	0.81	0.43
18 Others	0.00	2.64	1.32
Sub-total (inorganic)	6.75	7.46	7.11
Total	100	100	100

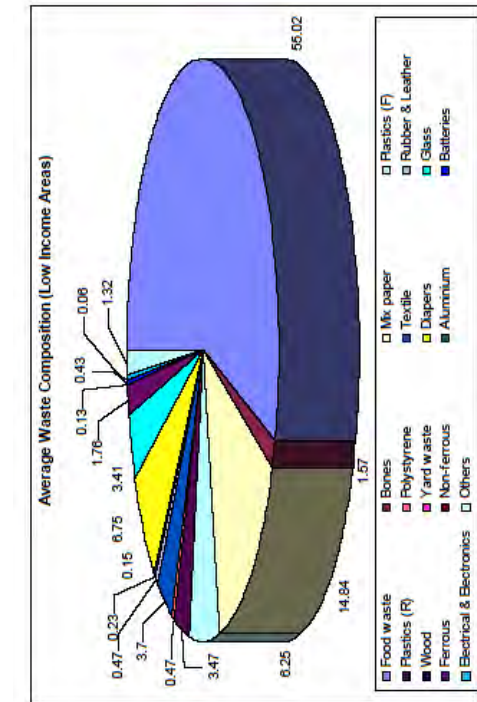


Figure 3: Average Waste Composition for Low Income Areas

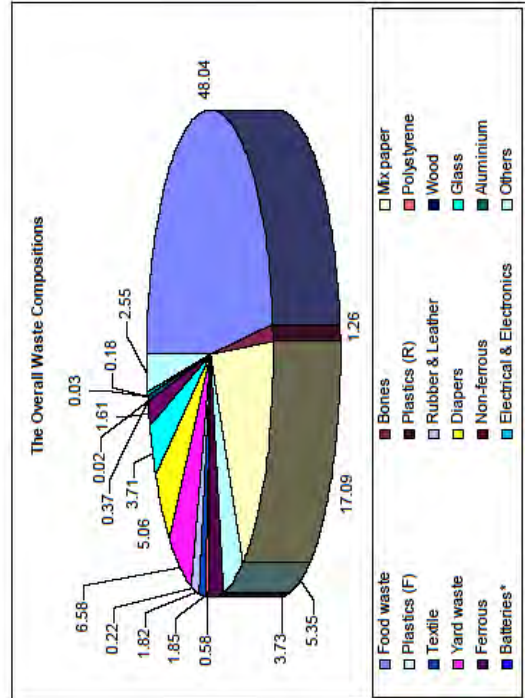


Figure 4: The Overall Average Waste Composition for the Study

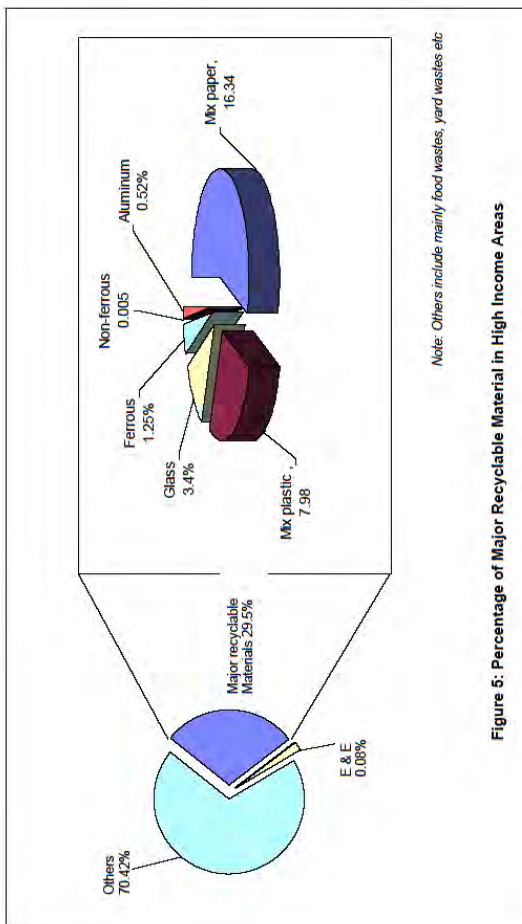


Figure 5: Percentage of Major Recyclable Material in High Income Areas

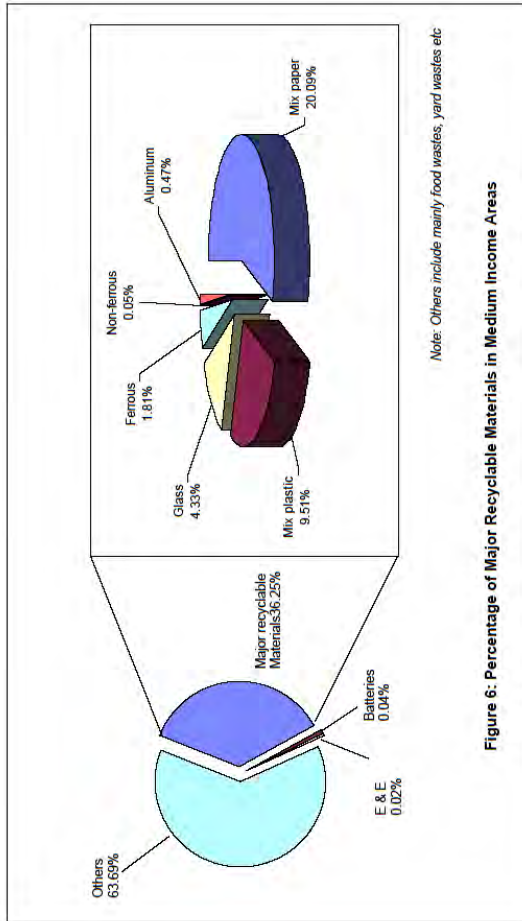


Figure 6: Percentage of Major Recyclable Materials in Medium Income Areas

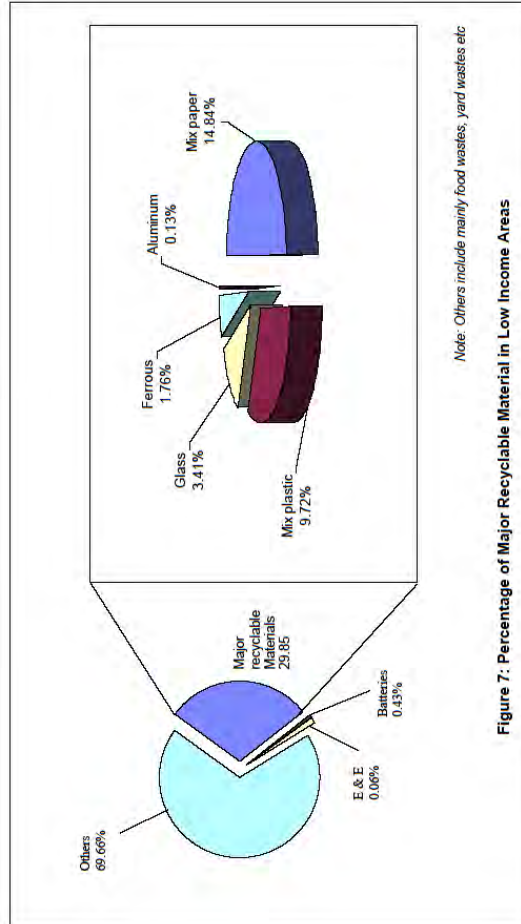


Figure 7: Percentage of Major Recyclable Material in Low Income Areas

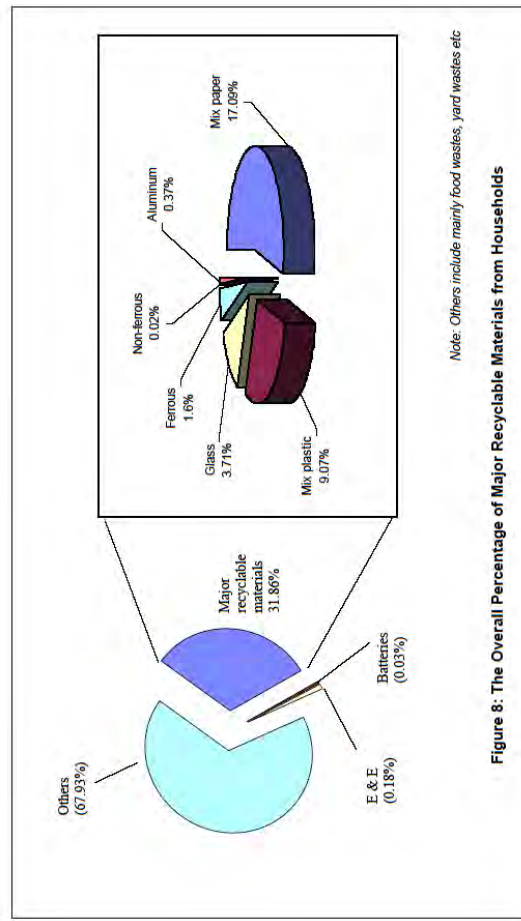


Figure 8: The Overall Percentage of Major Recyclable Materials from Households

Table 6: Moisture Contents of Food Waste Samples

No	Sampling areas	Moisture content (%)	Average (%)
1	Bangsar Bungalow	61.1	58.25
		55.4	
2	Kg. Abdullah Hukum Squatters	71.4	69.70
		68.0	
3	Subang Jaya Terrace	76.6	68.05
		59.5	
4	Menara Bangsar Apartment	55.6	60.10
		64.6	
5	Sri Bayu Subang Condominium	70.5	64.15
		57.8	
6	San Peng Flat	64.0	68.65
		73.3	
AVERAGE			64.82

Table 7: Total Waste as Discarded in 8 days

	Total Wastes as Discarded in 8 Days (kg)						Average (kg)
	A	B	C	D	E	F	
Food wastes	97.72	112.22	104.45	275.13	74.23	110.87	129.10
Bones	0.47	8.06	0.56	4.23	3.08	1.80	3.03
Mixed papers	38.89	45.81	60.32	74.74	21.76	27.42	44.82
Plastics (F)	12.18	11.01	14.11	24.11	9.15	11.57	13.69
Plastics (R)	10.63	7.80	9.96	21.46	4.43	7.33	10.27
Foam Polystyrene	1.14	0.97	1.76	4.90	0.835	0.64	1.71
Textile	1.44	3.28	2.24	4.56	0.80	13.42	4.29
Rubber & Leather	21.05	4.22	0.50	1.40	0.20	1.56	4.82
Wood	0.22	0.25	1.02	1.21	0.28	0.49	0.58
Yard wastes	75.75	0.65	6.40	42.33	0.106	0.44	20.95
Diapers	0.40	31.57	8.02	3.46	13.81	6.86	10.69
Glass	4.75	12.67	15.04	11.50	6.45	4.24	9.11
Ferrous	3.15	3.32	4.58	8.72	2.70	3.06	4.26
Non-ferrous	-	0.02	0.06	0.31	-	0	0.07
Aluminium	1.36	1.31	1.56	1.43	0.06	0.41	1.02
Batteries	-	-	0.14	0.13	0.04	0.18	0.08
E&E Wastes	-	0.39	-	0.22	0.06	1.60	0.38
Others	0.02	7.86	1.26	47.14	-	5.21	10.25
Total	269.17	251.41	231.98	526.98	137.99	197.10	269.11
No. of Household	10	15	20	25	10	20	16.67
Kg/household/day	3.36	2.10	1.45	2.63	1.72	1.23	2.08
Average no of capita/household*	5.9	4.4	2.5	5.2	5.4	4.7	4.68
Kg/capita/day	0.57	0.48	0.58	0.51	0.32	0.26	0.45
Average Waste Generation Rate (Per Capita Rate) = 0.45 kg/cap/day							

* Note: A - Bangsar Bungalow; B - Sri Bayu Condo; C - Menara Bangsar Apartment; D - Subang Jaya Terrace; E - Kg. Abd. Hukum Squatters; F - San Peng Flats

Average numbers of capita/household were derived from dividing the total number of capita in the households by the total households surveyed.

Table 8: Main Categories of Wastes Generated (on Weight Basis)

	Average Waste As Discarded		
	kg/8-day	kg/H'hold/day	kg/person/day
Food Waste	129.10	0.96	0.21
Papers	44.82	0.34	0.07
Plastics (F)	13.69	0.10	0.02
Plastics (R)	10.27	0.08	0.02
Yard wastes	20.95	0.16	0.03
Diapers	10.69	0.08	0.02

Table 9: Main Categories of Wastes Generated (on Volume Basis)

	Waste Density (kg/m ³)	Average Waste As Discarded		
		m ³ /8-day	m ³ /H'hold/day	m ³ /person/day
Food Waste	290.7	0.44410	0.00330	0.00072
Papers	89.0	0.50360	0.00382	0.00079
Plastics (F)	65.3	0.20965	0.00153	0.00031
Plastics (R)	40.0	0.25675	0.00200	0.00050
Yard wastes	100.9	0.20763	0.00159	0.00030
Diapers	350.0	0.03563	0.00027	0.00007

Table 10: Main Categories of Wastes Generated (on Volume Basis)

	Waste Density (kg/m ³)	Average waste as Discarded	
		m ³ /cap/day	m ³ /cap/year
Mixed waste (as disposed at landfill)	207.57	0.002	0.79

**Table 11: Total Waste Generation Rates Per Capita Per Day
(Taken into Account the Recyclable Materials Retained at Home)**

	Average Waste As Discarded* (kg/cap/day)	Average waste Retained** (kg/capita/day)	Total waste generation Rate (kg/cap/day)	Waste Separated at Source (%)
1. Bangsar Bungalow	0.57	0.07	0.64	10.9
2. Sri Bayu Condo	0.48	0.08	0.56	14.3
3. Bangsar Apartment	0.58	0.11	0.69	15.9
4. S. Jaya Terrace	0.51	0.13	0.64	20.3
5. Kg. Hj. Abd. Hukum	0.32	0.06	0.38	15.8
6. San Peng Flat	0.26	0.02	0.28	7.1
Average	0.45	0.08	0.53	14.1

Note: * Results obtained from the actual field surveys

** Estimations were made based on the figures given in questionnaires surveyed

7.2 Survey on Recycling of Business Entities and Households

1. The Objective of the Survey

The main objective of the survey is to investigate the current status of waste management and recycling activities by different categories of business entities and households in the country.

2. Survey Areas

The survey was divided into two parts. In the first part, face-to-face interview was carried out and in the second part, the questionnaires were sent by mails. The face-to-face interview was carried out at five (5) main cities in Peninsular Malaysia and these cities were already determined and selected by the JICA Study Team. They are as follows:

- 1) Shah Alam, Selangor
- 2) Kuantan, Pahang
- 3) Georgetown, Pulau Pinang
- 4) Johor Bahru, Johor
- 5) Kuala Terengganu, Terengganu

The mailing survey was carried out on similar areas and some additional questionnaires were also mailed to manufacturers that are located in Perak, Melaka, Kedah, Kelantan etc. The summary of the survey areas is shown in Table 2-1.

Table 2-1 Summary of Survey Areas

No	Type of Survey	Survey Areas
1	Face-to-face Interviews	<ul style="list-style-type: none"> • Shah Alam, Selangor • Kuantan, Pahang • Georgetown, Pulau Pinang • Johor Bahru, Johor • Kuala Terengganu, Terengganu
2	Mailing Surveys	<ul style="list-style-type: none"> • Selangor - Shah Alam, Klang, Petaling Jaya, Subang Jaya etc. • Pahang - Kuantan, Pekan, Temerloh etc. • Pulau Pinang - Georgetown, Seberang Prai etc. • Johor - Johor Bahru, Skudai, Senai, Kulai etc. • Terengganu - Kuala Terengganu, Kemaman etc. • Melaka - Alor Gajah, Bukit Rambai, Air Keroh • Perak - Ipoh • Kedah - Alor Setar, Sungai Petani, Jitra, Kulim • Kelantan - Kota Bahru

3. Outline of the Survey Methodology

The survey covered two (2) categories, first is the business entity (manufacturers, commercial companies, offices, construction companies and service companies) and secondly the households (high, medium and low income houses). The detailed target groups for each category and some examples are shown in Table 2-2. Generally, the survey was carried out in two ways, i.e. face-to-face interview, and mailing surveys. The

mailing survey was further divided into two, first is by ordinary mails and second is by hand delivery to the targeted respondents.

Table 2-2 Examples of Target Categories

No.	Categories	Example of Targeted Respondent
1	Manufacturers	Electronic industry, furniture industry, food industry, plastic industry etc.
2	Commercial companies	Supermarket, hypermarket, shop lots (e.g. book shop, optical shop), restaurant etc.
3	Offices	Any offices mainly located at high-rise office buildings
4	Construction companies	Developers, civil engineering company, renovation company etc.
5	Service companies	Bank, hotel, institution, saloon, insurance company etc.
6	Households	High income - Bungalow, condominium Medium income - Terrace, apartment Low income - squatter, flat

4. Results

This survey presents information on the amounts and composition of waste generated from households and different business entities including offices, commercial and service companies, construction companies and manufacturers. The common types of waste generated, the quantity as well as the common way of disposal were investigated.

Overall, the results of the survey can be summarized in Table 2-3.

Table 2-3 Summary of the Survey

No	Sources	Estimated Generation Rate			
		Amount	Unit	Amount	Unit
1	Households	37.5	Kg/household/month	1.25	Kg/household/day
2	Commercial and Service Companies	133.1	Kg/company/month	4.43	Kg/company/day
3	Offices	51.8	Kg/office/month	1.73	Kg/office/day
4	Construction Companies	4,309.9	Tonnes/company/month	143.66	Tonnes/company/day
5	Manufacturers	521.0	Tonnes/m ³ facturer/month	17.37	Tonnes/ m ³ facturer/day

Note: Estimations were based on the following numbers of samples surveyed:

- 1) Households – 609 samples 2) Commercial and Service Companies – 162 samples
 3) Offices – 74 samples 4) Construction Companies – 88 samples 5) Manufacturers – 224 samples

Table 2-4 summarises the detailed results for each business entity and household including the common methods of disposal for each category of waste.

Table 2-4 Summary of the Entire Survey on Households and Business Entities

Source	Waste Categories and Amount Generated			
Household	Type	Quantity (kg/day)	Two Major Methods of Collection / Disposal	
			1	2
	Old newspapers	0.39	Gave/Sold to door-to-door buyer	Municipal Waste Collection
	Waste magazines	0.10	Gave/Sold to door-to-door buyer	Municipal Waste Collection
	Other papers	0.12	Gave/Sold to door-to-door buyer	Municipal Waste Collection
	Aluminium cans	0.02	Municipal Waste Collection	Gave/Sold to door-to-door buyer
	Steel cans	0.03	Municipal Waste Collection	Gave/Sold to door-to-door buyer
	PET bottles	0.01	Municipal Waste Collection	Gave/Sold to door-to-door buyer
	Other plastic bottles	0.03	Municipal Waste Collection	Bring to recycling centers
	Other plastics	0.02	Municipal Waste Collection	Bring to recycling centers
	Glass bottles	0.10	Municipal Waste Collection	Gave/Sold to door-to-door buyer
	Other glass	0.01	Municipal Waste Collection	Bring to recycling centers
	Kitchen wastes	0.42	Municipal Waste Collection	Animal Feed
	Garden wastes	-	Municipal Waste Collection	Buried
Others	0.01	Depending	Depending	
Total	1.26	-	-	
Office	Type	Quantity (kg/day)	Two Major Methods of Collection / Disposal	
			1	2
	Old newspapers	0.71	Sold / given free to recyclers / collectors	Collected by waste municipal collectors
	Waste magazines	0.09	Sold / given free to recyclers / collectors	Collected by waste municipal collectors
	Other papers	0.64	Sold / given free to recyclers / collectors	Collected by waste municipal collectors
	Aluminium cans	0.08	Collected by waste municipal collectors	Sold / given free to recyclers / collectors
	Steel cans	0.02	Collected by waste municipal collectors	Given free to recyclers / collectors
	PET bottles	0.02	Collected by waste municipal collectors	Given free to recyclers / collectors
	Kitchen wastes	0.06	Collected by waste municipal collectors	Given free to recyclers / collectors
	Others	0.11	Depending	Depending
Total	1.73	-	-	

Source	Waste Categories and Amount Generated					
Commercial/Service	Type	Quantity (kg/day)	Two Major Methods of Collection / Disposal			
			1	2		
	Old Newspapers	0.73	Sold / given free to recyclers / collectors		Collected by waste municipal collectors	
	Waste Magazines	0.22	Sold / given free to recyclers / collectors		Others	
	Other Papers	1.81	Sold / given free to recyclers / collectors		Collected by waste municipal collectors	
	Aluminium Cans	0.06	Collected by waste municipal collectors		Sold / given free to recyclers / collectors	
	Steel cans	0.22	Collected by waste municipal collectors		Sold / given free to recyclers / collectors	
	PET bottles	0.25	Collected by waste municipal collectors		Sold / given free to recyclers / collectors	
	Kitchen wastes	0.52	Collected by waste municipal collectors		Others	
	Others	0.62	Depending		Depending	
Total	4.43	-		-		
Construction	Type	Quantity (kg/day)	Two Major Methods of Collection / Disposal			
			1	2		
	Excess soil	41.26	Reuse for backfilling		Sent to Landfill	
	Concrete	3.65	Reuse for backfilling		Sent to Landfill	
	Asphalt-concrete	0.36	Sent to Landfill		Reuse for backfilling	
	Wood	0.53	Collected by waste collector		Sent to Landfill	
	Slurry / Sludge	96.51	Sent to Landfill		Dumped to vacant land	
	Mixed waste	0.50	Sent to Landfill		Collected by waste collector	
	Ferrous metals	0.34	Sold to recycler / buyers		Collected by waste collector	
	N-Ferrous metals	0.42	Sold to recycler / buyers		Collected by waste collector	
	Waste plastics	0.05	Collected by waste collector		Sold to recycler / buyers	
	Waste papers	0.03	Sold to recycler / buyers		Collected by waste collector	
	Asbestos	0.01	Dumped to vacant land		Others	
Others	0.003	Depending		Depending		
Total	143.66	-		-		
Manufacturers	Type	On-site			Off-site	
		Reuse/ Recycle	Treatment	Storage / Disposal	Recycling	Collection/ Treatment / Disposal
	Wastes from Process Sources (Average = 521.03 tonnes/ manufacturer / month)	3.8% (19.80 tonnes /month)	2.2% (11.46 tonnes /month)	2.4% (12.50 tonnes /month)	27.9% (145.37 tonnes /month)	63.7% (331.90 tonnes /month)
Wastes from Non-process Sources (Average = 420.14 kg/ manufacturer / month)	0.2% (0.84kg/ month)	1.0% (4.20kg /month)	0.6% (2.52kg /month)	15.1% (63.44kg /month)	83.0% (348.72kg /month)	

Summarised Results/ Data:

Table 1: Summary of Study Areas

No	Type of Survey	Study Areas
1	Face-to-face Interviews	<ul style="list-style-type: none"> • Shah Alam, Selangor • Kuantan, Pahang • Georgetown, Pulau Pinang • Johor Bahru, Johor • Kuala Terengganu, Terengganu
2	Mailing Surveys	<ul style="list-style-type: none"> • Selangor - Shah Alam, Klang, Petaling Jaya, Subang Jaya etc. • Pahang - Kuantan, Pekan, Temerloh etc. • Pulau Pinang - Georgetown, Seberang Prai etc. • Johor - Johor Bahru, Skudai, Senai, Kulai etc. • Terengganu - Kuala Terengganu, Kemaman etc. • Melaka - Alor Gajah, Bukit Rambai, Air Keroh • Perak - Ipoh • Kedah - Alor Setar, Sungai Petani, Jitra, Kulim • Kelantan - Kota Bahru

Table 2: Examples of Target Categories

No	Categories	Example of Targeted Respondent
1	Manufacturers	Electronic industry, furniture industry, food industry, plastic industry etc.
2	Commercial companies	Supermarket, hypermarket, shop lots (e.g. book shop, optical shop), restaurant etc.
3	Offices	Any offices mainly located at high-rise office buildings
4	Construction companies	Developers, civil engineering company, renovation company etc.
5	Service companies	Bank, hotel, institution, saloon, insurance company etc.
6	Households	High income - Bungalow, condominium Medium income - Terrace, apartment Low income - squatter, flat

Table 3: Questionnaires Sent by Mails

No	Hand Delivery		Ordinary Mails	
	Targets	Number	Targets	Number
1	Households	950	Households	1,045
2	Offices	250	Manufacturers	1,000
3	Commercial	250	Construction	250
4	Services	250	-	-
Sub-Total		1,700		2,295
TOTAL			3,995	

Note: All mails were sent on 5/11/04 and deadline for return of questionnaire is 15/12/04

**Table 4: Distributions of the Returned Questionnaires
 (Interviews & Mails)**

	Interview	Mailing			Total Returned Questionnaires
		Sent	Returned	%	
<i>A) Business Entities</i>					
Offices	59	250	15	6.0	74
Commercial and Services	121	500	41	8.2	162
Construction Companies	69	250	19	7.6	88
Manufacturers	192	1,000	35	3.5	227
SUB-TOTAL	441	2,000	110	5.5	551
<i>B) Households</i>					
Households	201	1,995	408	20.5	609
GRAND TOTAL	642	3,995	518	13.0	1,160

Table 5: Distributions of the Questionnaires by Areas

	KL / Selangor	Penang	Johor	Kuantan	Kuala T'ganu	TOTAL
Offices	31	5	10	5	8	59
Commercial and Services	71	10	18	10	12	121
Construction Companies	45	5	9	5	5	69
Manufacturers	100	20	32	21	19	192
Households	102	20	40	20	19	201
TOTAL	349	60	109	61	63	642
Questionnaires returned by mails						518
Total questionnaires returned (interviews and mailing)						1,160

A) HOUSEHOLDS

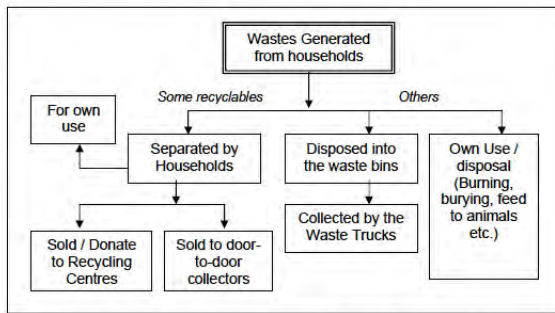


Figure 1: Summary of the Handling of Waste Generated from Households

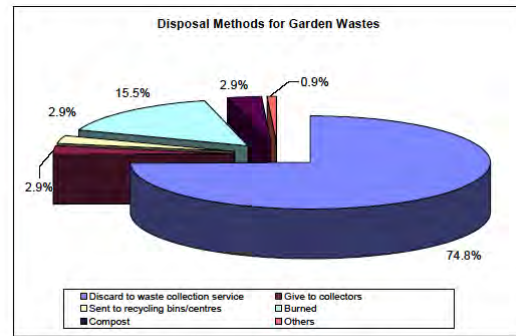


Figure 3: Disposal Methods of Garden Wastes

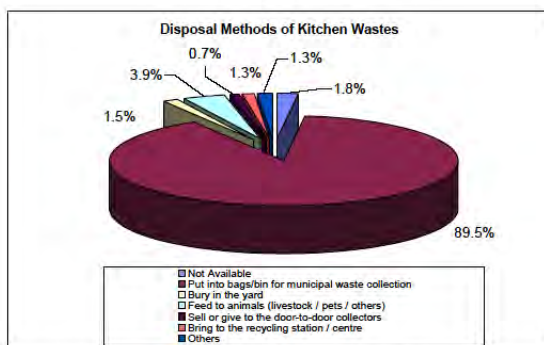


Figure 2: Disposal Methods of Kitchen Wastes

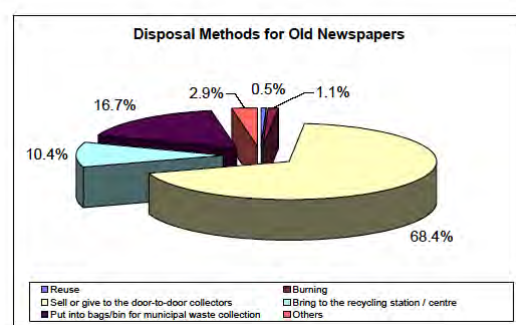


Figure 4: Disposal Methods of Old Newspapers

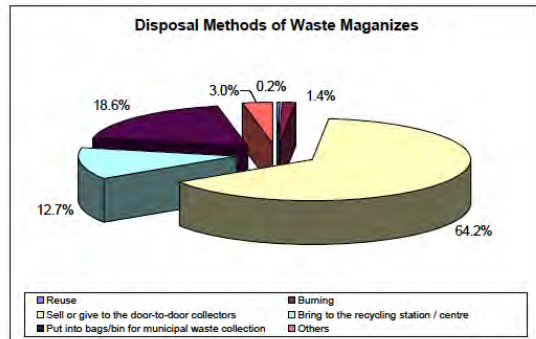


Figure 5: Disposal Methods of Waste Magazines

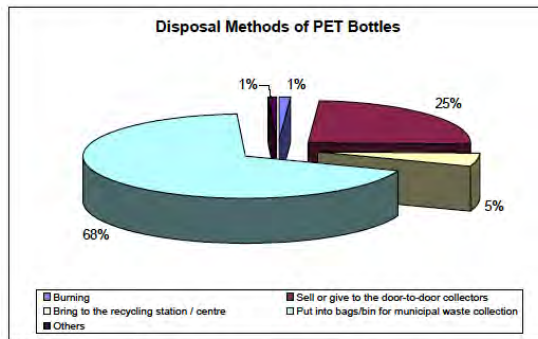


Figure 7: Disposal Methods of PET Bottles

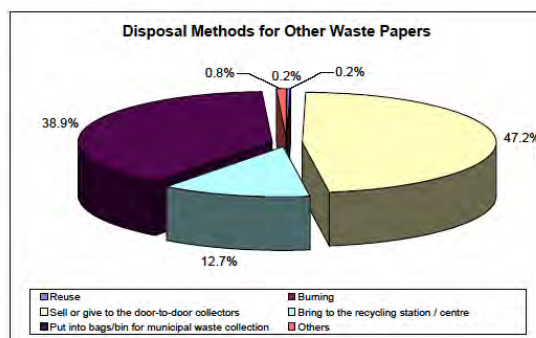


Figure 6: Disposal Methods of Other Waste Papers

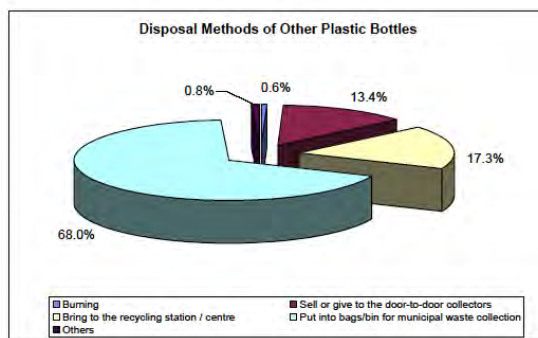


Figure 8: Disposal Methods of Other Plastic Bottles

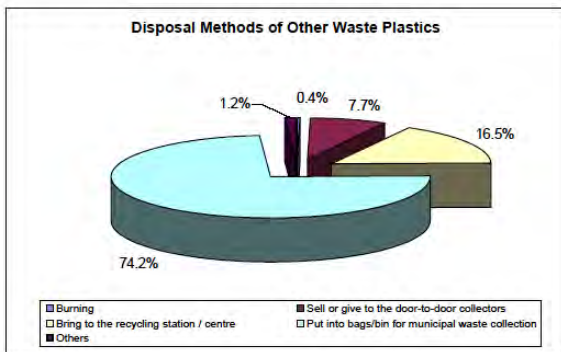


Figure 9: Disposal Methods of Other Waste Plastics

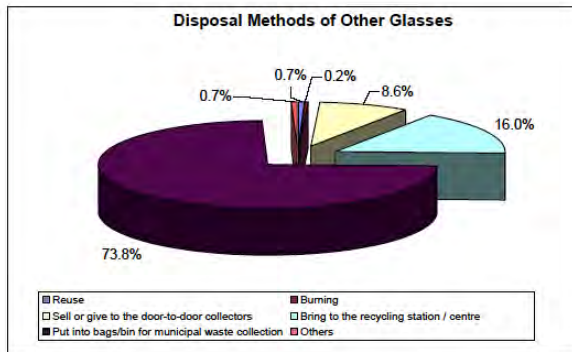


Figure 11: Disposal Methods of Other Glasses

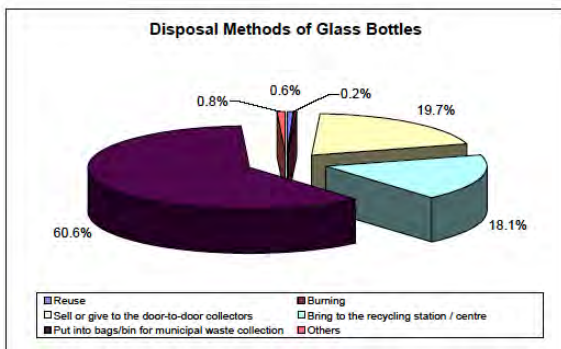


Figure 10: Disposal Methods of Glass Bottles

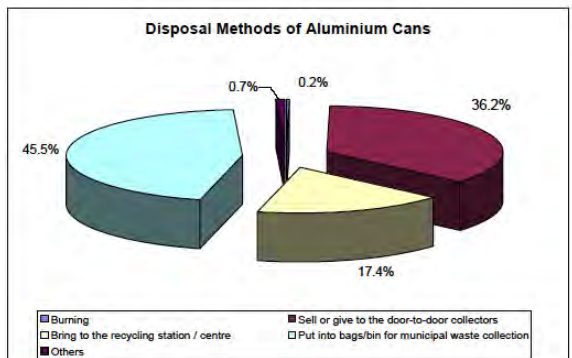


Figure 12: Disposal Methods of Aluminium Cans

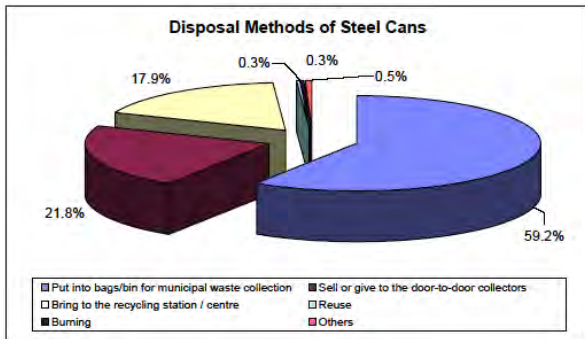


Figure 13: Disposal Methods of Steel Cans

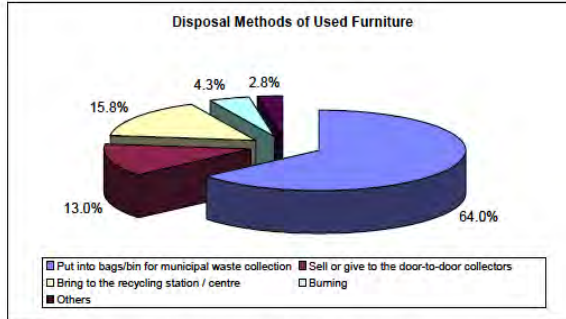


Figure 15: Disposal Methods of Used Furniture

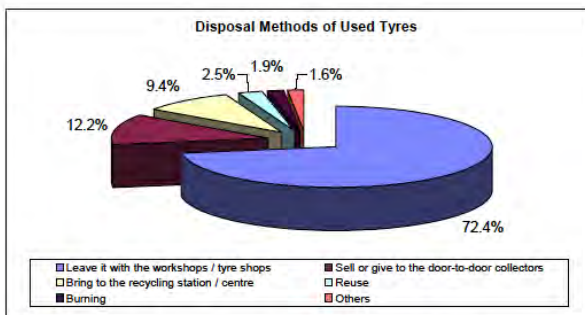


Figure 14: Disposal Methods of Used Tyres

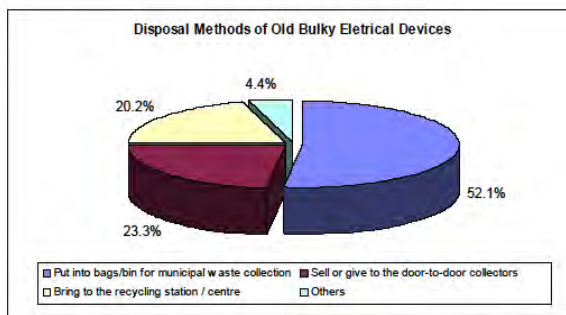


Figure 16: Disposal Methods of Old Bulky Electrical Devices

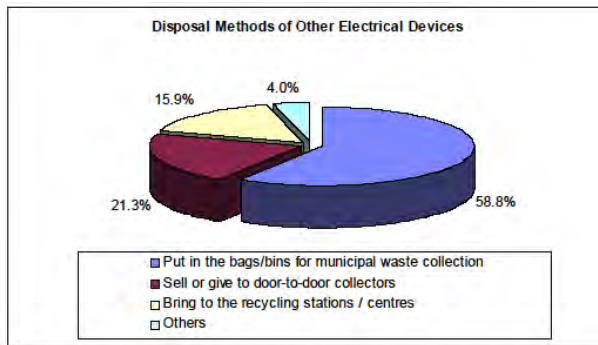
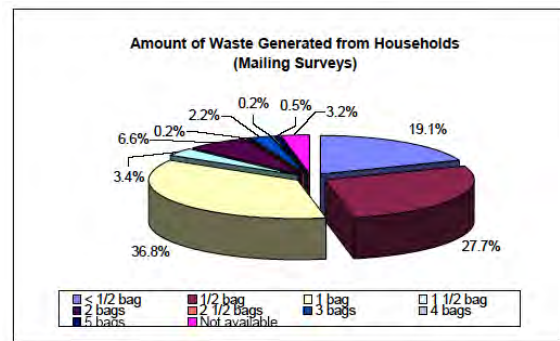


Figure 17: Disposal Methods of Other Electrical Devices



Note: Estimated bag size = 5kg rice bag

Figure 19: Amount of Waste Generated from Households (Mailing Surveys)

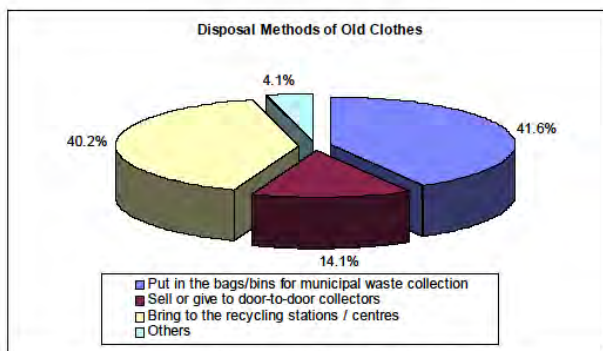


Figure 18: Disposal Methods of Old Clothes

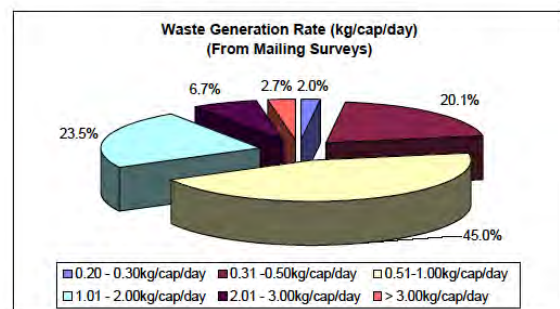


Figure 20: Waste Generation Rate (kg/cap/day)

Table 6: Amount of Waste Generated from Households

No	Waste Materials	Total (kg)	Average (kg/H'hold/week)	Average (kg/H'hold/day)
1	Old newspapers	553.0	2.74	0.39
2	Waste magazines	137.1	0.68	0.10
3	Other papers	172.1	0.85	0.12
4	Aluminium cans	28.4	0.14	0.02
5	Steel cans	39.5	0.20	0.03
6	PET bottles	12.4	0.06	0.01
7	Other plastic bottles	37.5	0.19	0.03
8	Other plastics	3.13	0.15	0.02
9	Glass bottles	145.1	0.72	0.10
10	Other glass	13.5	0.07	0.01
11	Kitchen wastes	589.2	2.92	0.42
12	Others	13.6	0.07	0.01
Total			8.79	1.26
Per Capita Generation Rate (kg)			-	0.25

Note: Total number of samples surveyed = 202; average number of people per household = 5

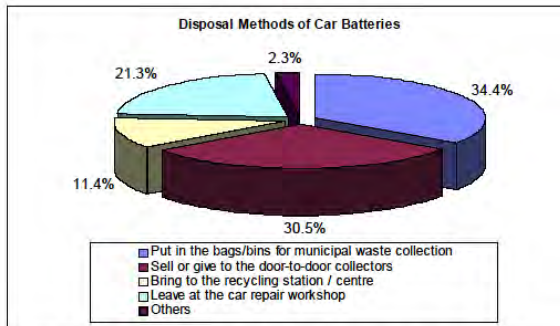


Figure 22: Disposal Methods of Car Batteries by Households

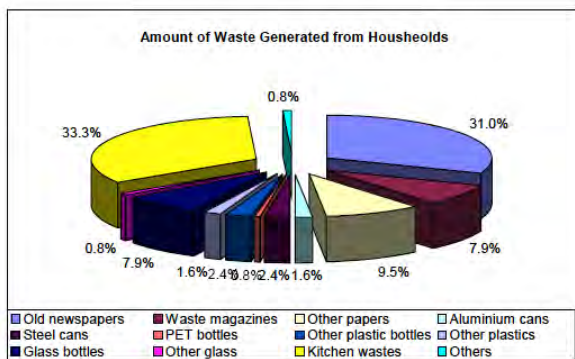


Figure 21: Amount of Waste Generated from Households

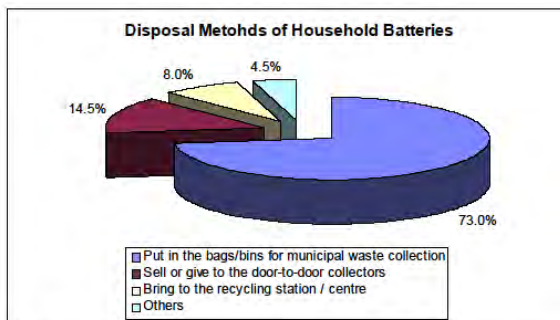


Figure 23: Disposal Methods of Dry Cell Batteries by Households

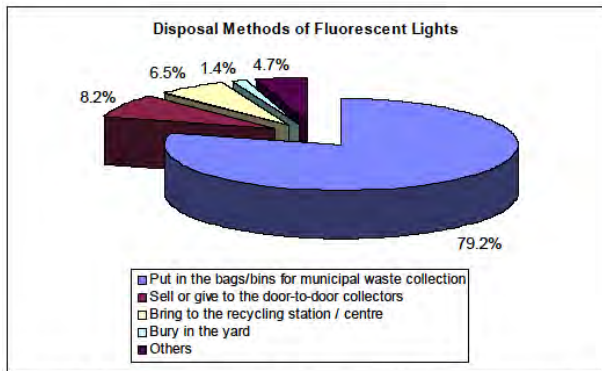


Figure 24: Disposal Methods of Fluorescent Lights by Households

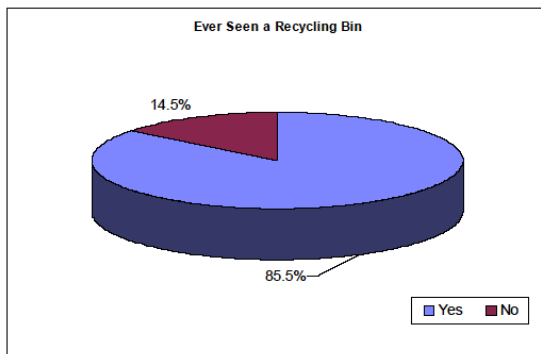


Figure 26: Household Responses whether they have seen Recycling Bins

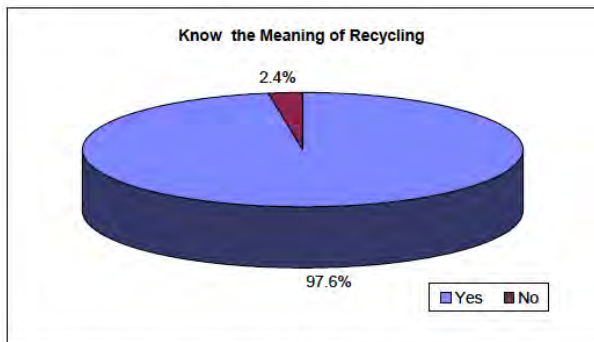


Figure 25: Knowledge of Household Respondents about the Meaning of Recycling

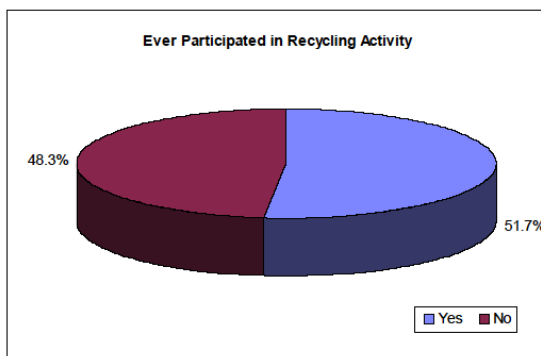


Figure 27: Household Responses whether they have Participated in Recycling Activities

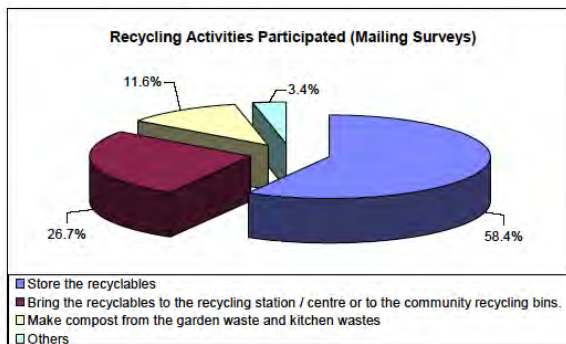


Figure 28: Types of Recycling Activities Participated by the Households (From Mailing Surveys)

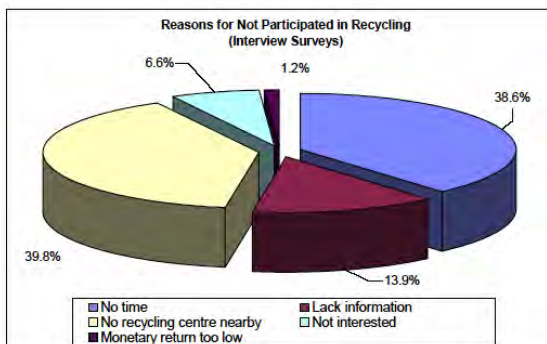


Figure 30: Reasons for not Participating in Recycling Activities

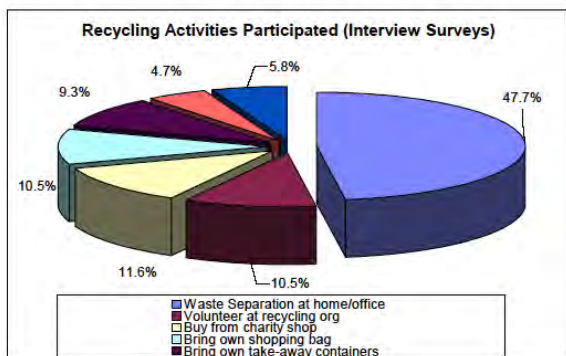


Figure 29: Types of Recycling Activities Participated by the Households (From Interview Surveys)

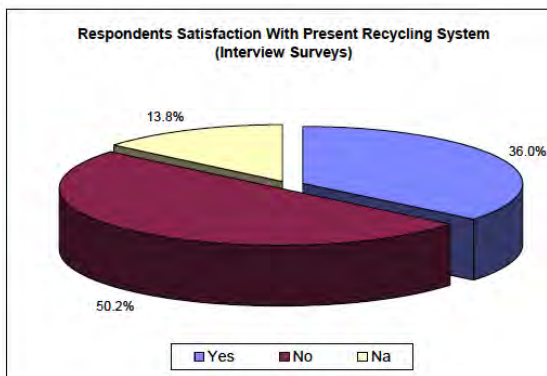


Figure 31: Respondents Satisfaction on the Present Recycling Systems

Table 7: Average Number and Estimated Lifespan of selected Furniture and Electrical Appliances in Households

No	Item	Number in House		Average Estimated Lifespan (Years)
		Total	Average	
1	Car	236	1.2	8.2
2	Motorbikes	182	0.9	8.7
3	Bicycles	157	0.8	6.2
4	Cupboards	511	2.5	8.8
5	Beds	626	3.1	8.3
6	Chairs	1087	5.4	8.2
7	Tables	364	1.8	8.3
8	Television	257	1.3	8.9
9	Refrigerators	202	1.0	10.5
10	Washing machines	194	1.0	8.8
11	Air conditional	116	0.6	8.1
12	Computers	104	0.5	5.1

Note: Total number of questionnaires collected was 202 (from interview only)

Table 8: Amount of Waste Generated from Commercial and Service Companies

No	Waste Materials	Total (kg)	Average (kg/Company/month)	Average (kg/Company/day)
1	Old newspapers	3,539.20	22.00	0.73
2	Waste magazines	1,083.40	6.70	0.22
3	Other papers	8,754.80	54.40	1.81
4	Aluminium cans	276.50	1.70	0.06
5	Steel cans	1,050.60	6.50	0.22
6	PET bottles	1,222.70	7.60	0.25
7	Kitchen wastes	2,488.50	15.50	0.52
8	Others	3,009.10	18.70	0.62
Total			133.10	4.43

Note: Total number of samples surveyed = 161

B) BUSINESS ENTITIES

Commercial and Services Companies

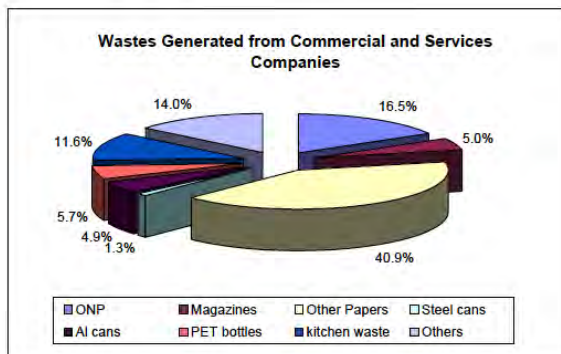


Figure 32: Wastes Generated from Commercial and Service Companies

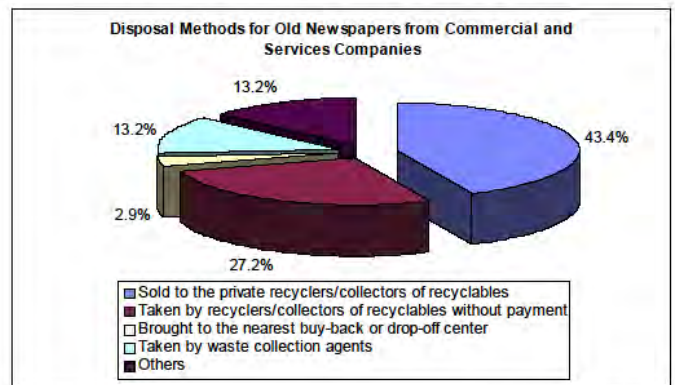


Figure 33: Disposal Methods for Old Newspapers from Commercial and Service Companies

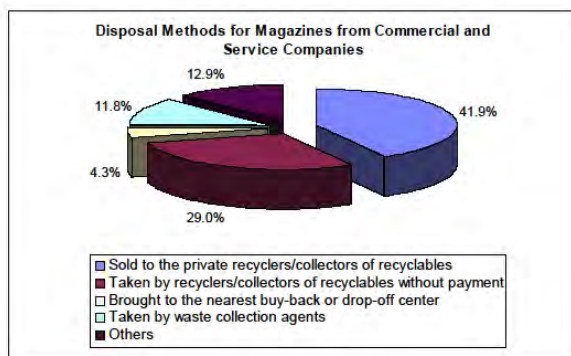


Figure 34: Disposal Methods for Magazines from Commercial and Service Companies

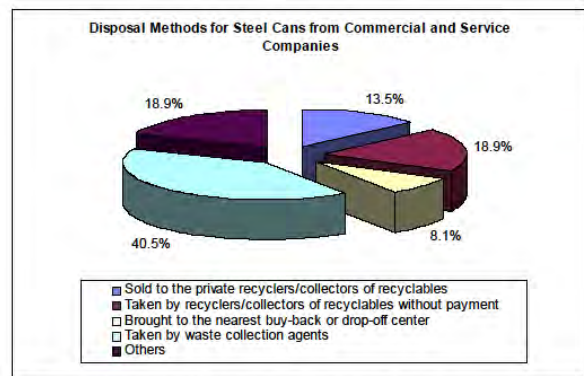


Figure 36: Disposal Methods for Steel Cans from Commercial and Service Companies

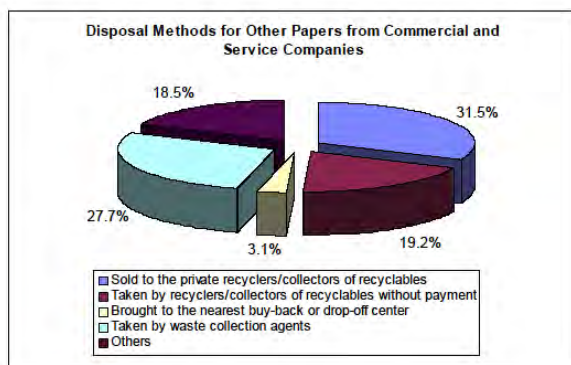


Figure 35: Disposal Methods for Other Papers from Commercial and Service Companies

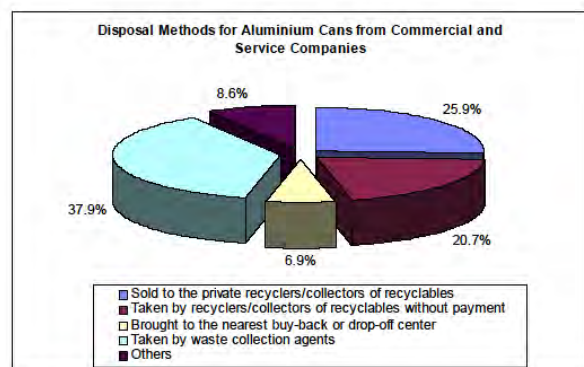


Figure 37: Disposal Methods for Aluminium Cans from Commercial and Service Companies

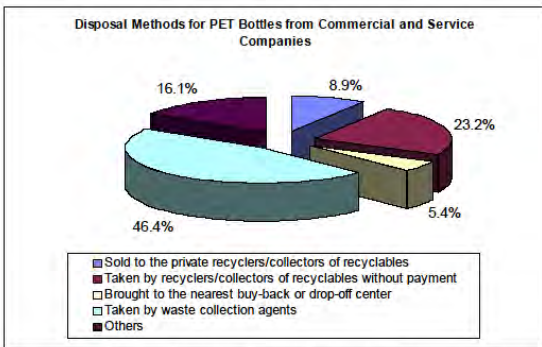


Figure 38: Disposal Methods for PET Bottles from Commercial and Service Companies

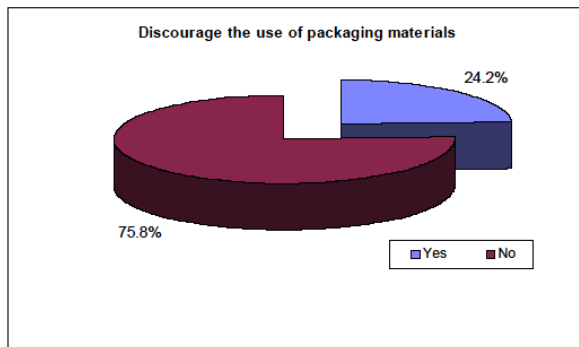


Figure 40: Discourage the Use of Packaging Materials by the Commercial and Service Companies

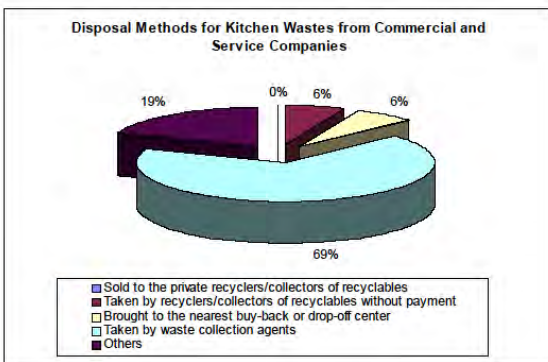


Figure 39: Disposal Methods for Kitchen Wastes from Commercial and Service Companies

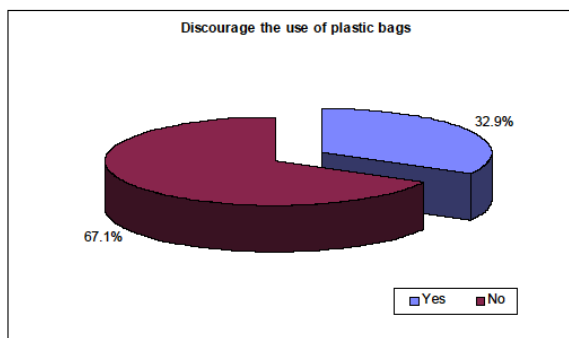


Figure 41: Discourage the Use of Plastic Bags by the Commercial and Service Companies

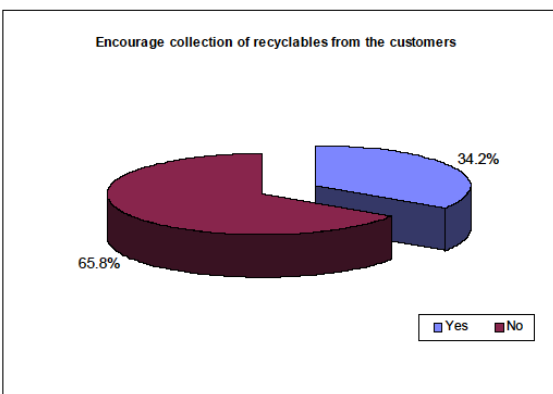


Figure 42: Encourage the Collection of Recyclables from the Customers by the Commercial and Service Companies

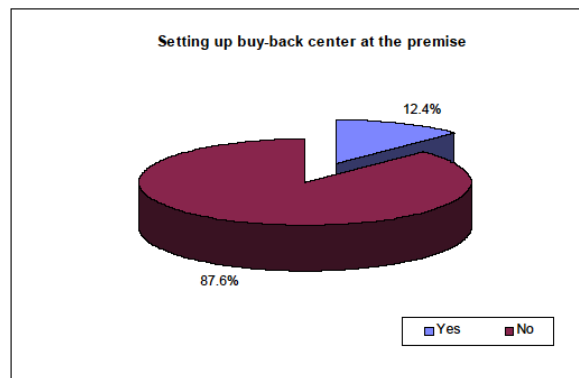


Figure 44: Setting up Buy Back Centre at the Premise of the Commercial and Service Companies

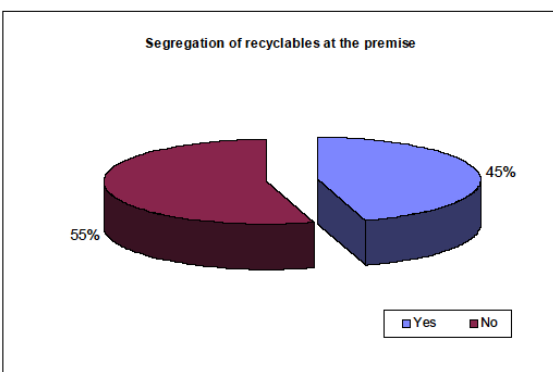


Figure 43: Segregations of Recyclables at the Premise of the Commercial and Service Companies

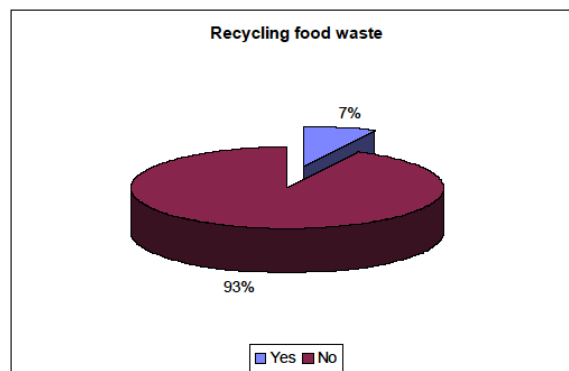


Figure 45: Recycling of Food Wastes by the Commercial and Service Companies

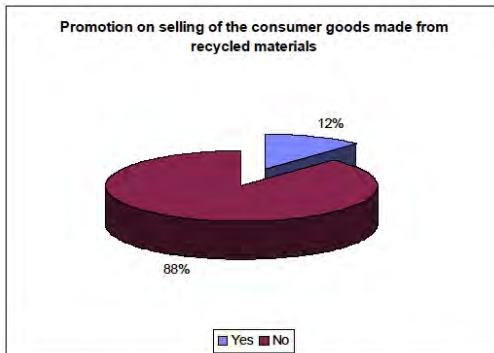


Figure 46: Promotion on the Sales of Products made from Recycled Materials by the Commercial and Service Companies

Table 9: Amount of Waste Generated from Offices

No	Waste Materials	Total (kg)	Average (kg/Office/month)	Average (kg/Office/day)
1	Old newspapers	1,565.00	21.15	0.71
2	Waste magazines	208.40	2.82	0.09
3	Other papers	1,416.80	19.15	0.64
4	Aluminium cans	43.90	2.33	0.08
5	Steel cans	172.50	0.59	0.02
6	PET bottles	44.60	0.60	0.02
7	Kitchen wastes	134.00	1.81	0.06
8	Others	248.80	3.36	0.11
Total			51.81	1.73

Note: Total number of samples surveyed = 74

Offices

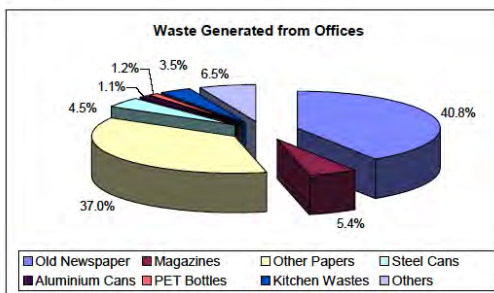


Figure 47: Main Categories of Wastes Generated from Offices

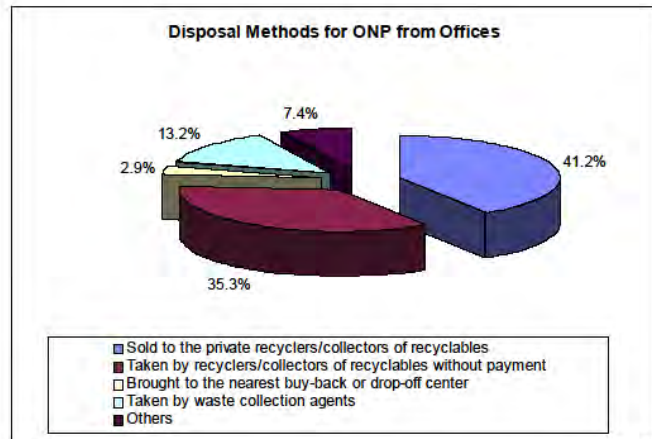


Figure 48: Disposal Methods of Old Newspapers from Offices

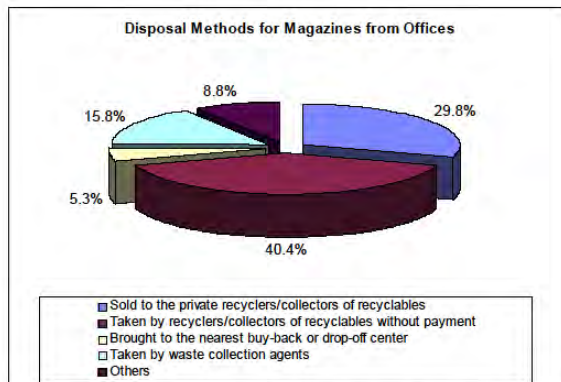


Figure 49: Disposal Methods of Magazines from Offices

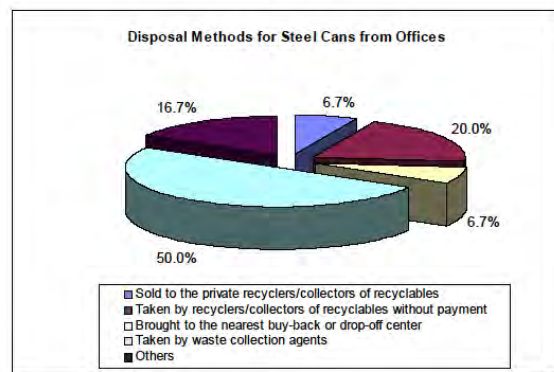


Figure 51: Disposal Methods of Steel Cans from Offices

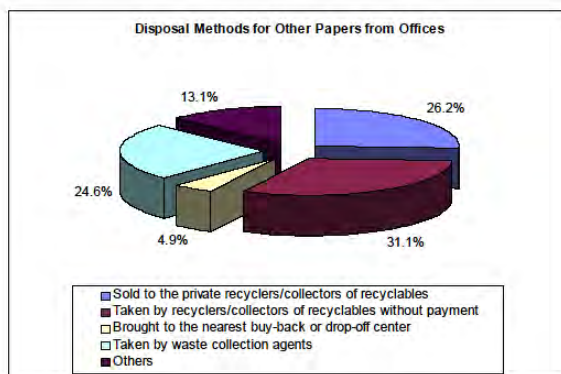


Figure 50: Disposal Methods of Other Papers from Offices

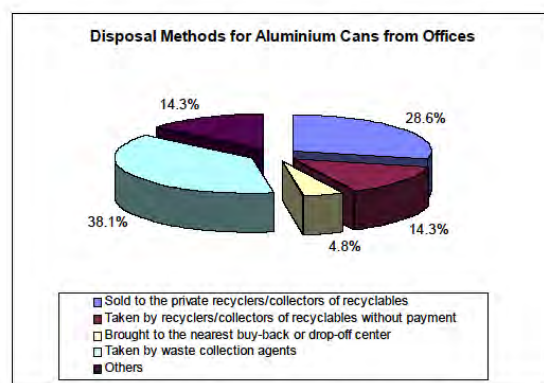


Figure 52: Disposal Methods of Aluminium Cans from Offices

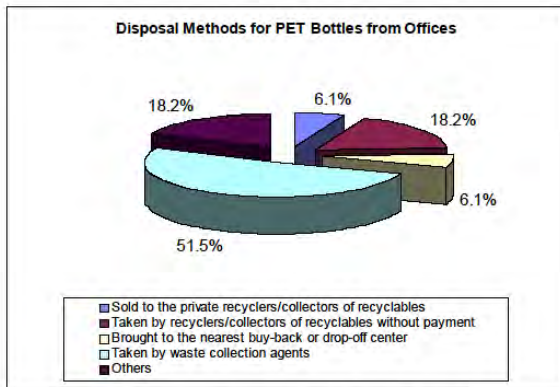


Figure 53: Disposal Methods of PET Bottles from Offices

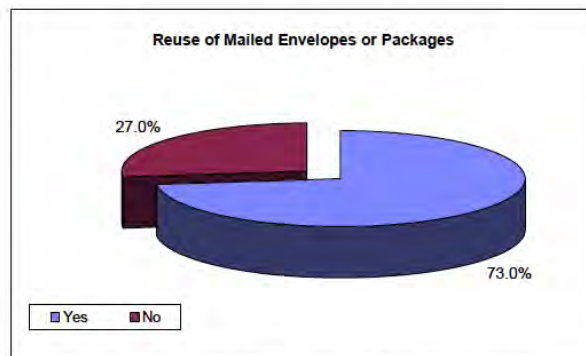


Figure 55: Reuse of Mailed Envelopes or Packages in Offices

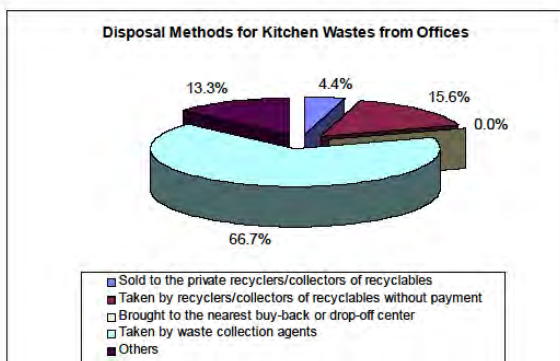


Figure 54: Disposal Methods of Kitchen Wastes from Offices

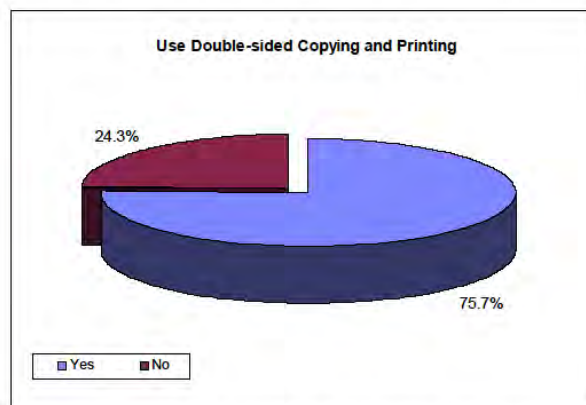


Figure 56: Use of Double-sided Copying in Offices

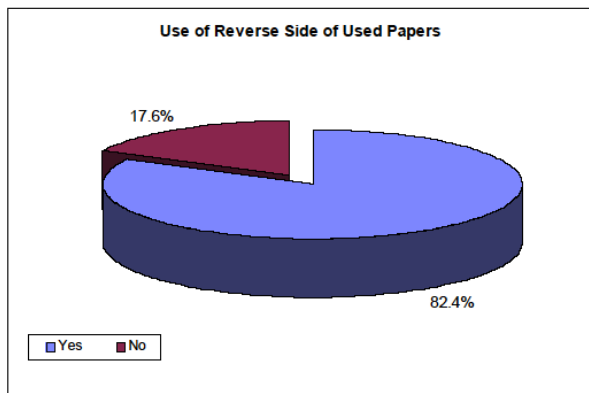


Figure 57: Use of Reverse Side of Used Papers in Offices

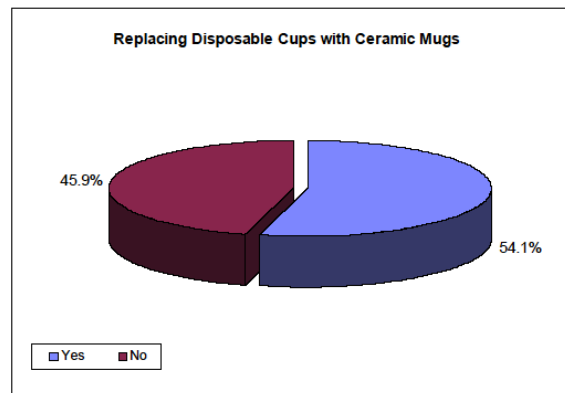


Figure 59: Replacing Disposable Cups with Ceramic Mugs in Offices

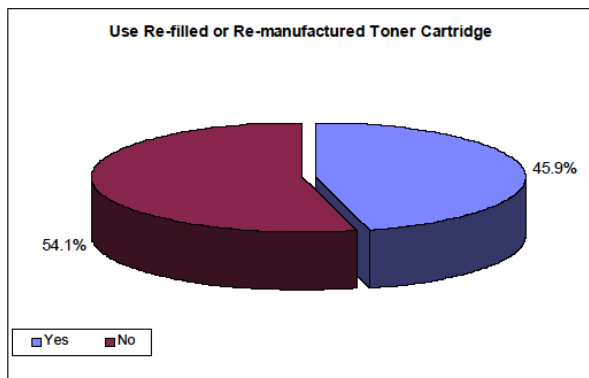


Figure 58: Use of Refilled or Re-manufactured Toners in Offices

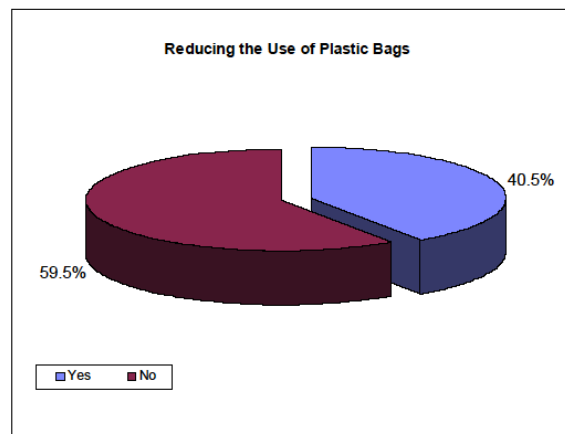


Figure 60: Reduce the Use of Plastic Bags in Offices

Construction Companies

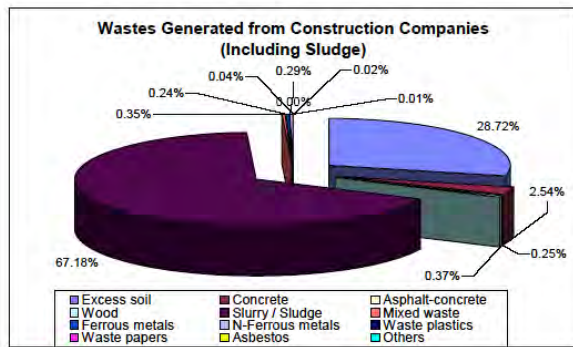


Figure 61: Main Waste Categories Generated by the Construction Companies (Including Sludge)

Table 10: Amount of Waste Generated from Construction Companies

No	Waste Materials	Total (tonnes)	Average (ton/company/month)	Average (ton/company/day)
1	Excess soil	108,914.30	1,237.66	41.26
2	Concrete	9,645.58	109.61	3.65
3	Asphalt-concrete	937.25	10.65	0.36
4	Wood	1,400.75	15.92	0.53
5	Slurry / Sludge	254,797.80	2,895.43	96.51
6	Mixed waste	1,318.95	14.99	0.50
7	Ferrous metals	903.59	10.27	0.34
8	N-Ferrous metals	1,107.18	12.58	0.42
9	Waste plastics	144.36	1.64	0.05
10	Waste papers	78.10	0.89	0.03
11	Asbestos	20.90	0.24	0.01
12	Others	8.25	0.09	0.003
Total			4,309.87	143.66

Note: Total number of samples surveyed = 88; solid content of slurry/sludge is only 0.5 - 5%

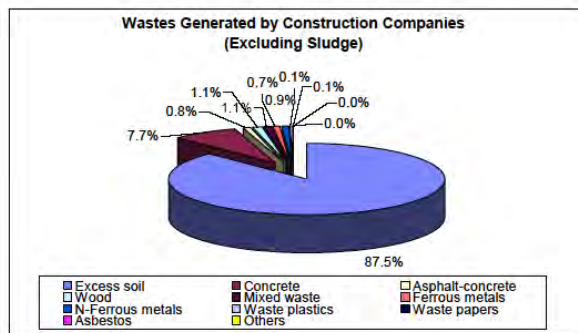


Figure 62: Main Waste Categories Generated by the Construction Companies (Including Sludge)

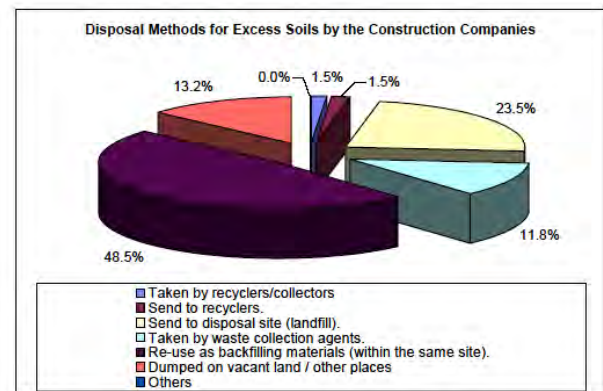


Figure 63: Disposal Methods for Excess Soils by the Construction Companies

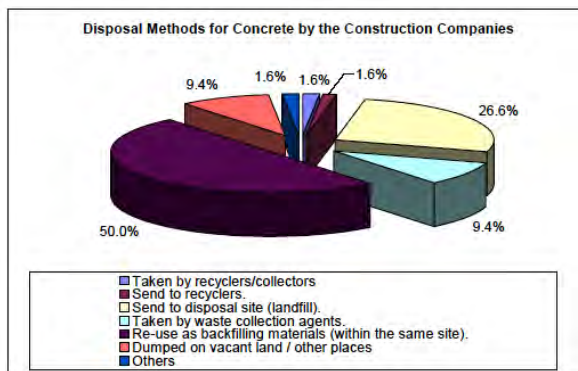


Figure 64: Disposal Methods for Concrete by the Construction Companies

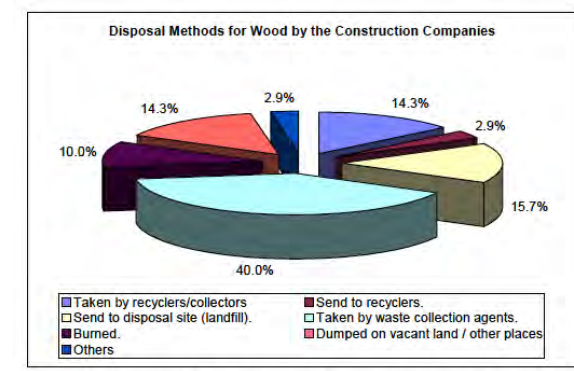


Figure 66: Disposal Methods for Wood by the Construction Companies

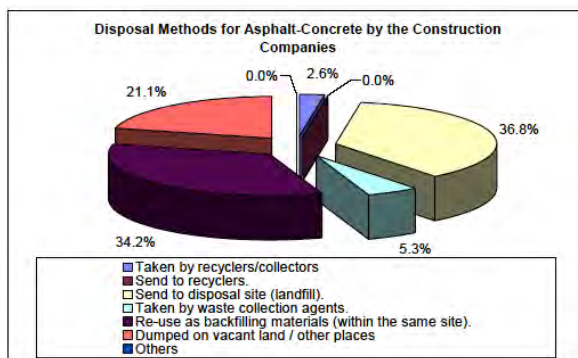


Figure 64: Disposal Methods for Asphalt-Concrete by the Construction Companies

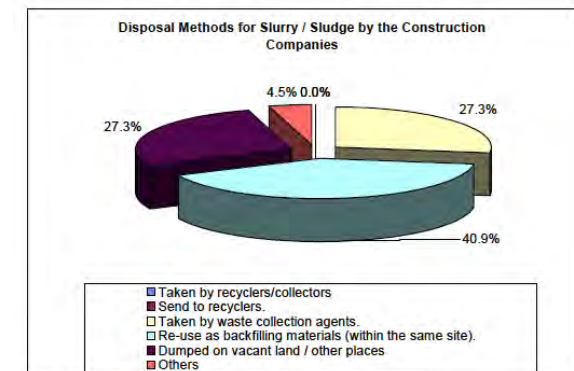


Figure 67: Disposal Methods for Slurry / Sludge by the Construction Companies

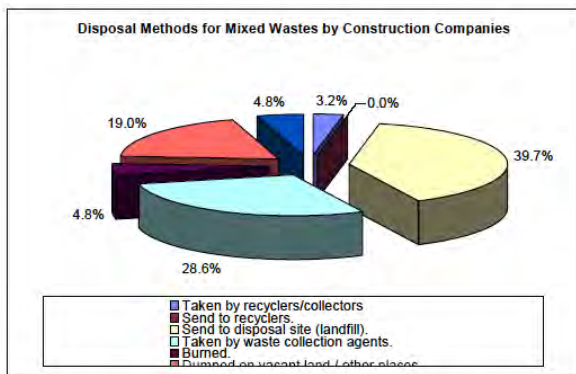


Figure 68: Disposal Methods for Mixed Wastes by the Construction Companies

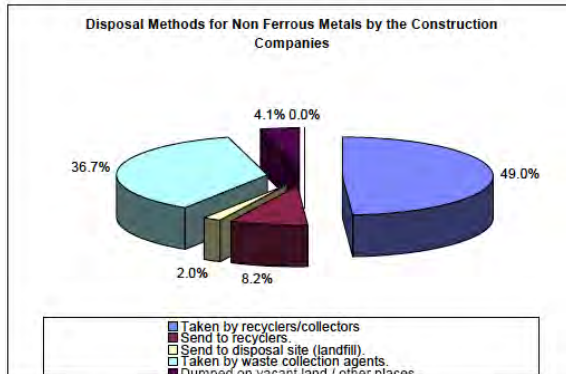


Figure 70: Disposal Methods for Non-Ferrous Metals by the Construction Companies

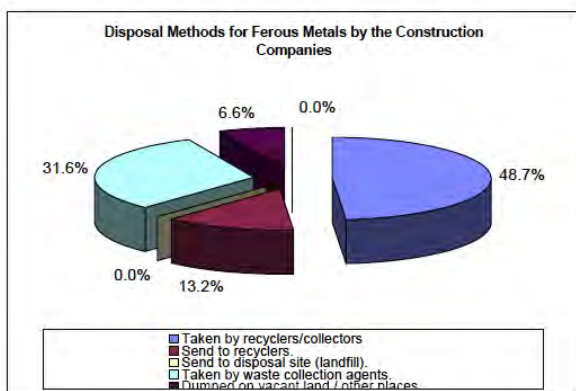


Figure 69: Disposal Methods for Ferrous Metals by the Construction Companies

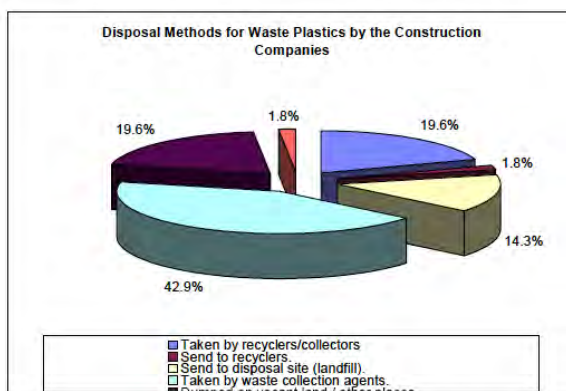


Figure 71: Disposal Methods for Waste Plastics by the Construction Companies

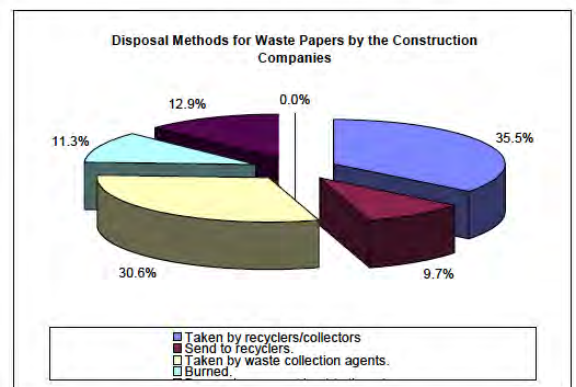


Figure 72: Disposal Methods for Waste Papers by the Construction Companies

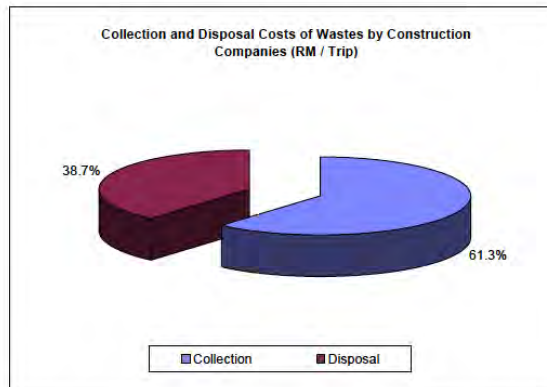


Figure 74: Waste Disposal and Collection Costs Paid by the Construction Companies

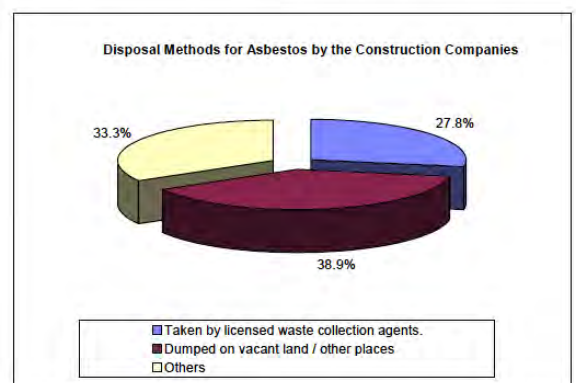


Figure 73: Disposal Methods for Asbestos by the Construction Companies

Manufacturers

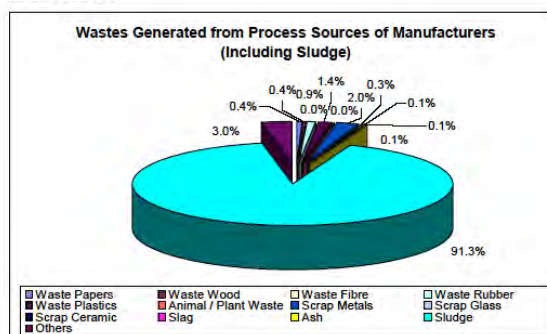


Figure 75: Wastes Generated from Process Sources of Manufacturers (Including Sludge)

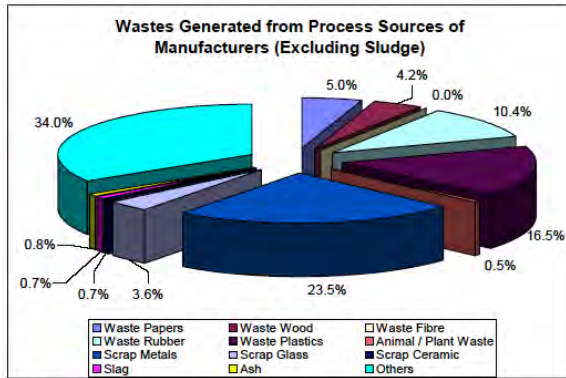


Figure 76: Wastes Generated from Process Sources of Manufacturers (excluding sludge)

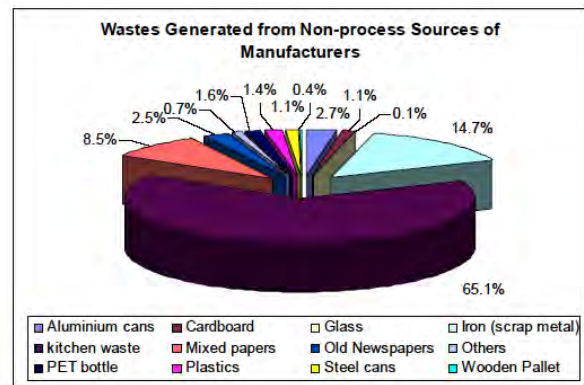


Figure 77: Wastes Generated from Non-Process Sources of Manufacturers

Table 11: Amount of Waste Generated from Process Sources of Manufacturers

No	Waste Materials	Total (tonnes)	Average (kg/Manufacturer/month)	Average (kg/Manufacturer/day)
1	Waste Papers	507,409	2,265.22	75.51
2	Waste Wood	427,050	1,906.47	63.55
3	Waste Fibre	4,807	21.46	0.72
4	Waste Rubber	1,057,668	4,721.73	157.39
5	Waste Plastics	1,670,562	7,457.86	248.60
6	Animal/Plant Waste	55,012	245.59	8.19
7	Scrap Metals	2,383,685	10,641.50	354.72
8	Scrap Glass	364,173	1,625.77	54.19
9	Scrap Ceramic	66,240	295.71	9.86
10	Slag	72,150	322.10	10.74
11	Ash	81,789	365.13	12.17
12	Sludge	106,574,519	475,779.00	15,859.30
13	Others	3,445,714	15,382.70	512.76
Total			521,030.00	17,367.68
Generation Rate (kg/employee/day)				24.73

Note: Total number of samples surveyed = 224
Average number of employees = 61

Table 12: Amount of Waste Generated from Non-Process Sources of Manufacturers

No	Waste Materials	Total (kg)	Average (kg/Manufacturer/month)	Average (kg/Manufacturer/day)
1	Aluminium cans	2,543.68	11.36	0.38
2	Cardboards	990.70	4.42	0.15
3	Glass	119.30	0.53	0.02
4	Scrap metals	13,854.68	61.85	2.06
5	Kitchen wastes	61,267.40	273.52	9.12
6	Mixed papers	7,985.30	35.65	1.19
7	Old newspapers	2,380.00	10.63	0.35
8	PET bottles	1,502.00	6.71	0.22
9	Other plastics	1,359.60	6.07	0.20
10	Steel cans	1,055.00	4.71	0.16
11	Wood pallets	381.00	1.70	0.06
12	Others	670.20	2.99	0.10
Total			420.14	14.01
Generation Rate (kg/employee/day)				0.23

Note: Total number of samples surveyed = 224
Average number of employees = 61

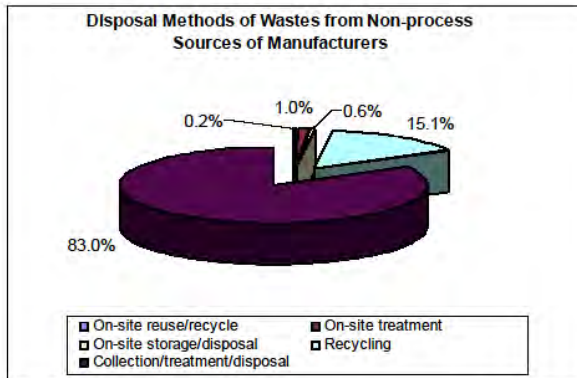


Figure 78: Disposal Methods for Wastes Generated from Non-Process Sources of Manufacturer

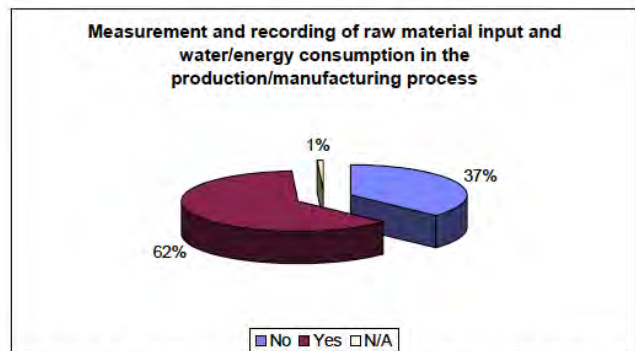


Figure 80: Measurement and Recording of Raw Material Input and Water/Energy Consumption in the Manufacturing Process

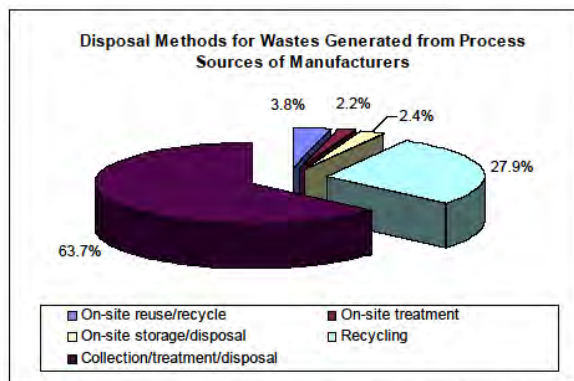


Figure 79: Disposal Methods for Wastes Generated from Process Sources of Manufacturer

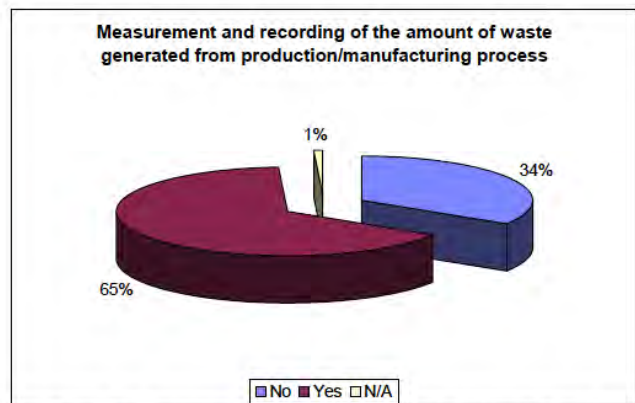


Figure 81: Measurement and Recording of the Amount of Waste Generated from Manufacturing Process



Figure 82: On-site reuse/recycling of waste

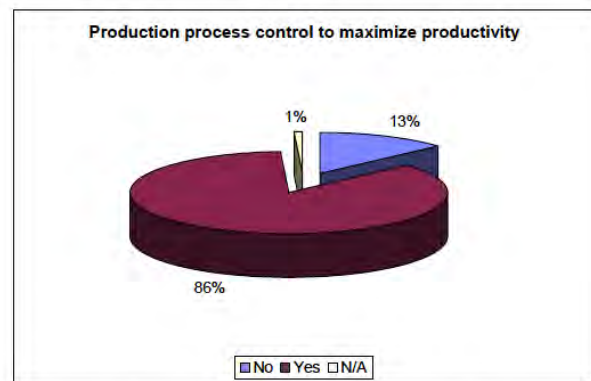


Figure 84: Production Process Control to Maximize Productivity

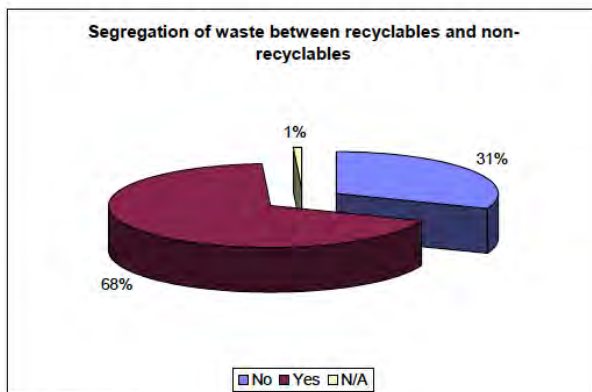


Figure 83: Segregation of Waste between Recyclables and Non-recyclables

Summary

Table 13: Summary of the Entire Study

No	Sources	Estimated Generation Rate			
		Amount	Unit	Amount	Unit
1	Households	37.5	Kg/household /month	1.25	Kg/household /day
2	Commercial and Service Companies	133.1	Kg/company /month	4.43	Kg/company /day
3	Offices	51.8	Kg/office/month	1.73	Kg/office/day
4	Construction Companies	4,309.9	Tonnes/company /month	143.66	Tonnes/company /day
5	Manufacturers	521.0	Tonnes/m'facturer /month	17.37	Tonnes/ m'facturer /day

Note:
 Estimations were based on the following numbers of samples surveyed:
 1) Households – 609 samples
 2) Commercial and Service Companies – 162 samples
 3) Offices – 74 samples
 4) Construction Companies – 88 samples
 5) Manufacturers – 224 samples

Table 14: Summary of the Entire Study on Households and Business Entities

Source	Waste Categories and Amount Generated			
Household	Type	Quantity (kg/day)	Two Major Methods of Collection / Disposal	
			1	2
	Old newspapers	0.39	Gave/Sold to door-to-door buyer	Municipal Waste Collection
	Waste magazines	0.10	Gave/Sold to door-to-door buyer	Municipal Waste Collection
	Other papers	0.12	Gave/Sold to door-to-door buyer	Municipal Waste Collection
	Aluminium cans	0.02	Municipal Waste Collection	Gave/Sold to door-to-door buyer
	Steel cans	0.03	Municipal Waste Collection	Gave/Sold to door-to-door buyer
	PET bottles	0.01	Municipal Waste Collection	Gave/Sold to door-to-door buyer
	Other plastic bottles	0.03	Municipal Waste Collection	Bring to recycling centers
	Other plastics	0.02	Municipal Waste Collection	Bring to recycling centers
	Glass bottles	0.10	Municipal Waste Collection	Gave/Sold to door-to-door buyer
	Other glass	0.01	Municipal Waste Collection	Bring to recycling centers
	Kitchen wastes	0.42	Municipal Waste Collection	Animal Feed
	Garden wastes	-	Municipal Waste Collection	Buried
	Others	0.01	Depending	Depending
TOTAL	1.26	-	-	
Office	Type	Quantity (kg/day)	Two Major Methods of Collection / Disposal	
			1	2
	Old newspapers	0.71	Sold / given free to recyclers / collectors	Collected by waste municipal collectors
	Waste magazines	0.09	Sold / given free to recyclers / collectors	Collected by waste municipal collectors
	Other papers	0.64	Sold / given free to recyclers / collectors	Collected by waste municipal collectors
	Aluminium cans	0.08	Collected by waste municipal collectors	Sold / given free to recyclers / collectors
	Steel cans	0.02	Collected by waste municipal collectors	Given free to recyclers / collectors
	PET bottles	0.02	Collected by waste municipal collectors	Given free to recyclers / collectors
	Kitchen wastes	0.06	Collected by waste municipal collectors	Given free to recyclers / collectors
	Others	0.11	Depending	Depending
TOTAL	1.73	-	-	
Commercial /Service	Type	Quantity (kg/day)	Two Major Methods of Collection / Disposal	
			1	2
	Old Newspapers	0.73	Sold / given free to recyclers / collectors	Collected by waste municipal collectors
	Waste Magazines	0.22	Sold / given free to recyclers / collectors	Others
	Other Papers	1.81	Sold / given free to recyclers / collectors	Collected by waste municipal collectors
	Aluminium Cans	0.06	Collected by waste municipal collectors	Sold / given free to recyclers / collectors
	Steel cans	0.22	Collected by waste municipal collectors	Sold / given free to recyclers / collectors
	PET bottles	0.25	Collected by waste municipal collectors	Sold / given free to recyclers / collectors
	Kitchen wastes	0.52	Collected by waste municipal collectors	Others
	Others	0.62	Depending	Depending
TOTAL	4.43	-	-	

Construction	Type	Quantity (tonnes/day)	Two Major Methods of Collection / Disposal	
			1	2
	Excess soil	41.26	Reuse for backfilling	Sent to Landfill
Concrete	3.65	Reuse for backfilling	Sent to Landfill	
Asphalt-concrete	0.36	Sent to Landfill	Reuse for backfilling	
Wood	0.53	Collected by waste collector	Sent to Landfill	
Slurry / Sludge	96.51	Sent to Landfill	Dumped to vacant land	
Mixed waste	0.50	Sent to Landfill	Collected by waste collector	
Ferrous metals	0.34	Sold to recycler / buyers	Collected by waste collector	
N-Ferrous metals	0.42	Sold to recycler / buyers	Collected by waste collector	
Waste plastics	0.05	Collected by waste collector	Sold to recycler / buyers	
Waste papers	0.03	Sold to recycler / buyers	Collected by waste collector	
Asbestos	0.01	Dumped to vacant land	Others	
Others	0.003	Depending	Depending	
TOTAL	143.66	-	-	

Manufacturers	Type	On-site			Off-site	
		Reuse/ Recycle	Treatment	Storage / Disposal	Recycling	Collection/ Treatment / Disposal
	Wastes from Process Sources (Average = 521.03 tonnes/ manufacturer / month)	3.8% (19.80 tonnes / month)	2.2% (11.46 tonnes / month)	2.4% (12.50 tonnes / month)	27.9% (145.37 tonnes / month)	63.7% (331.90 tonnes / month)
Wastes from Non-process Sources (Average = 420.14 kg/ manufacturer / month)	0.2% (0.84kg/month)	1.0% (4.20kg/month)	0.6% (2.52kg/month)	15.1% (63.44kg/month)	83.0% (348.72kg/month)	

7.3 Survey on Material Flow of Recyclables

1. The Objective of the Survey

The objective of the survey is to determine the flow of selected recyclable materials in Malaysia at each stage from generation, collection, trading, recycling and disposal. The existing practices and involvements of private companies, NGOs, CBOs and other organisations were also identified.

The main task of doing the surveys was to identify the types of recyclable materials currently being collected by each respective recycling player, the buying prices, selling prices etc. Information obtained from each respondent was used to track and trace the flow of the recyclable materials from one point to another as far as possible.

2. Survey Areas

The survey was conducted to determine the flow of recyclable materials at macro levels or at larger scale and hence areas with large number of population and industrial premises were selected for the survey.

Initially, the JICA Study Team selected four (4) areas in Peninsular Malaysia for the survey i.e.:

- 1) Shah Alam – to represent the Central region
- 2) Kuantan – to represent the Eastern region
- 3) Pulau Pinang – to represent the Northern region
- 4) Johor Bahru – to represent the Southern region

However, due to poor response and hence the number of samples collected were very small, the survey was expanded to other nearby areas such as the whole Klang Valley including Kuala Lumpur, Seberang Prai, Alor Setar, Sungai Petani, Sekudai etc. This countermeasure was taken to achieve a total number of samples to 400 as required by the JICA Study Team.

For Sabah and Sarawak, the survey was also carried out in about the same time as in Peninsular Malaysia. Cities that were selected for the survey are as follows:

- 1) Kuching, Miri and Sibul – to represent Sarawak
- 2) Kota Kinabalu and Sandakan – to represent Sabah

Table 3-1 Selected Survey Areas

No.	Regions	Cities
1	Southern	Johor Bahru, Sekudai
2	Northern	Pulau Pinang, Seberang Prai, Alor Setar, Sungai Petani
3	Central	Kuala Lumpur, Klang Valley
4	Sarawak	Miri, Sibul, Kuching
5	Sabah	Kota Kinabalu, Sandakan

3. Survey Approach/Methodology

(1) Interview Surveys

Primary data collection was carried out by interviewing the respondents using the questionnaire forms provided by the JICA Study Team (See Appendix A for the samples of the questionnaire forms).

There are 4 types of questionnaires used for different targets, namely:

- a) Questionnaire for scavengers, waste pickers, street collectors etc.
- b) Questionnaire for recycling centres (buy back and drop off centres)
- c) Questionnaire for traders, middlemen, junkshops of recyclable materials
- d) Questionnaire for recycling industries or any industry that uses recyclable materials in their production

Information collected and report for the survey was based on the questions in the questionnaires. However, information was also collected through informal communication and discussions with the respondents.

(2) Recycling Players Targeted

The recycling players targeted in this survey are as follows:

- The primary collectors (scavengers, waste pickers, street collectors etc.)
- The recycling centres (buy back and drop off centres)
- Traders
- Middlemen
- Junkshops of recyclable materials and recycling industries

In addition, some associations of manufacturers were also visited, and they are as follows:

- a) Pulp and Paper Association of Malaysia
- b) Malaysia Plastic Manufacturers Association (MPMA)
- c) Glass Manufacturers Association of Malaysia

At the initial stage, places such as local authorities and some known recycling centres were visited for gathering information on the other recycling players in the markets. Based on the information given and some surveys done on primary collectors such as scavengers at landfill sites and street collectors etc., the surveys were then be extended to more wide coverage areas to determine more recycling players especially the middlemen and traders until the recycling industries where the recyclable materials are finally sold.

The total number of samples required in this survey is 400 samples covering all variety of recycling players at the survey areas.

(3) Recyclable Materials Targeted

There are five (5) main categories of recyclable materials that were focussed in this survey, i.e.: plastics, glass, paper, ferrous metals and non-ferrous metals. However, the flows for other materials identified such as scrap computers, used batteries, used tyres, food wastes, electronic wastes etc. were also investigated.

(4) Data Entry and Analysis

Primary data collected by using the questionnaire was compiled in both soft and hard copies. Data in softcopies were formatted in Microsoft Excel and analysis was done based on both information gathered in the questionnaires as well as informal discussions made with the respondents.

4. Results

The field survey for the surveys of questionnaires was completed on 15 December 2004 when the total number of questionnaires obtained has achieved 400 samples. The distribution of the number of questionnaires done by survey area is summarised in Table 3-2.

Table 3-2 Summary of the Types and Number of Samples by Areas

	KL/SLG	PP	JH	KTN	SRW	SBH	TOTAL
Street Collector/Scavengers/Waste Pickers etc.	29	21	32	12	20	17	131
Recycling/Buy Back Centres	17	29	2	4	28	4	84
Traders/Middle-men/Junkshops	56	35	20	14	31	7	163
Recycling Industries	6	6	1	1	7	1	22
TOTAL	108	91	55	31	86	29	400

Note: KL/SLG - Kuala Lumpur & Selangor; PP - Pulau Pinang; JH - Johor, KTN - Kuantan; SRW - Sarawak; SBH - Sabah

Based on the information obtained from the questionnaires as well as field observations on the existing recycling activities in the survey areas, detailed analysis was carried out to determine the current situations of recycling in the survey areas, including the existing recycling practices, the recycling players, major recyclable materials being collected, the prices of the recyclable materials and finally the material flows of the recyclable materials.

(1) Existing Recycling Practices

a. Generation at Sources

For recyclable materials generated from households, the amount and compositions are generally similar but depending on the types of houses, number of households, income levels etc. Based on the results from the other survey on waste compositions at different household income levels, the overall composition of recyclable materials generated from households are summarised in Table 3-3.

Table 3-3 The Average of Recyclable Materials Generated at Households

	High Income	Medium Income	Low Income	Average (%)
<i>Major recyclable materials</i>				
Mixed paper	16.34	20.09	14.84	17.09
Mixed plastic	7.98	9.51	9.72	9.07
Glass	3.4	4.33	3.41	3.71
Ferrous metals	1.25	1.81	1.76	1.60
Non-ferrous metals	0.005	0.05	0.00	0.02
Aluminium	0.52	0.47	0.13	0.37
<i>Sub-total</i>	29.50	36.25	29.85	31.86
Batteries	0	0.04	0.06	0.03
Electrical & Electronics	0.08	0.02	0.43	0.18
<i>Sub-total</i>	0.08	0.06	0.49	0.21
Others	70.42	63.69	69.66	67.93
Total	100	100	100	100

Note: Others include mainly food wastes, yard wastes etc

b. Recycling Industries

Generally, most of the recyclable materials currently being collected in the markets are finally sent to domestic recycling industries or industries that use some recyclables as part of their manufacturing processes. This includes the industries for plastics, papers and carton boxes (cardboards), iron and steels, non-ferrous metals such as aluminium cans and coppers etc. The products that are manufactured are summarised in Table 3-4 as follows:

Table 3-4 Products Manufactured from Recycling Industries

No	Recyclable Materials	Products
1	Waste papers	Recycled papers, tissue papers, handicrafts
2	Waste carton boxes	Recycled carton boxes, handicrafts
3	Old newspapers	Recycled pencils, newspapers, handicrafts
4	Waste plastics	Recycled plastic resin, other plastic products
5	Scrap irons and steels	Recycled irons and steels
6	Scrap aluminium	Aluminium cans
7	Waste glass bottles	Glass bottles (reuse or recycling)
8	Expired food (bread)	Dried food (bread), animal feed
9	Waste candles	Recycled candles
10	Old clothes	Handicrafts

(2) Major Recyclable Materials and the Prices

The prices obtained from the survey are summarised in Table 3-3 below in order to make a comparison of price range for recyclable materials at different levels of recycling. It is clearly shown in the table that there is a big range for the selling price of each different recyclable material in the markets.

Table 3-3 Comparison of Price Range for Recyclable Materials at Different Levels of Recycling

No	Recyclable Materials	Selling Prices		
		Primary Collectors	Recycling Centres	Middlemen / Trader
1	Aluminium cans	RM0.35 - 5.50/kg	RM1.70 - 5.00/kg	RM1.50 - 5.20/kg
2	Car Batteries	RM1.00 - 3.00/Pcs	RM0.60/kg or RM5-10/pcs	RM1.75 - 13.00/pcs
3	Carton boxes (cardboards)	RM0.07 - 0.40/kg	RM0.10 - 0.85/kg	RM0.07 - 0.80/kg
4	Copper	RM1.00 - 3.20/kg	NA	RM0.85 - 9.50/kg
5	Glass Bottles	RM0.10/kg or RM0.16/pc	RM0.03 - 0.25/kg	RM0.05 - 3.00/kg
6	Other Papers	RM0.10 - 0.30/kg	RM0.07 - 0.50/kg	RM0.09- 0.70/kg
7	Old Newspaper	RM0.10 - 0.49/kg	RM0.10 - 0.35/kg	RM0.08 - 0.42/kg
8	Paper (Computer)	RM0.20 - 0.30/kg	RM0.20 - 0.45/kg	RM0.20 - 0.60/kg
9	Paper (Pure white)	RM0.20 - 0.30/kg	RM0.20 - 0.45/kg	RM0.77 - 0.80/kg
10	Paper (Magazine Book)	RM0.20 - 0.30/kg	RM0.05 - 0.50/kg	NA
11	Waste Plastics	RM0.10 - 0.70/kg	RM0.04 - 0.90/kg	RM0.18 - 1.10/kg
12	Scrap Metals	RM0.15 - 6.00/kg	RM0.10 - 6.00/kg	RM0.18 - 7.00/kg
13	Wood Pallets	RM 0.67/kg	NA	RM1.20 - 3.00/kg
14	Stainless Steels	NA	NA	NA
15	Old Clothes	FOC	Donate or RM1.60 - 2.00/kg	Donate or RM1.20/kg
16	Ink Cartridges	FOC	RM0.30/kg	RM3.00/kg
17	Used Mattress	NA	NA	RM15/pcs
18	Used computers	NA	NA	Depending
19	Rubber	FOC	NA	RM0.30/kg
20	Old furniture	FOC	Depending	Depending
21	Used electrical appliances	RM3.00 - 20.00 /pcs	Depending	Depending
22	Candles	RM0.10/kg	RM0.80/kg	NA
23	White Foam	NA	RM0.50/kg	NA
24	Waste poly-carbonate (1st and 2nd grade)	NA	RM0.15 - 0.60/kg	NA

Note: NA - Not Available; FOC - Free of charge;
Depending - price depending on the quality and conditions of the items

Summarised Results/ Data:

Table 1: Selected Study Areas

No.	Regions	Cities
1	Southern	Johor Bahru, Sekudai
2	Northern	Pulau Pinang, Seberang Prai, Alor Setar, Sungai Petani
3	Central	Kuala Lumpur, Shah Alam, Serdang, Subang, Puchong etc.
4	Eastern	Kuantan
5	Sarawak	Miri, Sibiu, Kuching
6	Sabah	Kota Kinabalu, Sandakan

Table 2: Summary of the Types and Number of Samples by Areas

	KL/SLG	PP	JH	KTN	SRW	SBH	TOTAL
Street Collector / Scavengers / Waste Pickers etc.	29	21	32	12	20	17	131
Recycling / Buy Back Centres	17	29	2	4	28	4	84
Traders / Middle-men / Junkshops	56	35	20	14	31	7	163
Recycling Industries	6	6	1	1	7	1	22
TOTAL	108	91	55	31	86	29	400

Note: KL/SLG - Kuala Lumpur & Selangor; PP - Pulau Pinang; JH - Johor, KTN - Kuantan; SRW - Sarawak; SBH - Sabah

Table 3: The Average of Recyclable Materials Generated at Households

	High Income	Medium Income	Low Income	Average %
<i>Major recyclable materials</i>				
Mixed paper	16.34	20.09	14.84	17.09
Mixed plastic	7.98	9.51	9.72	9.07
Glass	3.4	4.33	3.41	3.71
Ferrous metals	1.25	1.81	1.76	1.60
Non-ferrous metals	0.005	0.05	0.00	0.02
Aluminium	0.52	0.47	0.13	0.37
<i>Sub-total</i>	29.50	36.25	29.85	31.86
Batteries	0	0.04	0.06	0.03
Electrical & Electronics	0.08	0.02	0.43	0.18
<i>Sub-total</i>	0.08	0.06	0.49	0.21
Others	70.42	63.69	69.66	67.93
Total	100	100	100	100

Note: Others include mainly food wastes, yard wastes etc

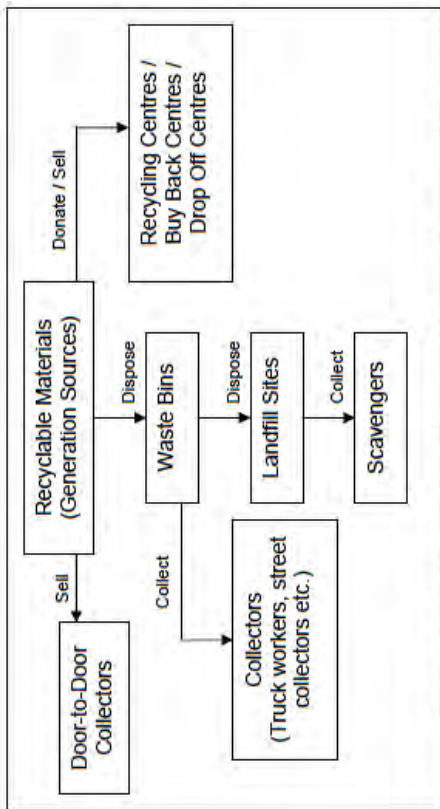


Figure 1: The Collection System of Recyclable Materials

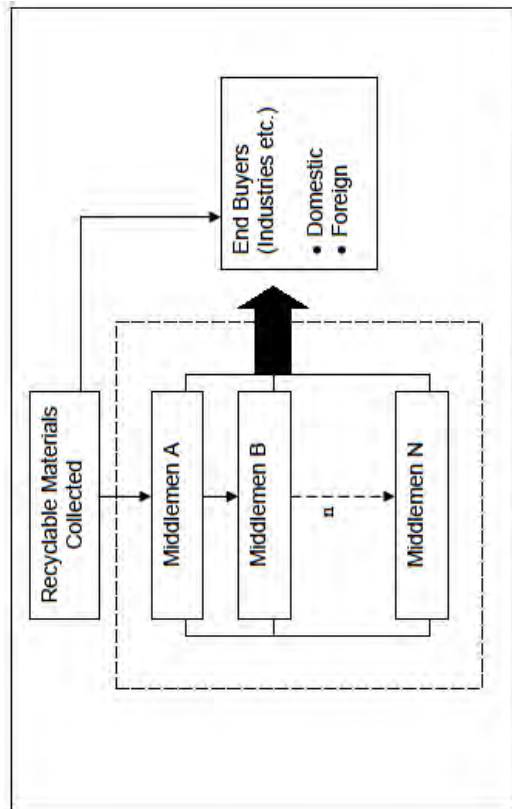


Figure 2: The Trading System of Recyclable Materials

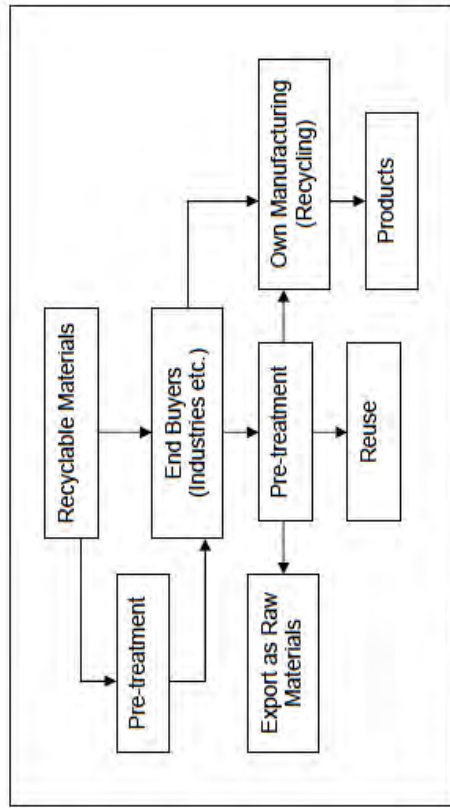


Figure 3: Reuse and Recycling of Recyclable Materials

Table 4: Range of Prices for Recyclable Materials Sold by Waste Pickers / Street Collectors / Scavengers

No	Recyclable Materials	Selling Prices
1	Aluminium cans	RM0.35 - 5.50/kg
2	Car Batteries	RM1.00 - 3.00/PCS
3	Carton boxes (cardboards)	RM0.07 - 0.40/kg
4	Copper Wires	RM1.00 - 3.20/kg
5	Glass Bottles	RM0.10/kg or RM0.16/pc
6	Mixed Papers	RM0.10 - 0.30/kg
7	Old Newspaper	RM0.10 - 0.49/kg
8	Paper (Magazine, Book)	RM0.20 - 0.30/kg
9	Paper (Computer)	RM0.20 - 0.30/kg
10	Mixed Plastics	RM0.10 - 0.70/kg
11	Scrap Metals	RM0.15 - 6.00/kg
12	Used Electrical	RM3.00 - 20.00 /pcs
13	Wood Pallets	RM 0.67/kg

Table 5: Buying and Selling Price Range of Recyclable for Recycling Centres

No	Recyclable Materials	Buying Prices	Selling Prices
1	Aluminium cans	RM1.00 - 3.30/kg	RM1.70 - 5.00/kg
2	Car Batteries	RM1.00 - 4.00/pcs	RM0.60/kg or RM5-10/pcs
3	Carton boxes (cardboards)	RM0.04 - 0.80/kg	RM0.10 - 0.85/kg
4	Glass Bottles	RM0.02 - 0.05/kg	RM0.03 - 0.05/kg
5	Mixed Papers	RM0.04 - 0.35/kg	RM0.07 - 0.50/kg
6	Old Newspaper	RM0.05 - 0.20/kg	RM0.10 - 0.35/kg
7	Paper (Computer)	RM0.10 - 0.30/kg	RM0.20 - 0.45/kg
8	Paper (Magazine, Book)	RM0.15/kg	RM0.05 - 0.50/kg
9	Mixed Plastics	RM0.03 - 0.40/kg	RM0.04 - 0.90/kg
10	Scrap Metals	RM0.08 - 0.50/kg	RM0.10 - 0.70/kg
11	Wood Pallets	RM1.00 - 2.50/kg	Unknown
12	Candles	RM0.10/kg	RM0.80/kg
13	Old Clothes	FOC	RM1.60 - 2.00/kg
14	Ink Cartridges	FOC	RM0.30/kg
15	White Foam	FOC	RM0.50/kg
16	Waste polycarbonate (1st grade)	Unknown	RM0.60/kg
17	Waste polycarbonate (2nd grade)	Unknown	RM0.15/kg
18	Rubber	RM0.10/kg	Unknown
19	Old furniture	FOC	Depending
20	Used electrical appliances	FOC	Depending

Note:

- 1) The buying prices shown are prices of recyclable materials collected mainly by the buy back centres since there are some recycling centres that are operating on charity with all materials collected with FOC.
- 2) Out of 84 recycling / buy back centres surveyed, 51 are collecting recyclable materials on FOC basis, 33 are paying for the recyclable materials.

Table 6: Buying and Selling Price Range of Recyclable for Traders / Junkshops / Middlemen

No	Recyclable Materials	Buying Prices	Selling Prices
1	Aluminium cans	RM1.10 - 5.50/kg	RM1.50 - 5.20/kg
2	Car Batteries	RM1.50 - 10.00/pcs	RM1.75 - 13.00/pcs
3	Carton boxes (cardboards)	RM0.02 - 0.33/kg	RM0.07 - 0.80/kg
4	Copper	RM1.50 - 9.00/kg	RM0.85 - 9.50/kg
5	Glass Bottles	RM0.05 - 0.20/kg	RM0.05 - 3.00/kg
6	Mixed Papers	RM0.04 - 0.50/kg	RM0.09 - 0.70/kg
7	Old Newspaper	RM0.04 - 0.33/kg	RM0.08 - 0.42/kg
8	Paper (Computer)	RM0.10 - 0.60/kg	RM0.20 - 0.60/kg
9	Paper (Pure white)	RM0.60 - 0.83/kg	RM0.77 - 0.80/kg
10	Paper (Magazine, Book)	RM0.15 - 0.20/kg	Unknown
11	Mixed Plastics	RM0.10 - 1.20/kg	RM0.18 - 1.10/kg
12	Scrap Metals	RM0.08 - 6.50/kg*	RM0.18 - 0.90/kg
13	Wood Pallets	RM1.00 - 2.50/kg	RM1.20 - 3.00/kg
14	Stainless Steels	RM0.20 - 4.80/kg	Unknown
15	Old Clothes	FOC or RM0.20 - 3.00/kg	Donate or RM1.20/kg
16	Ink Cartridges	Unknown	RM3.00/kg
17	Used Mattress	RM10/pcs	RM15/pcs
18	Used computers	RM5.00 - 40.00/pcs	Depending
19	Rubber	Unknown	RM0.30/kg
20	Old furniture	FOC	Depending
21	Used electrical appliances	FOC	Depending

Note:

- * The high upper range price of scrap metals is due to the mixed scrap metals reported including the copper, stainless steels etc.

Table 7: Comparison of Price Range for Recyclable Materials at Different Levels of Recycling

No	Recyclable Materials	Selling Prices		
		Primary Collectors	Recycling Centres	Middlemen / Trader
1	Aluminium cans	RM0.35 - 5.50/kg	RM1.70 - 5.00/kg	RM1.50 - 5.20/kg
2	Car Batteries	RM1.00 - 3.00/Pcs	RM0.60/kg or RM5-10/pcs	RM1.75 - 13.00/pcs
3	Carton boxes (cardboards)	RM0.07 - 0.40/kg	RM0.10 - 0.85/kg	RM0.07 - 0.80/kg
4	Copper	RM1.00 - 3.20/kg	NA	RM0.85 - 9.50/kg
5	Glass Bottles	RM0.10/kg or RM0.16/pc	RM0.03 - 0.25/kg	RM0.05 - 3.00/kg
6	Other Papers	RM0.10 - 0.30/kg	RM0.07 - 0.50/kg	RM0.09 - 0.70/kg
7	Old Newspaper	RM0.10 - 0.45/kg	RM0.10 - 0.35/kg	RM0.08 - 0.42/kg
8	Paper (Computer)	RM0.20 - 0.30/kg	RM0.20 - 0.45/kg	RM0.20 - 0.60/kg
9	Paper (Pure white)	RM0.20 - 0.30/kg	RM0.20 - 0.45/kg	RM0.77 - 0.80/kg
10	Paper (Magazine Book)	RM0.20 - 0.30/kg	RM0.05 - 0.50/kg	NA
11	Waste Plastics	RM0.10 - 0.70/kg	RM0.04 - 0.90/kg	RM0.18 - 1.10/kg
12	Scrap Metals	RM0.15 - 6.00/kg	RM0.10 - 6.00/kg	RM0.18 - 7.00/kg
13	Wood Pallets	RM0.67/kg	NA	RM1.20 - 3.00/kg
14	Stainless Steels	NA	NA	NA
15	Old Clothes	FOC	Donate or RM1.60 - 2.00/kg	Donate or RM1.20/kg
16	Ink Cartridges	FOC	RM0.30/kg	RM3.00/kg
17	Used Mattress	NA	NA	RM15/pcs
18	Used computers	NA	NA	Depending
19	Rubber	FOC	NA	RM0.30/kg
20	Old furniture	FOC	Depending	Depending
21	Used electrical appliances	RM3.00 - 20.00 /pcs	Depending	Depending
22	Candles	RM0.10/kg	RM0.80/kg	NA
23	White Foam	NA	RM0.50/kg	NA
24	Waste poly-carbonate (1st and 2nd grade)	NA	RM0.15 - 0.60/kg	NA

Note: NA - Not Available; FOC - Free of charge; Depending - price depending on the quality and conditions of the items

Table 8: Typical Selling Price for Major Recyclable Materials at Different Levels of Recycling

No	Recyclable Materials	Selling Prices		
		Primary Collectors	Recycling Centres	Middlemen / Trader
1	Aluminium cans	RM2.50/kg	RM2.50/kg	RM3.50/kg
2	Glass Bottles	RM0.10/kg	RM0.075/kg	RM0.175/kg
3	Waste Papers	RM0.25/kg	RM0.15/kg	RM0.45/kg
4	Waste Plastics	RM0.20/kg	RM0.15/kg	RM0.25/kg
5	Scrap Metals	RM0.35/kg	RM0.10/kg	RM0.75/kg

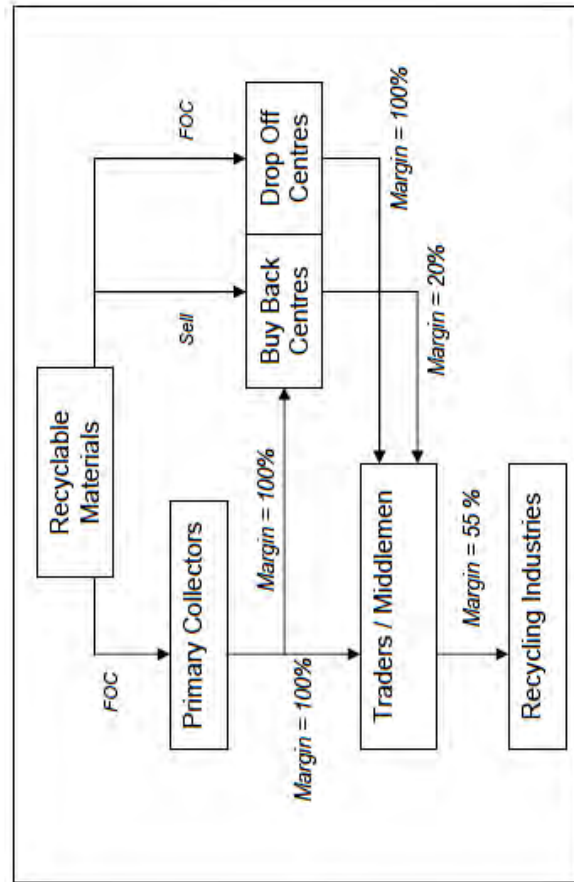


Figure 4: Profit Margins at Different Levels of Recycling

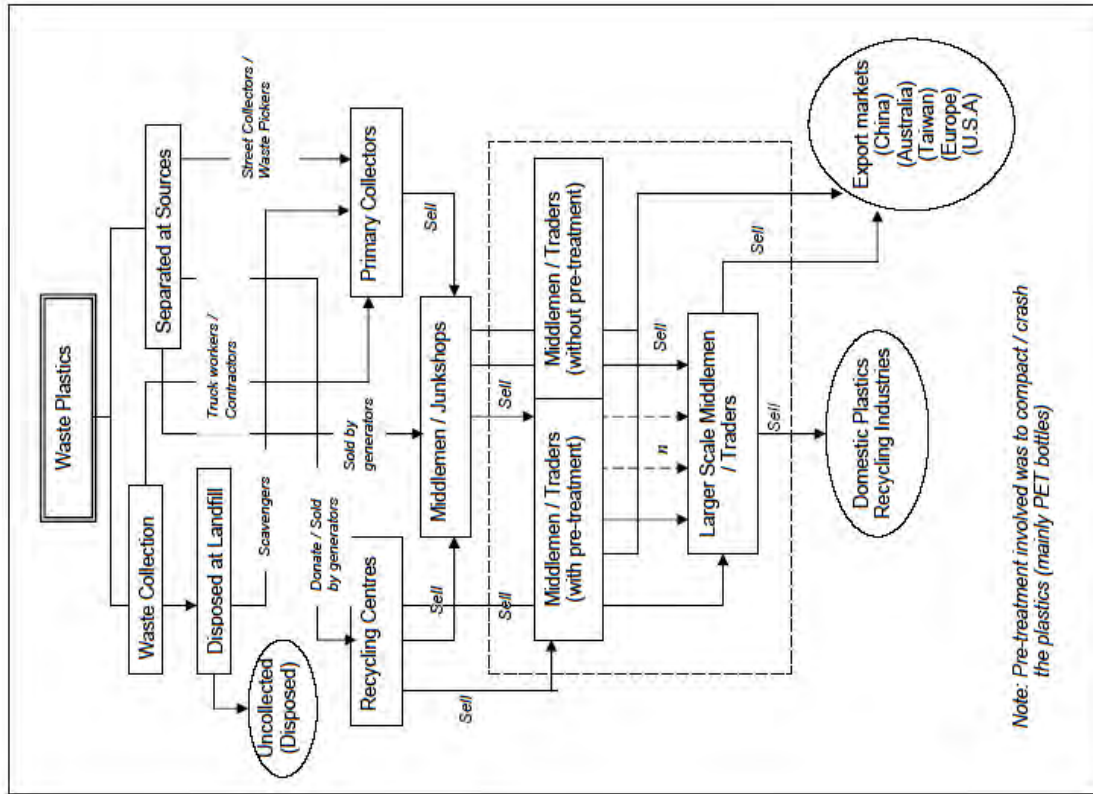


Figure 6: Material Flow for Plastics

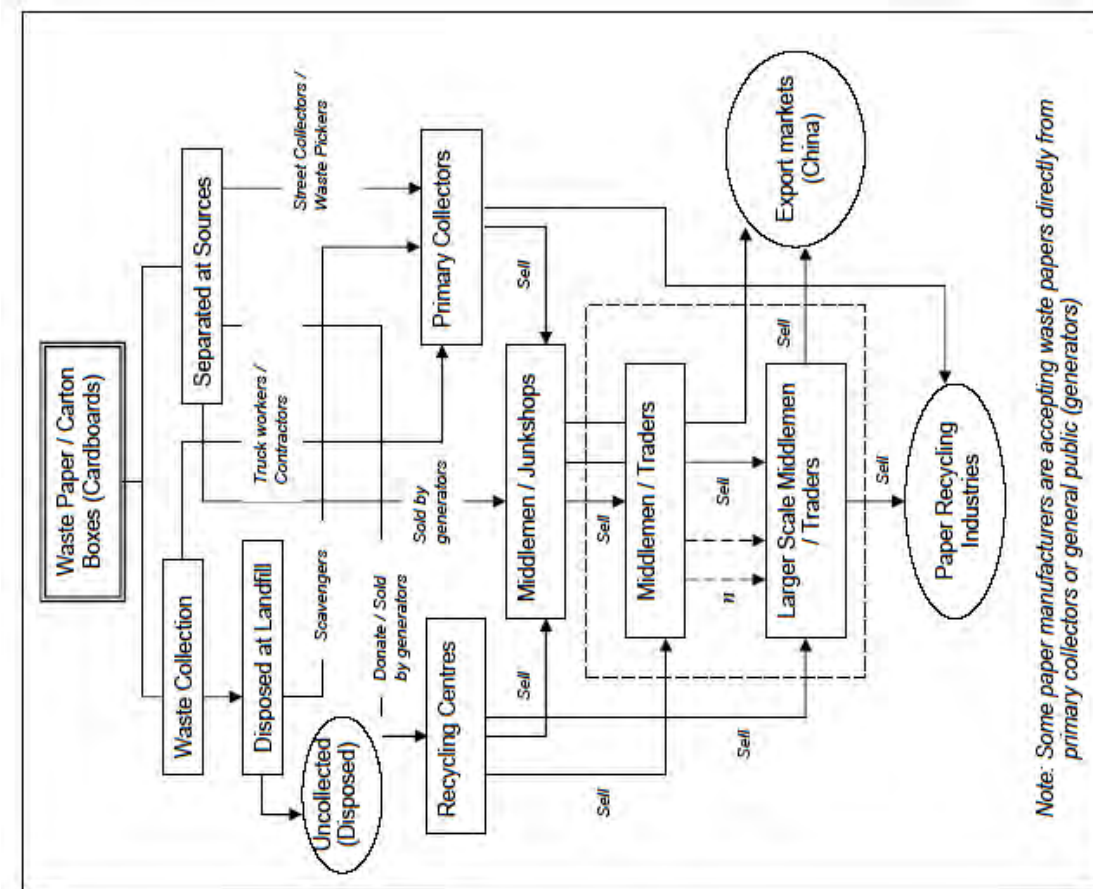


Figure 5: Material Flow for Papers and Cardboards

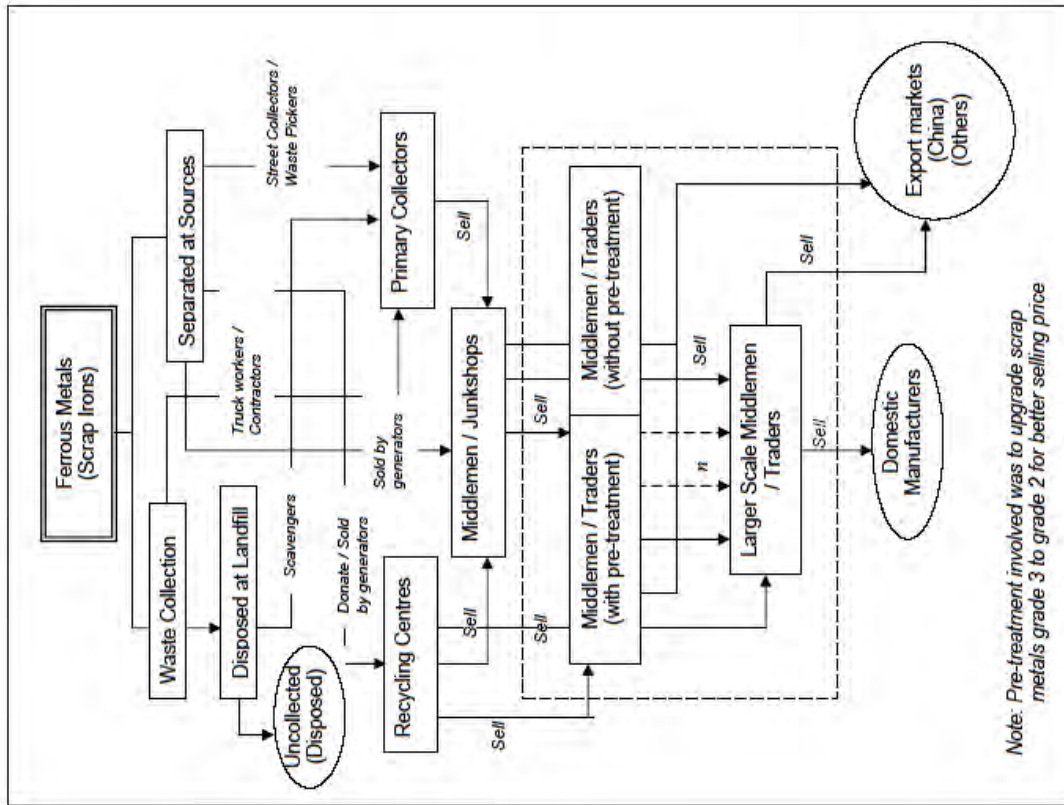


Figure 8: Material Flow for Ferrous Metals (Irons)

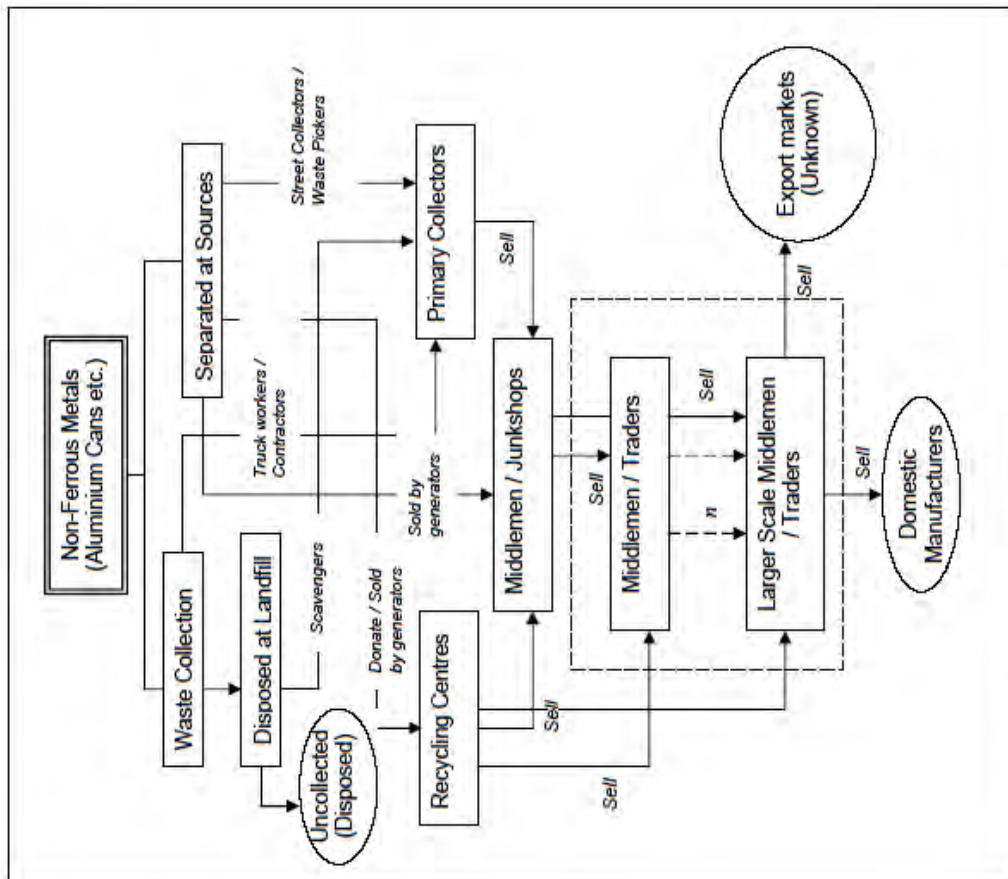


Figure 7: Material Flow for Non Ferrous Metals (Aluminium Cans etc.)

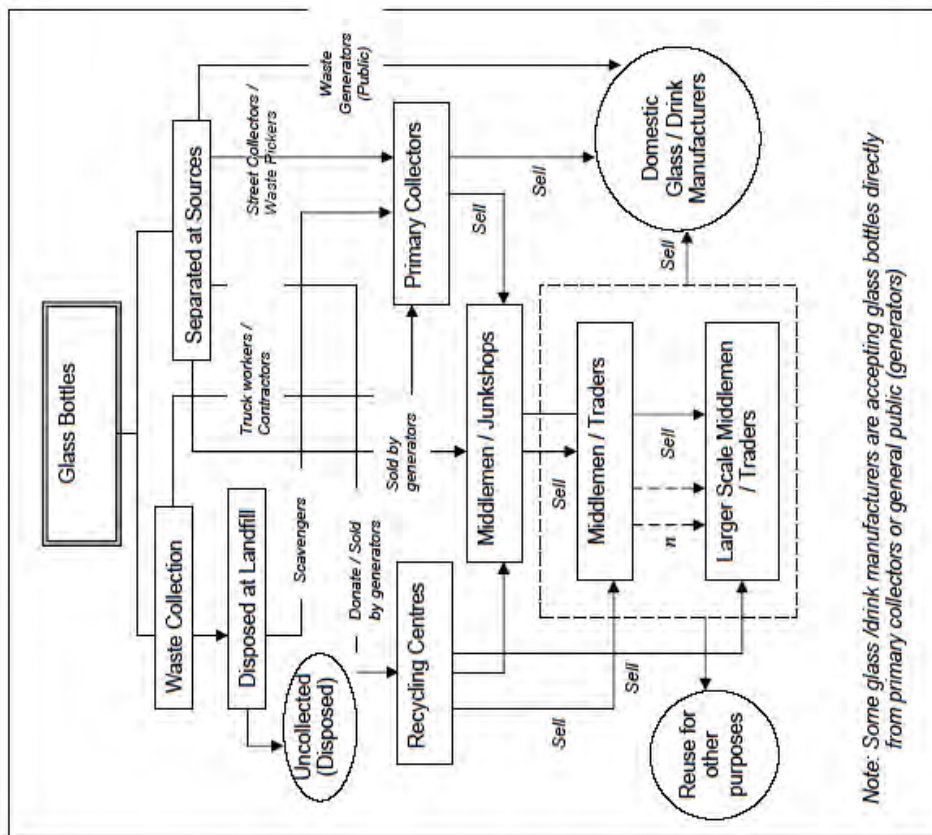


Figure 9: Material Flow for Glass Bottles

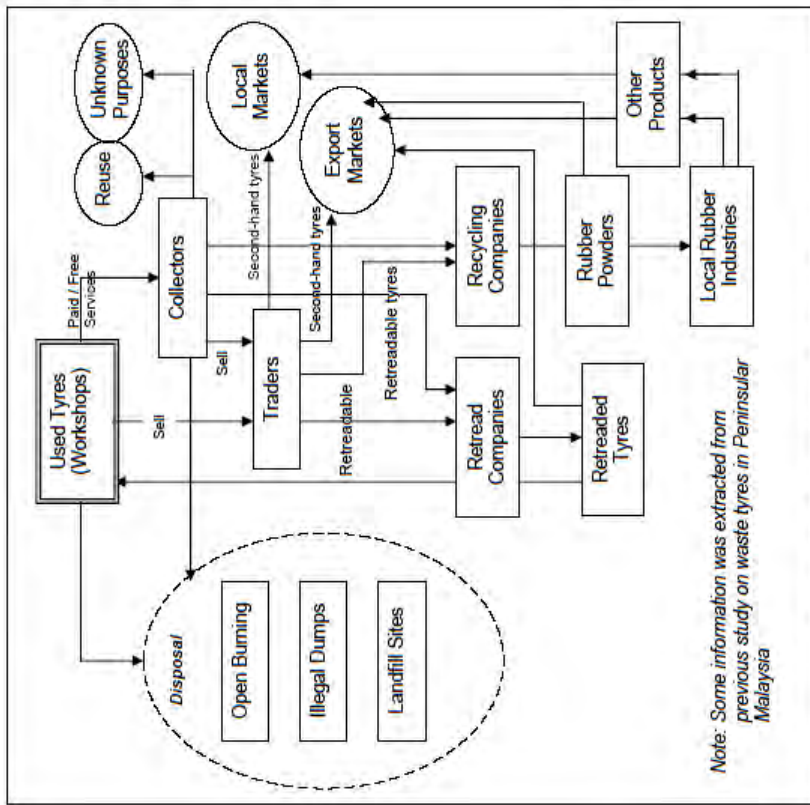


Figure 10: Material Flow for Used Tyres

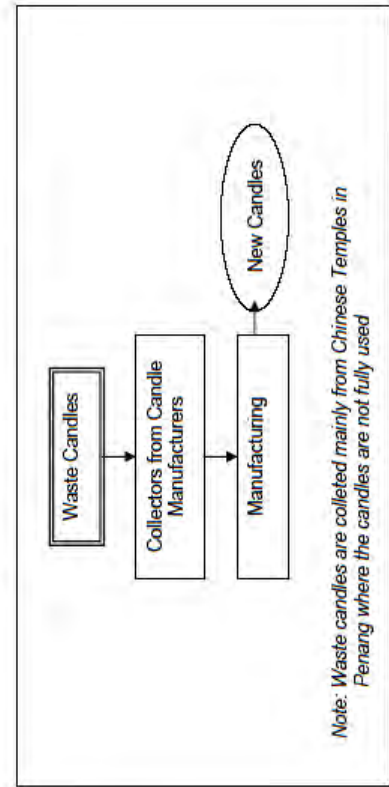


Figure 11: Material Flow for Waste Candles

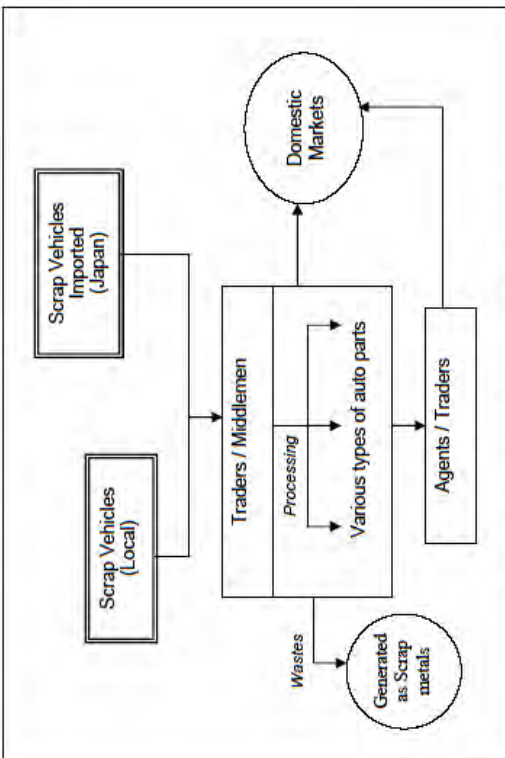
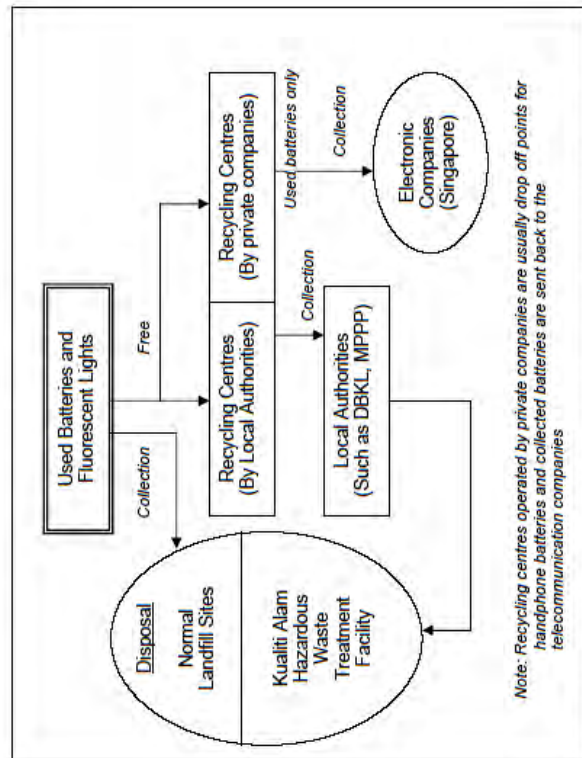


Figure 12: Material Flow for Scrap Vehicles



Note: Recycling centres operated by private companies are usually drop off points for handphone batteries and collected batteries are sent back to the telecommunication companies

Figure 13: Material Flow for Used Batteries and Fluorescent Lights

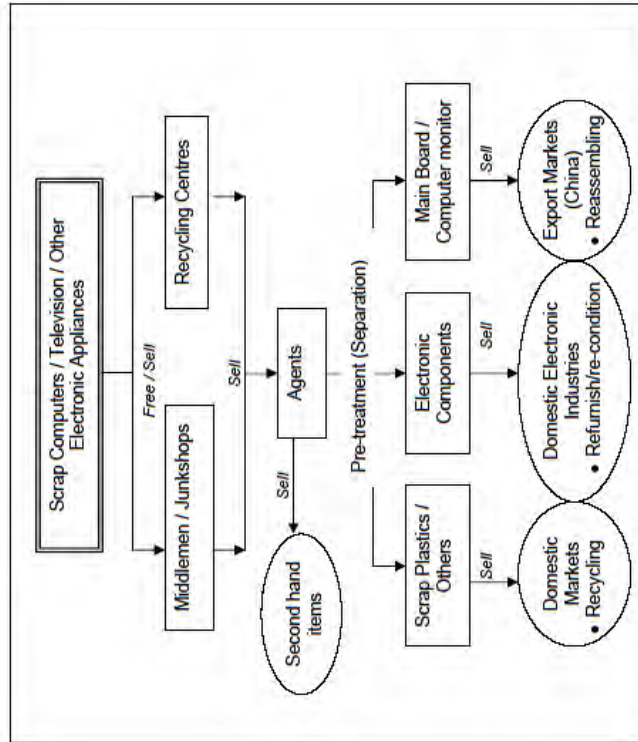


Figure 14: Material Flow for Used Computers / Television / Other Electronic Appliances

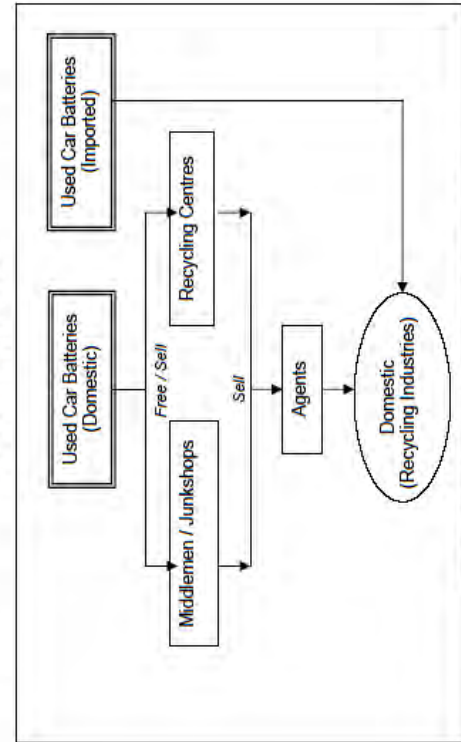


Figure 15: Material Flow for Car Batteries

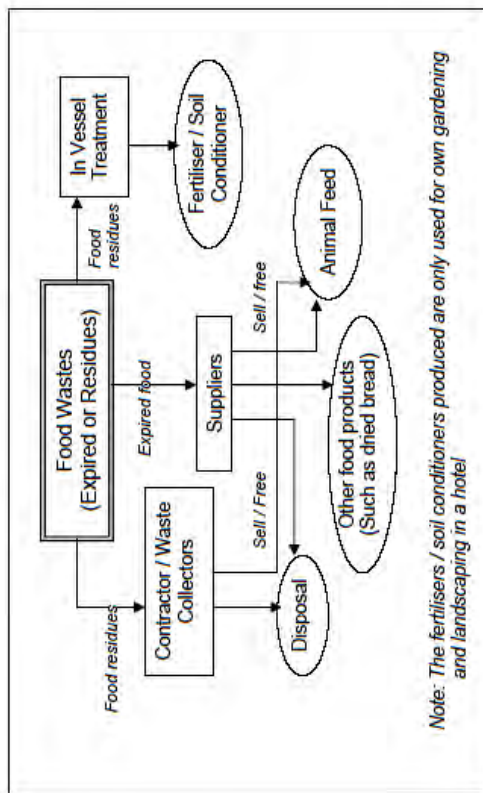


Figure 16: Material Flow for Food Wastes

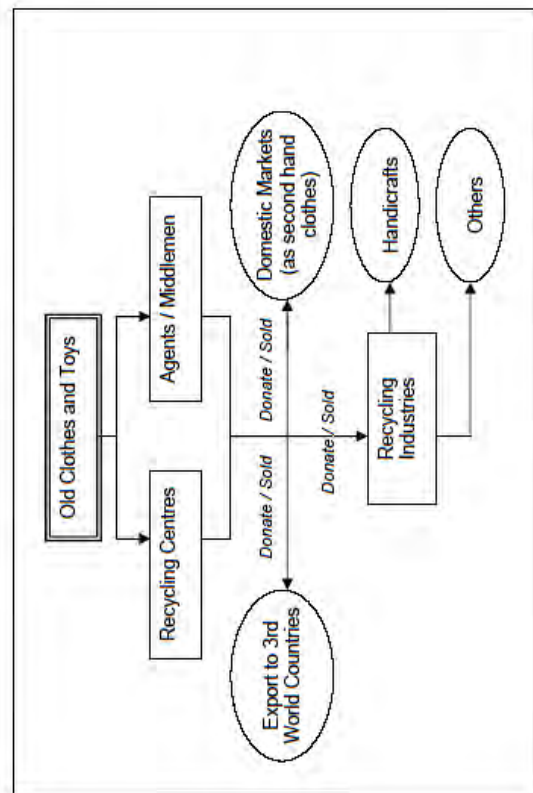


Figure 17: Material Flow for Old Clothes and Toys

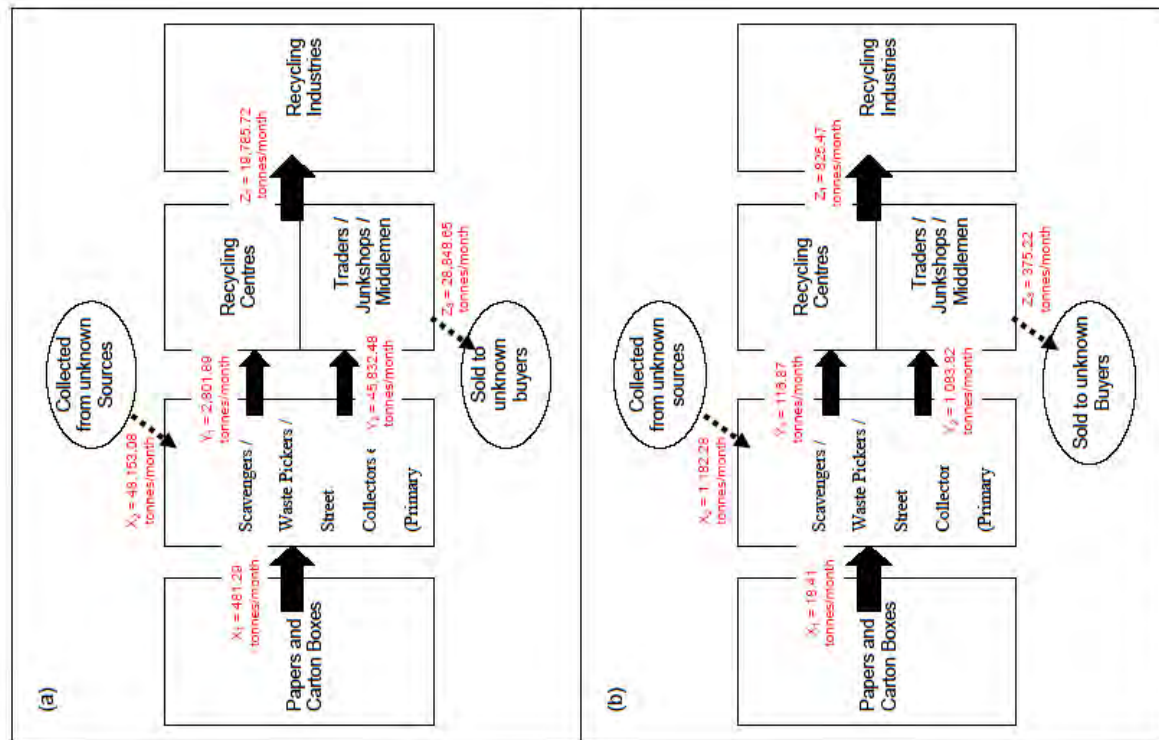


Figure 18: Mass Balance of Material Flow for Papers and Carton Boxes

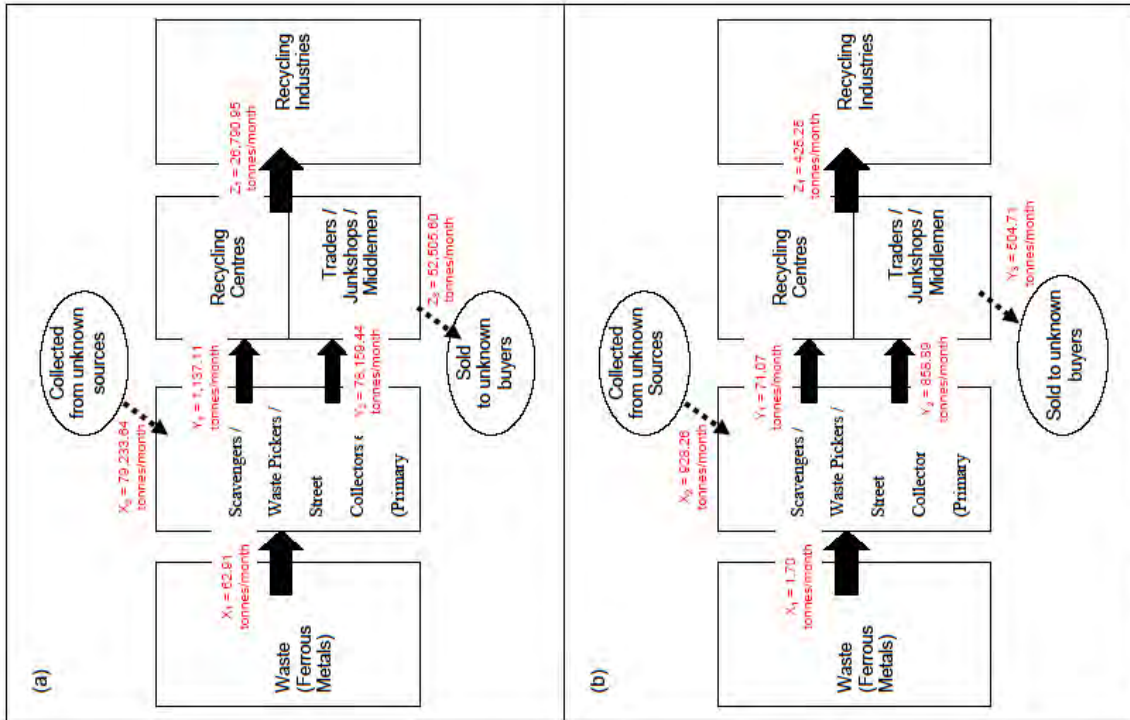


Figure 19: Mass Balance of Material Flow for Plastics

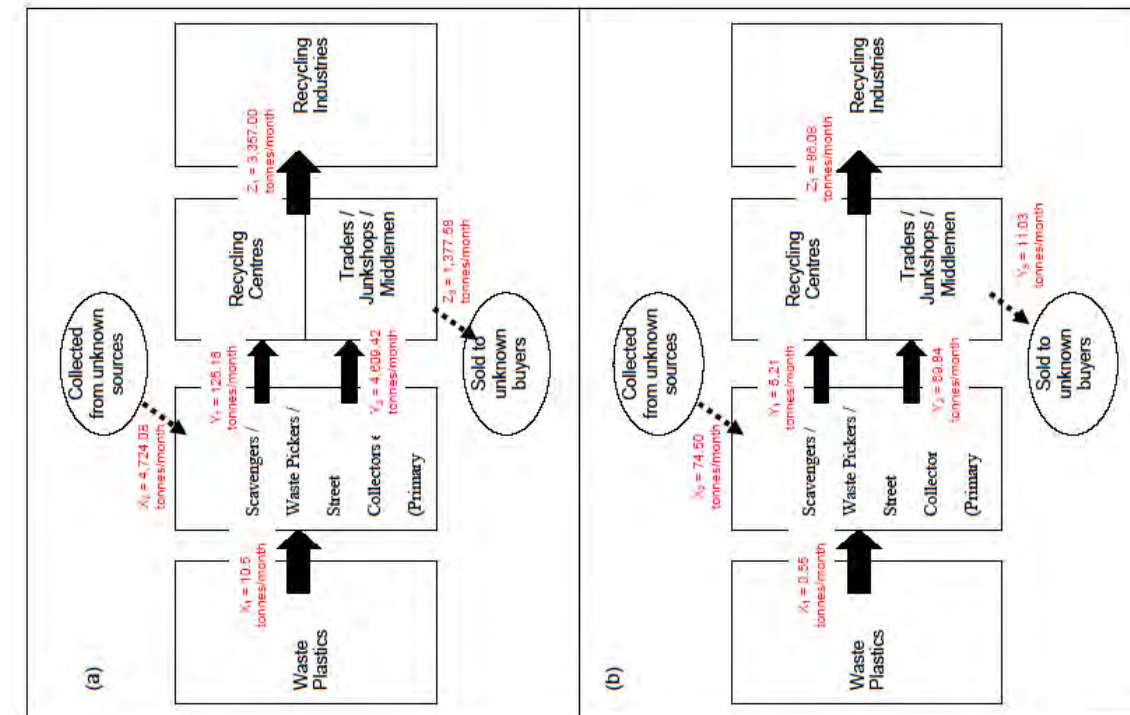


Figure 20: Mass Balance of Material Flow for Ferrous Metals (Iron)

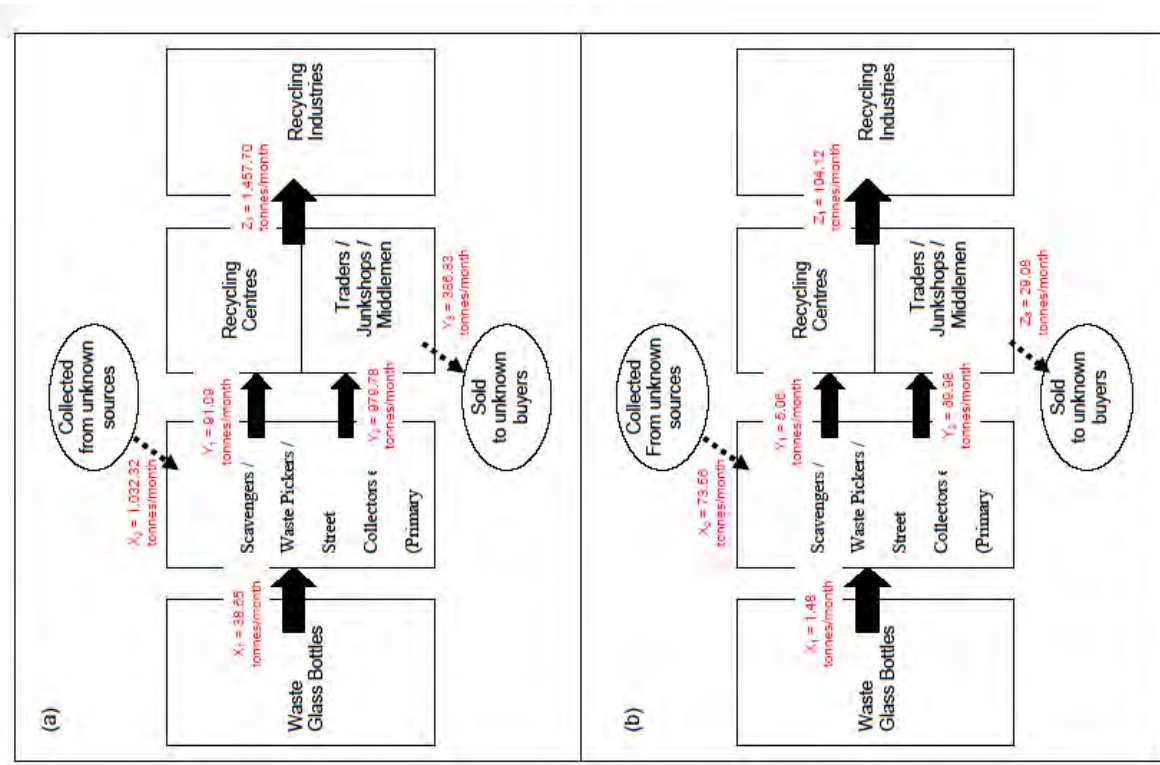


Figure 22: Mass Balance of Material Flow for Glass Bottles

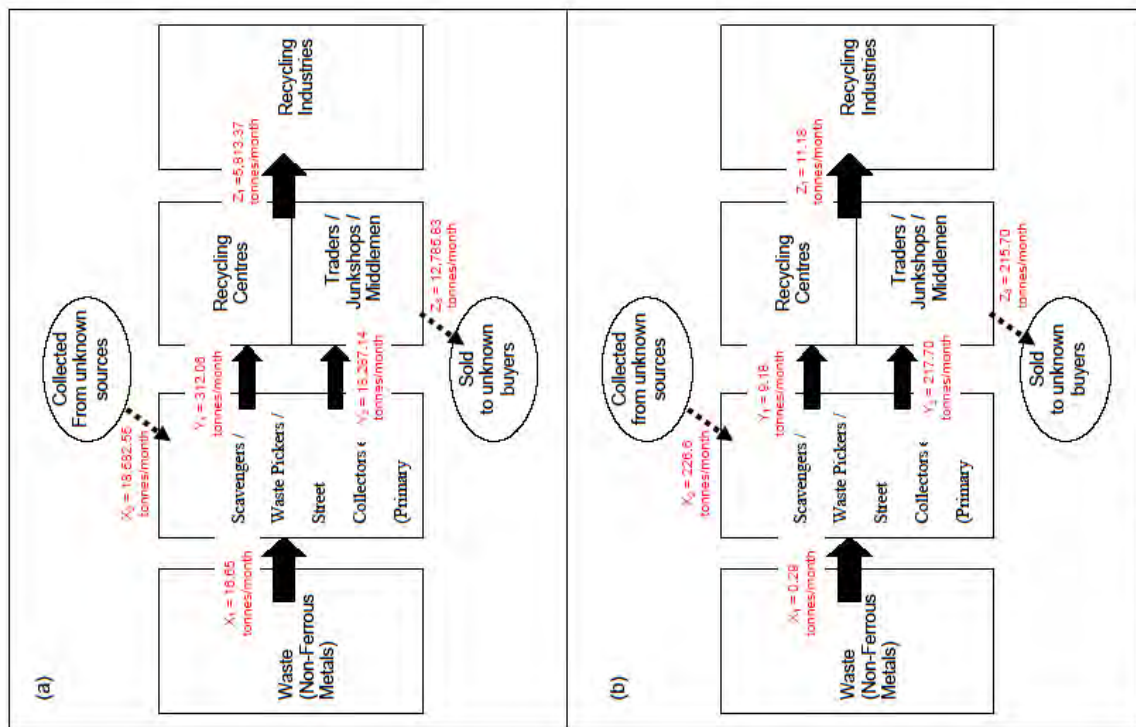


Figure 21: Mass Balance of Material Flow for Non-ferrous Metals (Aluminium cans)

7.4 Calculation of Per Capita Generation and Recycling Rate in Malaysia

a) Calculation of Waste Generation, Recovery and Disposed

In this study, field studies were carried out in the first Phase to determine some background data on per capita waste generation rate in selected areas within Kuala Lumpur areas. The waste generation rates from different sources of generation were identified including the low, medium and high income households, as well as the business entities. The results of the findings are summarised in Table 4-1 as follows:

Table 4-1 Summary Results on Per Capita Generation Rate from Phase 1 of the Study

No	Descriptions	Generation Rate (kg/cap/day)
1	Per capita Generation Rate of High/Medium Income (Households)	0.710
2	Per capita Generation Rate of Low Income (Households)	0.502
3	Per Capita Generation Rate of Business Entities	0.304
4	Average Per Capita Waste Recovery Rate	0.111

Due to the fact that the Phase 1 studies were carried out mainly in Kuala Lumpur areas, some extrapolations need to be done in order to produce figures that are more representable for the overall per capita generation rate in the country. The major concern on the results of studies carried out in Kuala Lumpur area as compared with other areas is the difference in terms of peoples' standard of living of these places, where it is assumed to directly affect the amount of solid waste generation.

Some useful information for the extrapolation was obtained from various sources as summarised below:

i) Percentage of Urban vs Rural in Malaysia:

1991 – Urban (51.05%) : Rural (48.95%)
2000 – Urban (61.99%) : Rural (38.01%)
2004 – Urban (66.86%) : Rural (33.14%)

Source: Statistic Yearbook 2004 (Department of Statistic Malaysia)

ii) Population in Malaysia (2004) : 25,580,900
Urban population (66.86%) : 17,103,390
Rural population (33.14%) : 8,477,510

Source: Statistic Yearbook 2004 (Department of Statistic Malaysia)

iii) Statistics on Expenditure:

Urban expenditure	:	RM1,943.00 per month
Rural expenditure	:	RM 1,270.00 per month
Ratio (Urban vs Rural)	:	60.47% vs 39.53%
	:	1 : 0.65

Source: Household Expenditure Survey 98/99 (Department of Statistic Malaysia)

Based on this information and results obtained from Phase 1 of the studies, estimation for the waste generation, recovery and disposal were carried with some key assumptions that:

- Waste generation rate for medium/high income areas in Phase 1 of the studies was taken to represent URBAN
- Waste generation rate for RURAL was calculated based on ration of Urban : Rural published by EPU, i.e. 1 : 0.65)
- Assuming that waste generation is proportional with level of expenditure
- Per Capita Waste Recovery Rate from se 1 of the studies was taken to represent URBAN
- Waste Recovery Rate for RURAL was assumed to be 50% of URBAN
- Waste Disposal Rate = Waste Generation Rate - Waste Retained Rate
- Assumption that the waste loss on other destinations are insignificant

Therefore, the total waste generation, recovery and disposal from households and business entities was calculated as follows:

Waste Generation:

i) For Households

Urban (per capita generation rate)	= 0.710 kg/cap/day
Rural (per capita generation rate)	= 0.710 kg/cap/day x 0.65 = 0.464 kg/cap/day
Total wastes generated from Urban	= 17,103,390 x 0.710 kg/cap/day = 12,135 tones/day
Total wastes generated from Rural	= 8,477,510 x 0.464 kg/cap/day = 3,931 tones/day
Total wastes generated	= 16,066 tones/day
Average per capita generation rate	= 0.628 kg/cap/day

ii) For Business Entities	
Urban (per capita generation rate)	= 0.304 kg/cap/day
Rural (per capita generation rate)	= 0.304 kg/cap/day x 0.65 = 0.198 kg/cap/day
Total wastes generated from Urban	= 17,103,390 x 0.304 kg/cap/day = 5,193 tones/day
Total wastes generated from Rural	= 8,477,510 x 0.198 kg/cap/day = 1,682 tones/day
Total wastes generated	= 6,875 tones/day
Average per capita generation rate	= 0.269 kg/cap/day

Based on these calculations, the total wastes generated in Malaysia was then estimated to be (16,066 + 6,875) tones/day, or **22,941 tones/day**. This is equivalent to about **0.897 kg/cap/day**.

Waste Recovery:

i) For Households	
Urban (per capita recovery rate)	= 0.111 kg/cap/day
Rural (per capita recovery rate)	= 0.111 kg/cap/day x 0.5 = 0.055 kg/cap/day
Total wastes recovered from Urban	= 17,103,390 x 0.111 kg/cap/day = 1,896 tones/day
Total wastes recovered from Rural	= 8,477,510 x 0.055 kg/cap/day = 470 tones/day
Total wastes recovered	= 2,365 tones/day
Average per capita recovery rate	= 0.092 kg/cap/day

ii) For Business Entities	
Urban (per capita recovery rate)	= 0.061 kg/cap/day
Rural (per capita recovery rate)	= 0.061 kg/cap/day x 0.5 = 0.031 kg/cap/day
Total wastes recovered from Urban	= 17,103,390 x 0.061 kg/cap/day = 1,047 tones/day
Total wastes recovered from Rural	= 8,477,510 x 0.031 kg/cap/day = 259 tones/day
Total wastes recovered	= 1,306 tones/day
Average per capita recovered rate	= 0.051 kg/cap/day

Based on these calculations, the total wastes recovered in Malaysia was then estimated to be (2,365+ 1,306) tones/day, or **3,671 tones/day**. This is equivalent to about **0.144 kg/cap/day**.

Waste Disposal:

i) For Households	
Per capita disposal rate	= (0.628 – 0.092) kg/cap/day = 0.536 kg/cap/day
Total wastes disposed from households	= (16,066 – 2,365) tones/day = 13,701 tones/day

For Business Entities	
Per capita disposal rate	= (0.269 – 0.051) kg/cap/day = 0.218 kg/cap/day
Total wastes disposed from b. entities	= (6,875 – 1,306) tones/day = 5,569 tones/day

Based on these calculations, the total wastes recovered in Malaysia was then estimated to be (13,701+ 5,569) tones/day, or **19,270 tones/day**. This is equivalent to about **0.753 kg/cap/day**.

In summary, the overall waste generation, recovery and disposal rates estimated for Malaysia are summarized in Table 4-2 as follows:

Table 4-2 Summary of Overall Waste Generation, Recovery and Disposal Rates in Malaysia

Descriptions	Unit in kg/cap/day		
	Households	B. Entities	Total
Per Capita Generation Rate	0.628	0.269	0.897
Per Capita Recovery Rate	0.092	0.051	0.144
Per Capita Disposal Rate	0.536	0.218	0.753
	Unit in tones/day		
	Households	B. Entities	Total
Total Waste Generated	16,066	6,875	22,941
Total Waste Recovered	2,365	1,306	3,671
Total Waste Disposed	13,701	5,569	19,270

b) Calculation of Existing Recycling Rate

It was found from the field studies that not all the wastes generated from sources (households and business entities) are discarded from the sources, but some of the wastes are retained at sources for other purposes including recycling. It is therefore observed that recycling activities take parts not only at recycling centres which are always the targets as far as recycling is concerned, but it happens even at the generation sources, where the wastes are directly sold as recyclables.

Therefore, two different types of recycling activities should be clearly defined, i.e. the recycling activities that are carried out under private business initiatives, and recycling activities are under public sector initiatives. The boundaries of these two different types of recycling activities can be illustrated in the overall wastes flow as shown in Figure 4-1 below.

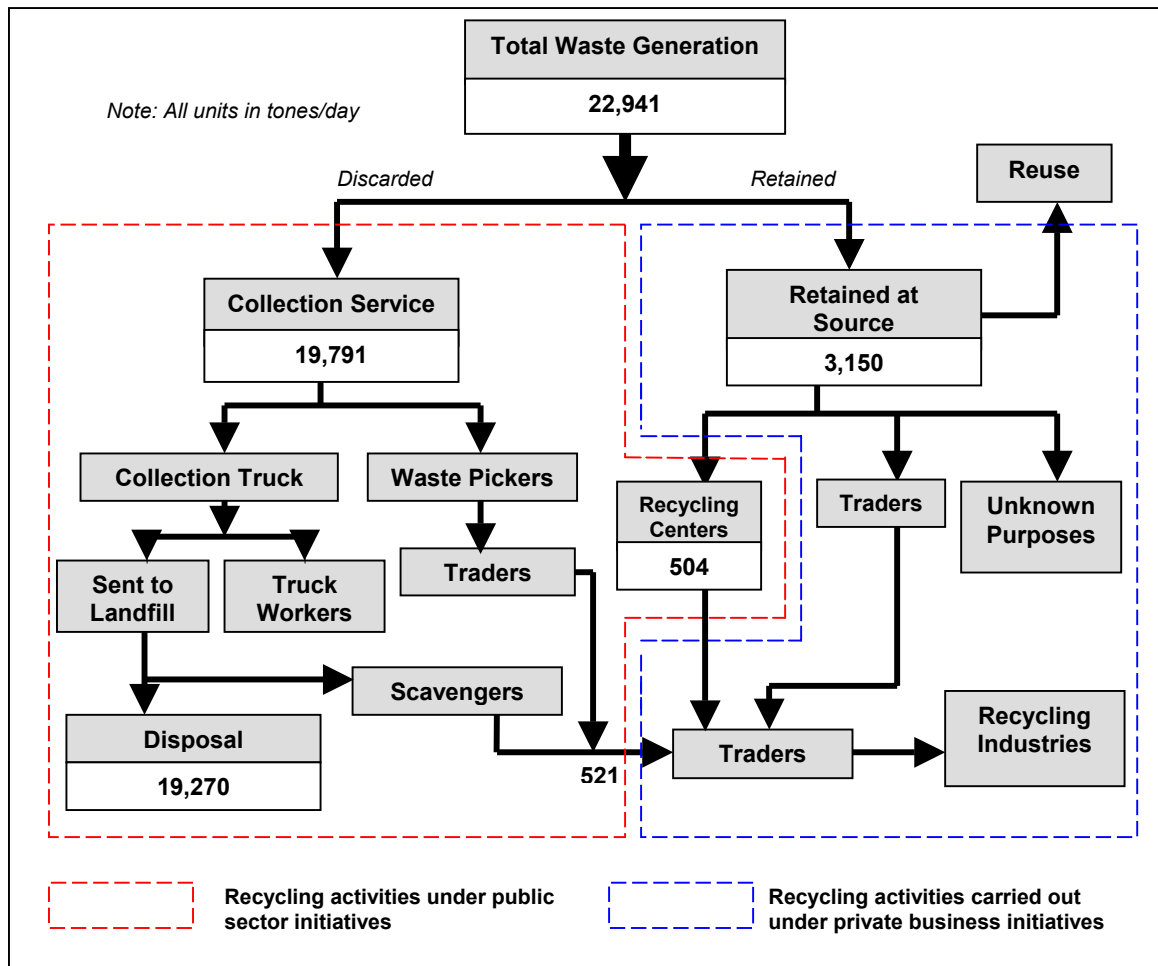


Figure- 4-1 Boundaries of Recycling Activities Carried out under Private Business and Public Sector Initiatives

The recycling activities that are under private business initiatives are difficult to be captured and these private businesses are unpredictable depending on the market price of the recyclables.

Therefore the target recycling rate is focused only on the public sector initiatives, where it covers mainly the recycling activities in recycling centres initiated not only by the government, but also the local authorities and other organisations such as charity organisations and NGOs.

The numbers shown in Figure 1 show the estimated amount of waste generated, recovered and disposed as discussed earlier. The total waste generated in Malaysia was calculated as 22,941 tons/day. Out of this total, about 3,671 tons/day of wastes were recovered, but only 1,025 tons/day was recorded as part of the recycling activities

under public sector initiatives (504 from recycling centres and 521 from waste pickers and scavengers).

The recycling rate is therefore calculated as:

The Recycling Rate	= (1,025 / 22,941) x 100%
	= 4.5%

APPENDICES

Questionnaires Used in the Survey

Appendix 1

Survey on Waste Generation / Composition and Questionnaires on Selected Households in Kuala Lumpur



AMOUNT AND COMPOSITION OF WASTE FROM HOUSEHOLDS (for Interview)

Interviewer: _____ Date: _____

I. BASIC DESCRIPTION OF RESPONDENT

1. Name: (Mr / Mrs / Ms / others (Pls. specify) _____

2. Address: _____

3. Telephone : _____ **E-mail :** _____

4. Age Group : (a)16~25 (b)26~35 (c)36~45 (d)46~55 (e)56~65 (f) more than 65

5. Are you the head of the household: (a) Yes (b) No

II. HOUSEHOLD

Q1. Total number of family members living in the house _____ persons

Q2. Household total monthly income

(a) less than RM1000 (b) RM1000~RM2000 (c) RM2001~RM3000 (d) RM3001~RM4000

(e) RM 4001~RM5001 (f) RM5001~RM7000 (g) more than RM7000

Q3. How many persons are working for your family? _____ persons

Q4. Type of housing:

(a) Single Storey Terraced House (b) 2-3 Storey Terraced House (c) Single Storey Semi-Detached House
 (d) 2-3 Storey Semi-Detached House (e) Single Storey Detached House (f) 2-3 Storey Detached House
 (g) Low Cost Flats (h) Apartment / Condominium (i) Others

III. HOUSEHOLD WASTE

Q5. In the past 7 days (1 week), how much waste did your household throw out? Please indicate the days and estimated amount of waste in the table below.

Date (D/M/Y)	Days	Waste thrown out (Specify the type of waste)	Estimated equivalent amount of waste		
			Small Bag	Medium Bag	Large Bag
	Sun	Yes <input type="checkbox"/> No <input type="checkbox"/> ()			
	Mon	Yes <input type="checkbox"/> No <input type="checkbox"/> ()			
	Tue	Yes <input type="checkbox"/> No <input type="checkbox"/> ()			
	Wed	Yes <input type="checkbox"/> No <input type="checkbox"/> ()			
	Thu	Yes <input type="checkbox"/> No <input type="checkbox"/> ()			
	Fri	Yes <input type="checkbox"/> No <input type="checkbox"/> ()			
	Sat	Yes <input type="checkbox"/> No <input type="checkbox"/> ()			

Q6. Please specify the amount of recyclables produced from your house for the PAST ONE WEEK.

Items	Amount	Unit (Pls. specify)	Recycling Method
(1) Newspaper			[] a. Sell or give to the door-to-door collectors [] b. Bring to the recycling station / centre [] c. Waste bin (no separation) [] d. Others (pls. specify)
(2) Magazines			[] a. Sell or give to the door-to-door collectors [] b. Bring to the recycling station / centre [] c. Waste bin (no separation) [] d. Others (pls. specify)



Items	Amount	Unit (Pls. specify)	Recycling Method
(3) Other papers			<input type="checkbox"/> a. Sell or give to the door-to-door collectors <input type="checkbox"/> b. Bring to the recycling station / centre <input type="checkbox"/> c. Waste bin (no separation) <input type="checkbox"/> d. Others (<i>pls. specify</i>)
(4) Aluminium Can			<input type="checkbox"/> a. Sell or give to the door-to-door collectors <input type="checkbox"/> b. Bring to the recycling station / centre <input type="checkbox"/> c. Waste bin (no separation) <input type="checkbox"/> d. Others (<i>pls. specify</i>)
(5) Steel Cans water/ Soft drink bottles)			<input type="checkbox"/> a. Sell or give to the door-to-door collectors <input type="checkbox"/> b. Bring to the recycling station / centre <input type="checkbox"/> c. Waste bin (no separation) <input type="checkbox"/> d. Others (<i>pls. specify</i>)
(6) PET Bottles			<input type="checkbox"/> a. Sell or give to the door-to-door collectors <input type="checkbox"/> b. Bring to the recycling station / centre <input type="checkbox"/> c. Waste bin (no separation) <input type="checkbox"/> d. Others (<i>pls. specify</i>)
(7) Other plastic bottles			<input type="checkbox"/> a. Sell or give to the door-to-door collectors <input type="checkbox"/> b. Bring to the recycling station / centre <input type="checkbox"/> c. Waste bin (no separation) <input type="checkbox"/> d. Others (<i>pls. specify</i>)
(8) Other plastics (<i>pls. specify</i>)			<input type="checkbox"/> a. Sell or give to the door-to-door collectors <input type="checkbox"/> b. Bring to the recycling station / centre <input type="checkbox"/> c. Waste bin (no separation) <input type="checkbox"/> d. Others (<i>pls. specify</i>)
(9) Glass Bottles			<input type="checkbox"/> a. Sell or give to the door-to-door collectors <input type="checkbox"/> b. Bring to the recycling station / centre <input type="checkbox"/> c. Waste bin (no separation) <input type="checkbox"/> d. Others (<i>pls. specify</i>)
(10) Other types of glass / ceramic			<input type="checkbox"/> a. Sell or give to the door-to-door collectors <input type="checkbox"/> b. Bring to the recycling station / centre <input type="checkbox"/> c. Waste bin (no separation) <input type="checkbox"/> d. Others (<i>pls. specify</i>)
(11) Kitchen Waste			<input type="checkbox"/> a. Put into bags/bin for municipal waste collection <input type="checkbox"/> b. Bury in the yard <input type="checkbox"/> c. Feed to animals (livestock / pets / others) <input type="checkbox"/> d. Sell or give to the door-to-door collectors <input type="checkbox"/> e. Bring to the recycling station / centre <input type="checkbox"/> f. Others (<i>pls. specify</i>)
(12) Others (<i>pls. specify</i>)			<input type="checkbox"/> a. Sell or give to the door-to-door collectors <input type="checkbox"/> b. Bring to the recycling station / centre <input type="checkbox"/> c. Waste bin (no separation) <input type="checkbox"/> d. Others (<i>pls. specify</i>)
(13)			
(14)			
(15)			



IV. DISPOSAL AND RECYCLING METHOD

Q7. Please indicate your household disposal methods in the table below. (Please indicate [1] for the most frequent method, and [2] for the 2nd frequent method.)

Items	Disposal and recycling methods
(a) Car lead acid battery	[] a. Call up the municipal waste collection service to collect [] b. Sell or give to the door-to-door collectors [] c. Bring to the recycling station / centre [] d. Leave at the car repair workshop [] e. Others (pls. specify: _____)
(b) Small dry cell batteries and hp batteries	[] a. Put into bags / bin for waste collection service [] b. Sell or give to the door-to-door collectors [] c. Bring to the recycling station / centre [] d. Others (pls. specify: _____)
(c) Fluorescent tubes	[] a. Put into bags / bin for municipal waste collection [] b. Bury in the yard [] c. Sell or give to the door-to-door collectors [] d. Bring to the recycling station / centre [] g. Others (pls. specify: _____)

V. LIFESPAN OF THE ITEMS IN YOUR HOUSE

Q8. Please indicate how many of the following items you have in your house and after how many years do you usually replace the items

Items	a. Car	b. Motor bike	c. Bicycle	d. Cupboards	e. Beds	f. Chairs
No. units						
After how many years do you usually replace the items?						

Items	g. Table & Desks	h. TV sets	i. Refrigerators	j. Washing Machines	k. Air Conditioners	l. PC devices
No. units						
After how many years do you usually replace the items?						

VI. AWARENESS AND WILLINGNESS TO RECYCLE

Q9. Do you know the meaning of “Recycling”? (a) Yes (b) No (c) No idea

Q10. Have you ever seen the “Recycling bin”? (a) Yes (b) No (c) No idea

Q11. Do you participate in any recycling activity (individual basis)? (a) Yes (b) No

(1) If yes, please describe activity:

- (a) Waste Separation at home/office
- (b) Volunteer at recycling org
- (c) Buy from charity shops
- (d) Bring own shopping bag
- (e) Bring own take-away containers
- (f) Operate recycling business (pls. specify)
- (g) Other activities (pls. specify)

(2) If No, please state reason:

- (a) No time
- (b) Lack information
- (c) No recycling centre nearby
- (d) Not interested
- (e) Monetary return too low
- (f) Other reasons (pls. specify)



Q12. Are you satisfied with the present recycling system/facilities?

(a) Yes (b) No

Please give reasons:

.....

.....

.....

Q13. Do you have any comment on the “Solid Waste Management” in your community?

Ans.

This is the end of questionnaire. Thank you for kind cooperation!!

Appendix 2

Survey on Waste Generation and Recycling by Business Entities and Households



Questionnaire on Business Entities (Offices)

Date		
Interviewer		
Respondent	Name	
	Position	

1. Company Profile

Name of Company			
Type of Business			
Year of Incorporation		Website	
		Phone	
Office Address		FAX	
		E-mail	
		Number of Employees	
Annual Sales (Turnover)			
Annual Report Provided?	<input type="checkbox"/> Yes <input type="checkbox"/> No		

2. Current Status of Recycling Activities

2.1 Segregation of waste for recycling at your office

Do you segregate the waste at your office? If you do, specify the types and amount of the waste that are segregated.

	Types of Waste Segregated	Amount (per month)	
		Unit	Amount
1	ONP (Old Newspaper)		
2	Magazines		
3	Other waste papers		
4	Steel cans		
5	Aluminum cans		
6	PET bottles		
7	Kitchen waste		
8	Others ()		
9	Others ()		
10	Others ()		



2.2 Destination of Segregated Wastes

Please specify how you deal with the segregated wastes. Please the appropriate box.

Items		Methods of Recycling
1	ONP (Old Newspaper)	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
2	Magazines	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
3	Other waste papers	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
4	Steel cans	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
5	Aluminum cans	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
6	PET bottles	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)



Items		Methods of Recycling
7	Kitchen / Pantry waste	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
8	Others (Specify)	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
9	Others (Specify)	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
10	Others (Specify)	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)

2.3 Price of Segregated Recyclables

If you sell your recyclables, please indicate the prices.

Type of recyclables		Price	
		Unit	RM
1	ONP (Old Newspaper)		
2	Magazines		
3	Other waste papers		
4	Steel cans		
5	Aluminum cans		
6	PET bottles		
7	Kitchen waste		
8	Others ()		
9	Others ()		
10	Others ()		



2.4 Activities in relation to Waste Minimization and Recycling

What other waste minimization and recycling activities are carried out at your office?

Please

1	Reuse of mailed envelopes and/or packages	
2	Use double-sided copying and printing	
3	Use of reverse side of used papers	
4	Using re-filled or re-manufactured toner cartridge	
5	Replacing disposable cups with ceramic mugs	
6	Reducing the use of plastic bags	
7	Others (Specify)	
8	Others (Specify)	
9	Others (Specify)	

2.5 Issues in further promoting waste minimization and recycling

What are the main issues that should be addressed for further promoting waste minimization and recycling? Select the 3 most important issues.

1	Raising awareness on recycling.	
2	Establishment of clear National Guidelines and Regulations	
3	Strict enforcement of the regulations	
4	Provision of incentives	
5	More material recycling facilities required	
6	Introduction of waste collection and disposal taxes	
7	Consistent collection and buy-back system	
8	Others (Specify)	
9	Others (Specify)	

This is the end of questionnaire. Thank you for your kind cooperation.



Questionnaire on Business Entities (Commercial & Services)

Date		
Interviewer		
Respondent	Name	
	Position	

1. Company Profile

Name of Company			
Type of Business			
Year of Incorporation		Website	
Office Address		Phone	
		FAX	
		E-mail	
Annual Sales (Turnover)		Number of Employees	
Annual Report Provided?	<input type="checkbox"/> Yes <input type="checkbox"/> No		

2. Current Status of Recycling Activities

2.1 Segregation of waste for recycling

Do you segregate the waste at your premise? If you do, specify the types and amount of the waste that are segregated.

Types of Waste Segregated		Amount (per month)	
		Unit	Amount
1	ONP (Old Newspaper)		
2	Magazines		
3	Other waste papers		
4	Steel cans		
5	Aluminum cans		
6	PET bottles		
7	Pantry / food waste		
8	Others ()		
9	Others ()		
10	Others ()		



2.2 Destination of Segregated Wastes

Please specify how you deal with the segregated wastes. Please the appropriate box.

Items		Methods of Recycling
1	ONP (Old Newspaper)	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
2	Magazines	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
3	Other waste papers	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
4	Steel cans	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
5	Aluminum cans	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
6	PET bottles	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)



Items		Methods of Recycling
7	Pantry / food waste	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
8	Others (Specify)	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
9	Others (Specify)	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)
10	Others (Specify)	<input type="checkbox"/> Sold to the private recyclers/collectors of recyclables <input type="checkbox"/> Taken by recyclers/collectors of recyclables without payment <input type="checkbox"/> Brought to the nearest buy-back or drop-off center <input type="checkbox"/> Taken by waste collection agents <input type="checkbox"/> Others (Specify)

2.3 Price of Segregated Recyclables

If you sell your recyclables, please indicate the prices.

Type of recyclables		Price	
		Unit	RM
1	ONP (Old Newspaper)		
2	Magazines		
3	Other waste papers		
4	Steel cans		
5	Aluminum cans		
6	PET bottles		
7	Kitchen waste		
8	Others ()		
9	Others ()		
10	Others ()		



2.4 Activities in relation to Waste Minimization and Recycling

What other waste minimization and recycling activities are carried out at your premise?

Please

1	Discourage the use of packaging materials	
2	Discourage the use of plastic bags	
3	Encourage collection of recyclables from the customers (e.g. setting up recycling bins)	
4	Segregation of recyclables at the premise	
5	Setting up buy-back center at the premise	
6	Recycling food waste	
7	Promotion on selling of the consumer goods made from recycled materials	
8	Others (Specify)	
9	Others (Specify)	
10	Others (Specify)	

2.5 Issues in further promoting waste minimization and recycling

What are the main issues that should be addressed for further promoting waste minimization and recycling? Select the 3 most important issues.

1	Raising awareness on recycling.	
2	Establishment of clear National Guidelines and Regulations	
3	Strict enforcement of the regulations	
4	Provision of incentives	
5	More material recycling facilities required	
6	Introduction of waste collection and disposal taxes	
7	Consistent collection and buy-back system	
8	Others (Specify)	
9	Others (Specify)	

This is the end of questionnaire. Thank you for your kind cooperation.



Questionnaire on Business Entities (Construction)

Date		
Interviewer		
Respondent	Name	
	Position	

1. Company Profile

Name of Company			
Type of Business			
Year of Incorporation		Website	
Office Address		Phone	
		FAX	
		E-mail	
Annual Sales (Turnover)		Number of Employees	
Annual Report Provided?	<input type="checkbox"/> Yes <input type="checkbox"/> No		

2. Generation & Management of Construction Waste

2.1 The amount of construction waste generated

Specify the types and amount of construction waste that are generated from your construction activities.

Types of Waste Segregated		Amount (per month)	
		Unit	Amount
1	Excess soil		
2	Concrete waste		
3	Asphalt-concrete waste		
4	Wood waste		
5	Slurry / Sludge		
6	Mixed construction waste		
7	Scrap metals (Ferrous)		
8	Scrap metals (Non-Ferrous)		
9	Waste plastics		
10	Waste papers		
11	Asbestos		
12	Others (specify		



2.2 Treatment and disposal methods of construction waste

Please specify how you deal with the construction wastes. Please the appropriate box.

Items		Methods of Recycling
1	Excess soil	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Send to disposal site (landfill). <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Re-use as backfilling materials (within the same site). <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify)
2	Concrete waste	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Send to disposal site (landfill). <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Re-use as backfilling materials (within the same site). <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify)
3	Asphalt-concrete waste	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Send to disposal site (landfill). <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Re-use as backfilling materials (within the same site). <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify)
4	Wood waste	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Send to disposal site (landfill). <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Burned. <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify)
5	Slurry / Sludge	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Re-use as backfilling materials (within the same site). <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify)
6	Mixed construction waste	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Send to disposal site (landfill). <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Burned. <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify)



Items		Methods of Recycling
7	Scrap metals (Ferrous)	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Send to disposal site (landfill). <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify _____)
8	Scrap metals (Non-Ferrous)	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Send to disposal site (landfill). <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify _____)
9	Waste plastics	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Send to disposal site (landfill). <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify _____)
10	Waste papers	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Burned. <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify _____)
11	Asbestos	<input type="checkbox"/> Taken by licensed waste collection agents. <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify _____)
12	Others (specify _____)	<input type="checkbox"/> Taken by recyclers/collectors <input type="checkbox"/> Send to recyclers. <input type="checkbox"/> Send to disposal site (landfill). <input type="checkbox"/> Taken by waste collection agents. <input type="checkbox"/> Re-use as backfilling materials (within the same site). <input type="checkbox"/> Burned. <input type="checkbox"/> Dumped on vacant land / other places <input type="checkbox"/> Others (Specify _____)



2.3 Price of Recyclables

If you sell your recyclables, please indicate the prices.

Type of recyclables		Price	
		Unit	RM
1	Excess soil		
2	Concrete waste		
3	Asphalt-concrete waste		
4	Wood waste		
5	Slurry / Sludge		
6	Mixed construction waste		
7	Scrap metals (Ferrous)		
8	Scrap metals (Non-Ferrous)		
9	Waste plastics		
10	Waste papers		
11	Asbestos		
12	Others (specify		

2.4 Collection and disposal fees

If you use the disposal services of the 3rd party contractors, please specify the charges for collection and disposal.

Items	Charges		Remarks
	Unit	RM	
Collection			
Disposal			

This is the end of questionnaire. Thank you for your kind cooperation.



Questionnaire on Business Entities (Manufacturing Factory)

Date		
Interviewer		
Respondent	Name	
	Position	

1. Company Profile

Name of Company			
Type of Business			
Year of Incorporation		Website	
Office Address		Phone	
		FAX	
		E-mail	
Annual Sales (Turnover)		Number of Employees	
Annual Report Provided?	<input type="checkbox"/> Yes <input type="checkbox"/> No		

2. Baseline Data of the Factory

2.1 Types and amount of production output

Please specify the types and amount of production output in your factory.

	Types of Products	Production Output (per month)	
		Unit	Amount
1			
2			
3			
4			
5			
6			
7			
8			



2.2 Types and amount of raw materials used

Please specify the types and amount of raw and processed materials input in your factory

	Type	Usage/Purpose	Amount (Tonnes/month)
1			
2			
3			
4			
5			
6			
7			
8			

2.3 Water consumption

Please specify the amount of water consumed in your factory by following purposes.

	Purpose	Water consumption (m ³ /month)	Cost of Water Consumption (RM/month)
1	Industrial Use (Process Water)		
2	Others		

2.4 Energy consumption

Please specify the types and amount of energy resources used in your factory.

	Type	Monthly Consumption	
		Unit	Amount
1	Electricity	KWH	
2	Solid fuels (Coal, Coke, Peat, etc.)		
3	Liquid fuels (Oil and other petroleum products)		
4	Gaseous fuels (Natural Gas, LPG, etc)		
5	Biomass (wood, charcoal, etc.)		
6	Others (please specify)		
7	Others		
8	Others		



2.5 Production Process Flow Chart

Production process flow chart provided? Yes No

3. Baseline Data of Waste Generation

3.1 Types and amount of waste generated from production process

Please specify the types and amount of waste generated from your production process.

Type	Generation Source in the Process	Generation (per month)	
		Unit	Amount
1. Non-Scheduled Waste			
1	Waste paper		
2	Waste wood		
3	Waste fibres		
4	Waste rubber		
5	Waste plastic		
6	Animal/Plant waste		
7	Scrapped metals		
8	Scrapped glass		
9	Scrapped ceramics		
10	Slag		
11	Ash		
12	Sludge		
13	Others (Specify)		
14	Others		
15	Others		
16	Others		
17	Others		
18	Others		
19	Others		
20	Others		



Type	Generation Source in the Process	Generation (per month)	
		Unit	Amount
2. Scheduled Waste (Please specify in accordance with DOE's Scheduled Waste Code)			
1			
2			
3			
4			
5			
6			
7			

3.2 Types and amount of non-scheduled waste generated from non-process sources

Please specify the types and amount of waste generated from non-process sources in your factory.

Type	Generation (per month)	
	Unit	Amount
1 Waste papers		
2 Steel cans		
3 Aluminum cans		
4 PET bottles		
5 Glass bottles		
6 Kitchen waste		
7 Other Wastes (specify)		
8		
9		
10		
11		
12		
13		
14		
15		



3.3 Efforts of Waste Minimization at Source

What kind of efforts are currently made in your factory for waste minimization at the source?

Please all that apply.

a	Measurement and recording of raw material input and water/energy consumption in the production/manufacturing process.	
b	Measurement and recording of the amount of waste generated from production/manufacturing process.	
c	On-site reuse/recycling of waste	
d	Segregation of waste between recyclables and non-recyclables	
e	Production process control to maximize productivity (water/energy/raw material saving, minimization of defective products, etc.)	
f	Others (Please specify)	

4.2 Use of Recycled Materials in the Factory

Do you currently accept any recycled materials for use in your factory? If you do, please specify them in accordance with the table below.

Type	Amount (per month)	Supply		Price (RM/kg)	Use/Purpose
		from	%		
		1. Collectors			<input type="checkbox"/> Raw Materials <input type="checkbox"/> Energy use (as fuel) <input type="checkbox"/> Others (Specify)
		2. Other factories			
		3. Import			
		4. Others			
		1. Collectors			<input type="checkbox"/> Raw Materials <input type="checkbox"/> Energy use (as fuel) <input type="checkbox"/> Others (Specify)
		2. Other factories			
		3. Import			
		4. Others			
		1. Collectors			<input type="checkbox"/> Raw Materials <input type="checkbox"/> Energy use (as fuel) <input type="checkbox"/> Others (Specify)
		2. Other factories			
		3. Import			
		4. Others			
		1. Collectors			<input type="checkbox"/> Raw Materials <input type="checkbox"/> Energy use (as fuel) <input type="checkbox"/> Others (Specify)
		2. Other factories			
		3. Import			
		4. Others			
		1. Collectors			<input type="checkbox"/> Raw Materials <input type="checkbox"/> Energy use (as fuel) <input type="checkbox"/> Others (Specify)
		2. Other factories			
		3. Import			
		4. Others			

4.3. Future use of Recycled Material

What other future / potential recycled materials to be used in your factory? Please specify.

4.4 Issues on Waste Management and Recycling

Please describe the issues your factory is currently facing in relation to waste management and recycling.

This is the end of questionnaire. Thank you for your kind cooperation

Appendix 3

Survey on Material Flows of Recyclables in Malaysia



2.2 Buyer of Recyclables

Please specify the name, location of the major buyers go to your station or centre and the type of recyclables that they buy, in accordance with the table below.

Buyer	Amount (kg/month)	Price (RM)	Number of Buyers

2.3 Sales of Recyclable Materials

If you have any recyclables collected and packed in your premise, please specify their types, sale amount, selling price and destination of the items in accordance with the table below.

Type of Recyclable	Monthly Sales		Price of Recyclables (RM)		Major Destination of Recyclables Collected
	Unit		Unit		
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign



2.4 Recycling Cost

Please specify the recycling cost at your premise in accordance with the table below.

(Remark: If you do not produce any specific recycled products, but still use recyclable materials at your premise for other purposes, please specify the incremental cost arising from accepting the recyclable materials.)

Items	Cost (RM/month)
1. Labour cost	
2. Input materials cost	
3. Fuel cost	
4. Utility Cost (Water, Electricity, etc.)	
5. Maintenance/Repair cost	
6. Depreciation of facility/machinery	
7. Others (specify below)	
8.	
9.	
10.	

2.5. Factors Affecting Recycling Activities

Please choose the three (3) biggest factors affecting the recycling activities at your premise from the options below.

- Difference in price between virgin and recyclable materials
- Quantity of recyclable materials supplied
- Quality of recyclable materials supplied
- Market demand of recycled products
- Awareness of the company in recycling
- Others (Please specify below)

This is the end of questionnaire. Thank you for kind cooperation!!



QUESTIONNAIRE ON MATERIAL FLOW OF RECYCLABLES (Recyclers and Manufacturers who accept recyclables)

Date		
Interviewer		
Respondent	Name	
	Position	

1. Company Profile

Name of Company			
Type of Business			
Year of Incorporation		Website	
Address		Phone	
		FAX	
		E-mail	
Annual Sales (Turnover)		Number of Employees	

2. Recycling Activities

2.1 Types, Amount and Price and Use of Recyclable Materials

Please specify the types, amount and price of recyclable materials currently accepted in your premise in accordance with the table below.

Type of Recyclables	Amount (kg/month)	Price (RM)	Use



2.2 Sellers of Recyclables

Please specify the name, location of the major sellers go to your premise and the type of recyclables that they sell, in accordance with the table below.

Seller	Location	Type of Recyclables

2.3 Manufacturing of Recycled Products

If you have any recycled products manufactured in your premise, please specify their types, production amount, selling price and destination of product market in accordance with the table below.

Type of Product	Monthly Production		Price of Product (RM)		Major Destination of Product Market
	Unit		Unit		
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign



2.4 Recycling Cost

Please specify the recycling cost at your premise in accordance with the table below.

(Remark: If you do not produce any specific recycled products, but still use recyclable materials at your premise for other purposes, please specify the incremental cost arising from accepting the recyclable materials.)

Items	Cost (RM/month)
1. Labour cost	
2. Input materials cost	
3. Fuel cost	
4. Utility Cost (Water, Electricity, etc.)	
5. Maintenance/Repair cost	
6. Depreciation of facility/machinery	
7. Others (specify below)	
8.	
9.	
10.	

2.5. Factors Affecting Recycling Activities

Please choose the three (3) biggest factors affecting the recycling activities at your premise from the options below.

- Difference in price between virgin and recyclable materials
- Quantity of recyclable materials supplied
- Quality of recyclable materials supplied
- Market demand of recycled products
- Awareness of the company in recycling
- Others (Please specify below)

This is the end of questionnaire. Thank you for kind cooperation!!



QUESTIONNAIRE ON MATERIAL FLOW OF RECYCLABLES (Traders, Middle man and Junk shop who deal recyclables)

Date		
Interviewer		
Respondent	Name	
	Position	

1. Company Profile

Name of Company			
Type of Business			
Year of Incorporation		Website	
Address		Phone	
		FAX	
		E-mail	
Annual Sales (Turnover)		Number of Employees	

2. Recycling Activities

2.1 Types, Amount and Price Purchase of Recyclable Materials

Please specify the types, amount and price of recyclable materials currently accepted in your premise and the number of sellers of those items in accordance with the table below.

Type of Recyclables	Amount (kg/month)	Price (RM)	Number of Sellers



2.2 Buyer of Recyclables

Please specify the name, location of the major buyers go to your premise and the type of recyclables that they buy, in accordance with the table below.

Buyer	Amount (kg/month)	Price (RM)	Number of Buyers

2.3 Sales of Recyclable Materials

If you have any recyclables collected and packed in your premise, please specify their types, sale amount, selling price and destination of the items in accordance with the table below.

Type of Recyclable	Monthly Sales		Price of Recyclables (RM)		Major Destination of Recyclables Collected
	Unit		Unit		
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign
					<input type="checkbox"/> Domestic <input type="checkbox"/> Foreign



2.4 Recycling Cost

Please specify the recycling cost at your premise in accordance with the table below.

(Remark: If you do not produce any specific recycled products, but still use recyclable materials at your premise for other purposes, please specify the incremental cost arising from accepting the recyclable materials.)

Items	Cost (RM/month)
1. Labour cost	
2. Input materials cost	
3. Fuel cost	
4. Utility Cost (Water, Electricity, etc.)	
5. Maintenance/Repair cost	
6. Depreciation of facility/machinery	
7. Others (specify below)	
8.	
9.	
10.	

2.5. Factors Affecting Recycling Activities

Please choose the three (3) biggest factors affecting the recycling activities at your premise from the options below.

- Difference in price between virgin and recyclable materials
- Quantity of recyclable materials supplied
- Quality of recyclable materials supplied
- Market demand of recycled products
- Awareness of the company in recycling
- Others (Please specify below)

This is the end of questionnaire. Thank you for kind cooperation!!



QUESTIONNAIRE ON MATERIAL FLOW OF RECYCLABLES

(Street Collector, Waste Picker at Collection Vehicles, and Scavenger at Landfill)

Date		
Interviewer		
Respondent	Name	
	Position	

1. Collection and Recovery Field

Name of Site or Streets			
Type of Business	<input type="checkbox"/> (a) Door-to-door collector	Years of Work	_____ years
	<input type="checkbox"/> (b) Street collector	Working Day	S M T W T F S
	<input type="checkbox"/> (c) Waste collection workers		
No. of Colleagues	_____ /week	Only Collectors May Answer Below	
Weekly Sales	RM _____ /week	No. of the waste bins you visit	_____ /day
Other Income (if available)	RM _____ /month	No. of the households you visit	_____ /day

2. Recycling Activities

2.1 Types, Amount and Price of Recyclable Materials

Please specify the types, amount and price of recyclable materials currently collected and the number of sellers of those items in accordance with the table below.

Type of Recyclables	Amount (kg/week)	Price (RM)	Buyer (Pls. specify Name or Place)



Type of Recyclables	Amount (kg/week)	Price (RM)	Buyer (Pls. specify Name or Place)

2.2 Problems

<p>What is a major problem at present, when you collect the recyclables?</p>
<p>What is a major problem at present, when you segregate the recyclables?</p>
<p>What is a major problem at present, when you sell the recyclables?</p>

This is the end of questionnaire. Thank you for kind cooperation!!

