Identification of Reduction and Recycling Potential by a Detailed Waste Composition Analysis

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Background

"Industrialised" (1bil.)

Incinerator / Sanitary Landfill in place

Resources cheap compared to labour (recycling requires support)

Resource depletion / Climate concern -> Emphasis on "3R"

"Less Developed" (3.5bil.)

Poor infrastructure for waste -> Needs provision

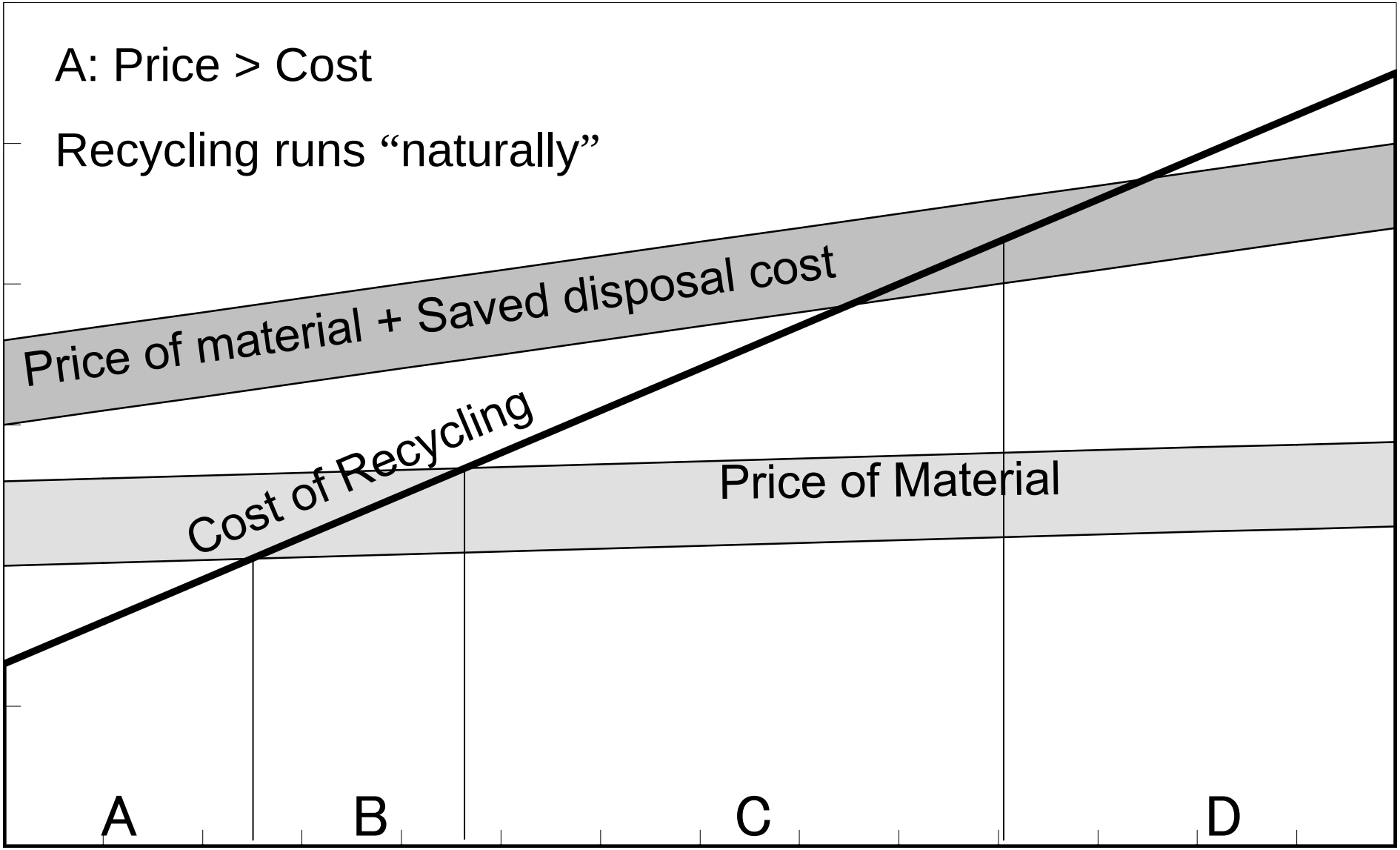
Resources expensive v. labour wage -> recycling runs "naturally"

"Newly emerging / Transition" (2bil.)

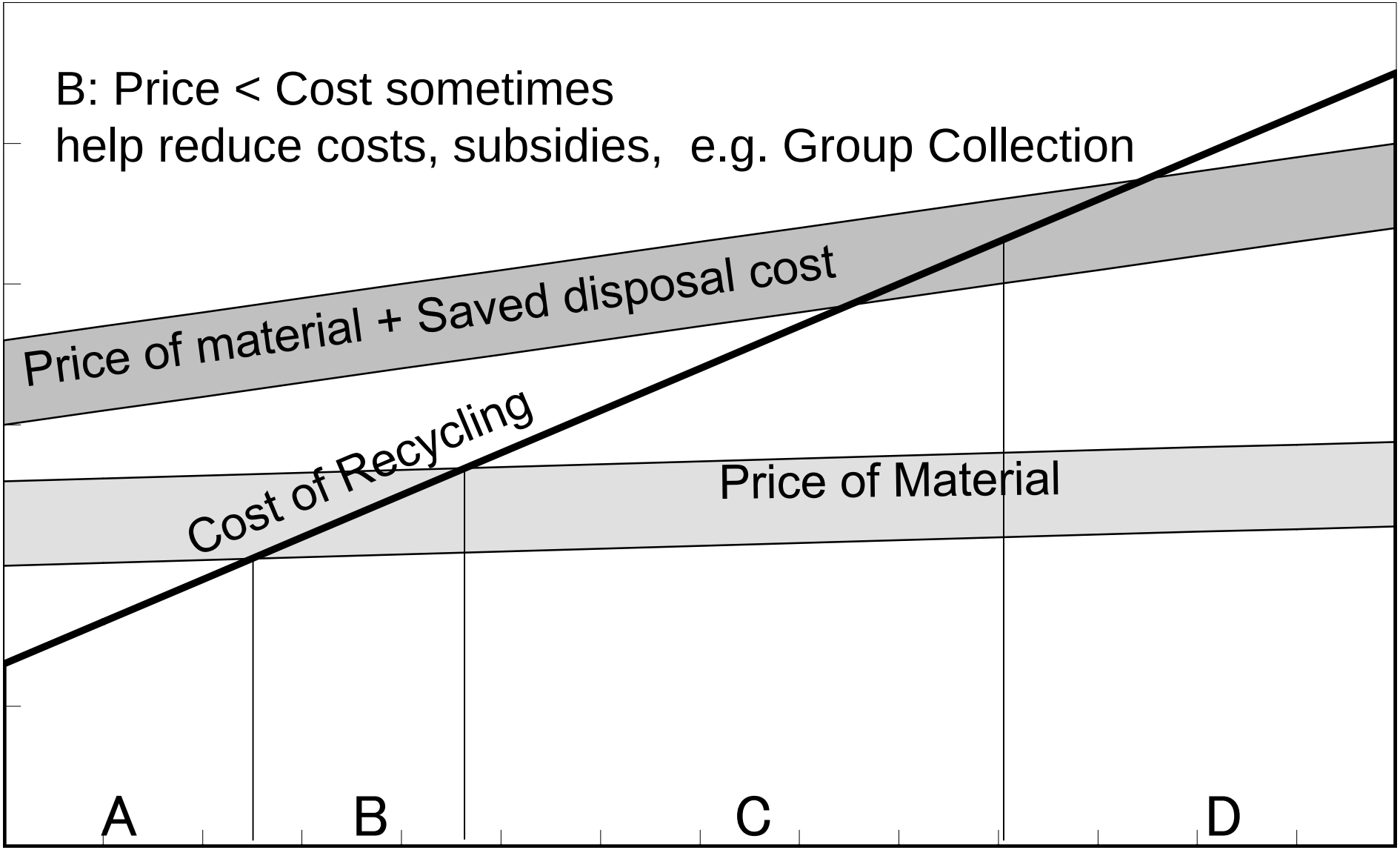
To what extent is 3R necessary /possible?

-> Waste Composition Analysis with focus on 3R, in the KL area

When / for Which item is Public sector involvement required?



When / for Which item is Public sector involvement required?



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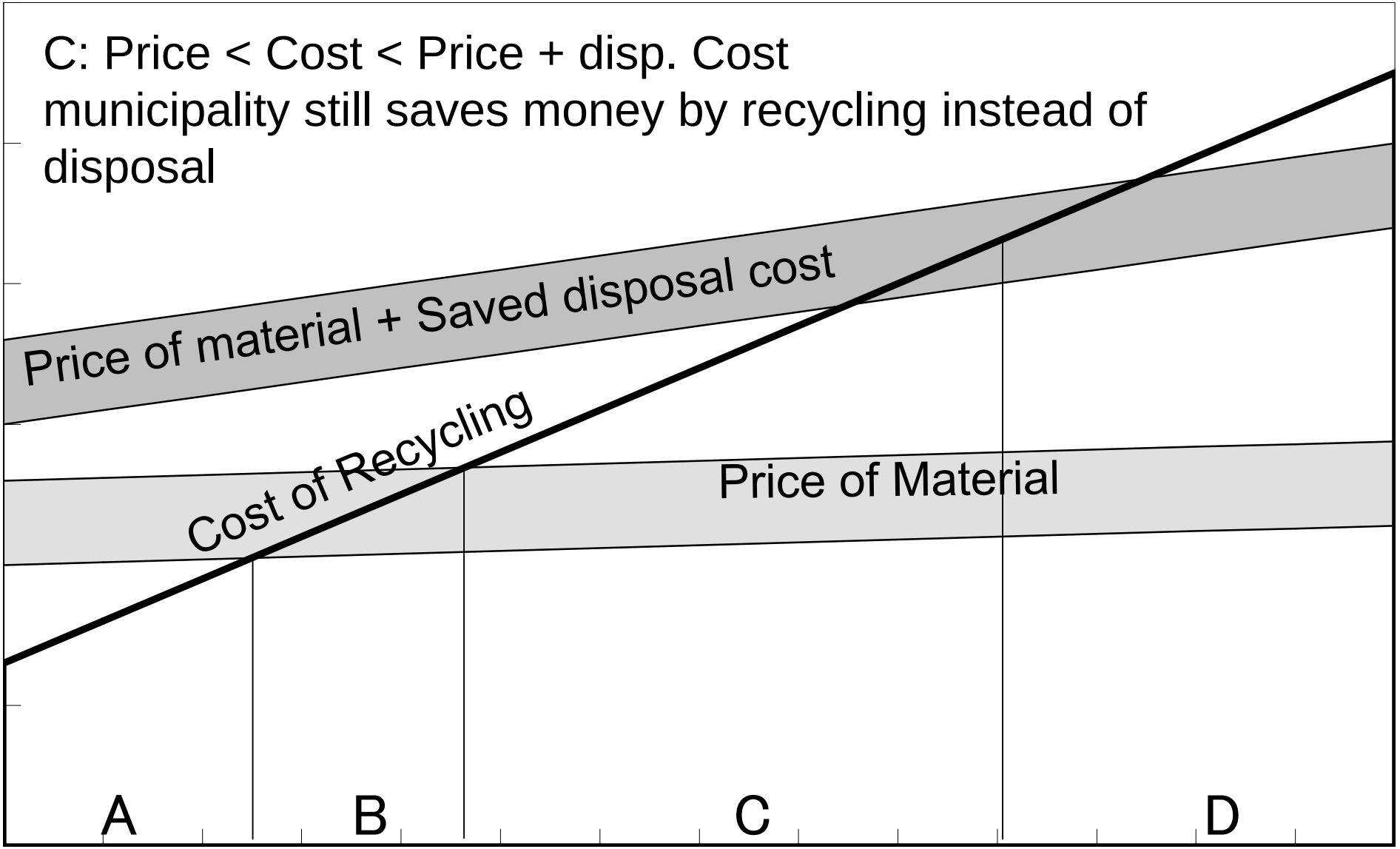

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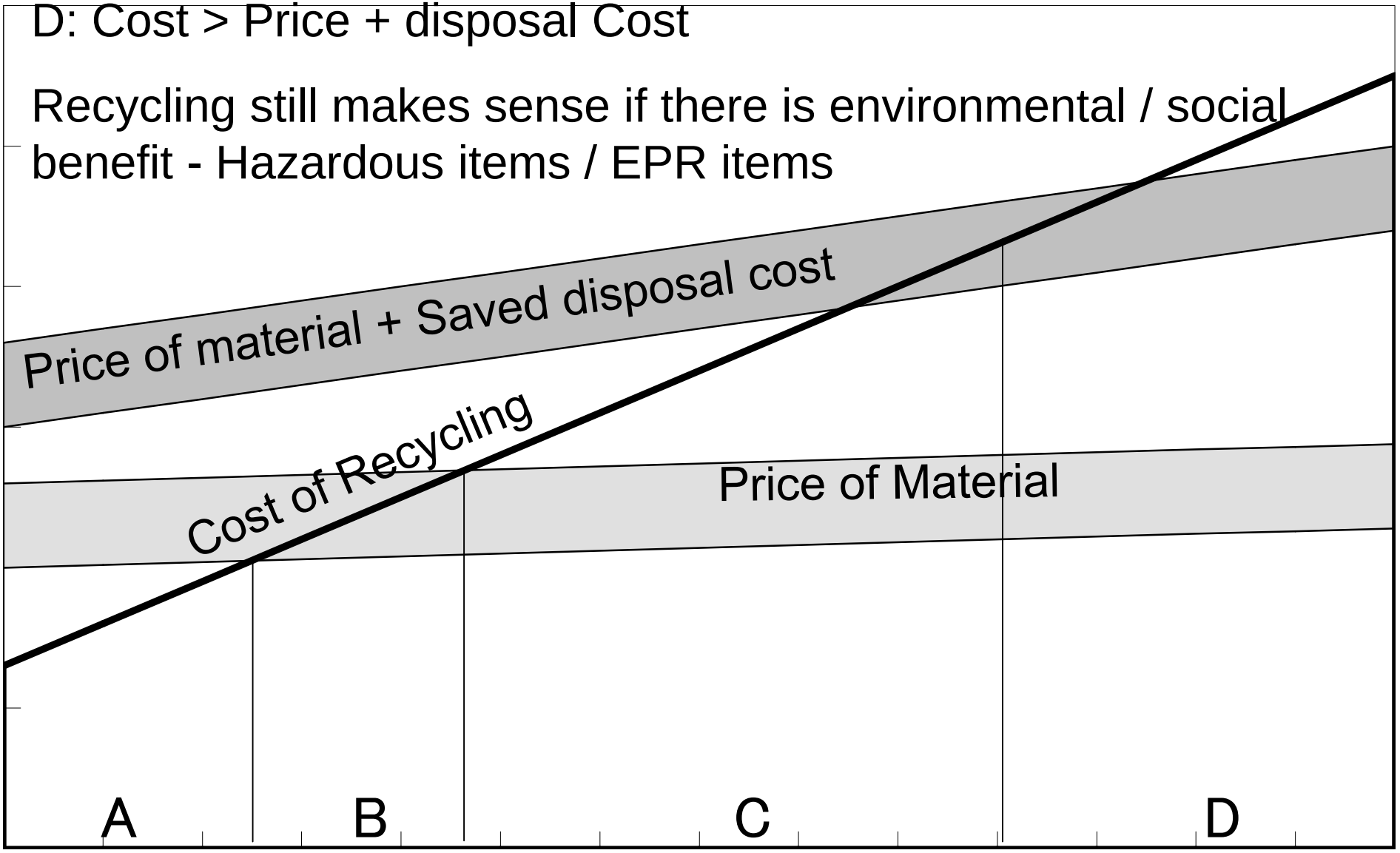


Detailed compositional data is required as we pursue measures higher up in the waste hierarchy

Waste Hierarchy	Typical Data Requirements
Waste Minimisation / Source Reduction	Original purpose of items (goods /packaging etc) Target waste creating actors /activities
Material Recycling	Material composition
Incineration	Calorific value / Elemental composition
Landfill	Basic quantity data (weight)

Sorting with more detailed categories

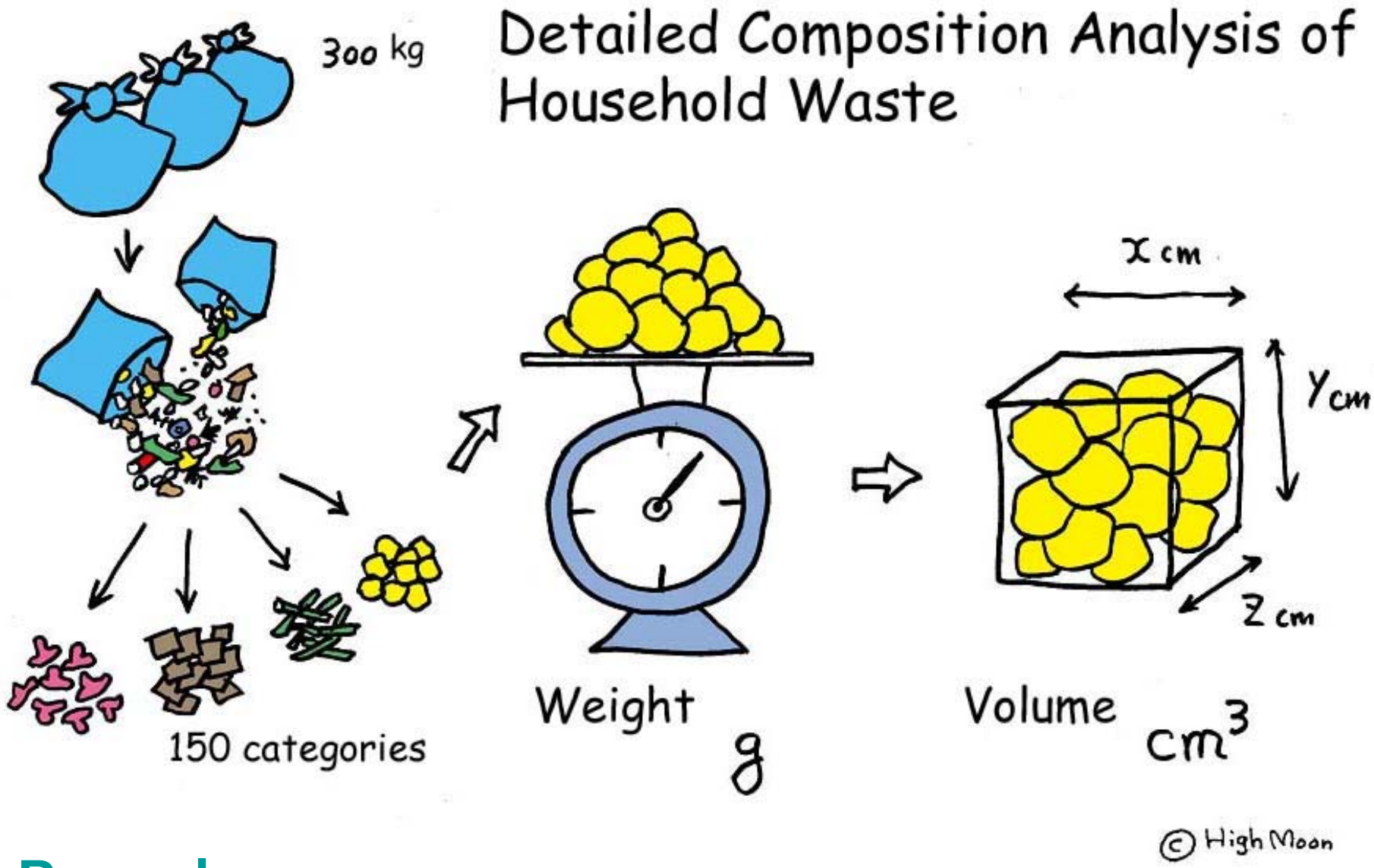
Rationale: Material x Use x Packaging add stage x 3R-able?

Kyoto City - 300 categories, 30 years
Cambridge (UK), Freiburg (DE), Aarhus (DK) - 120 categories

Detailed results can be aggregated into summary tables by various criteria

Methods

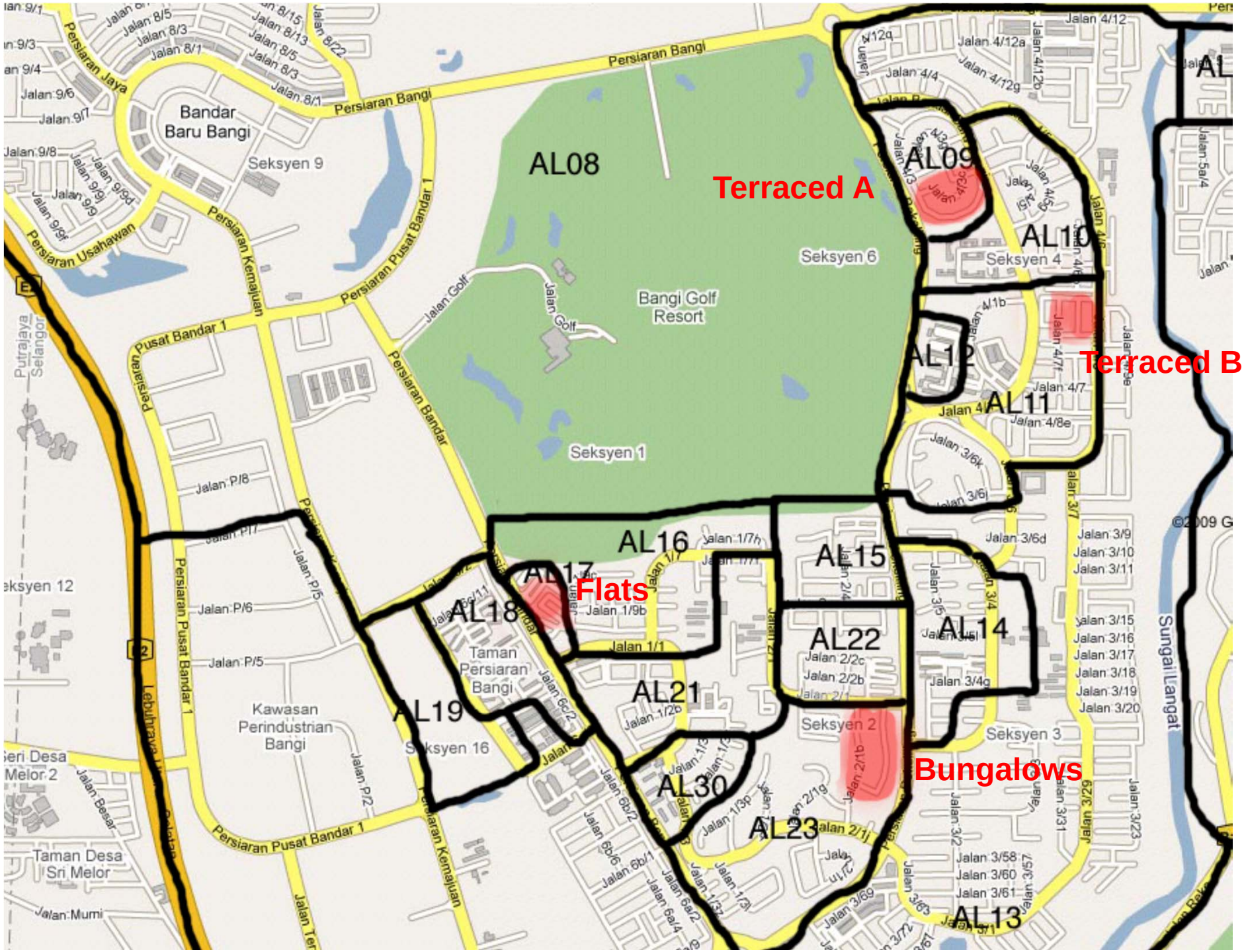
Methods	
Cone Sampling	2-4t Sample(collection vehicle)->Mechanical mixing->200-300kg handsort (Representative mix / Detailed sorting difficult)
Bag (Bin) Sampling	200-300kg sample in container (Representativeness? Detailed sorting possible)
Panel Survey	Panel Households provided with a scale and recording sheet (Representativeness? influences behaviour)



Procedure

Sampling -> Measuring -> Crude Sorting -> Detailed Sorting -> Measuring


Selangor
Rawang
Bukit Rotan
54
5
Gombak
E1
Batu Caves
Kuala Selangor
Kuala Selangor
Kapar
Kuala Lumpur
Ampang
Petaling Jaya
WP Kuala Lumpur
Shah Alam
Subang Jaya
Hulu Langat
Klang
Klang
Sungai Kelang
Seri Kembangan
Pulau Ketam
Pulau Klang
Pelabuhan Klang
Puchong
Kajang
Pulau Tengah
Pulau Lumut
E6
★ Bangi
Pulau Che Mat Zin
Pulau Indah
Putrajaya
Klang
E2
Sungai Langat
Beranang
Pulau Carey
Kuala Langat
Nilai
E21
Sepang
Mantin
Banting
B59
5
Labu
KL Int'l Apt
Seremban
Seremban
Tanjong Sepat
Sepang
10 km
10 mi
©2010 Google - Map data ©2010 MapIT, Tele Atl


AL08
Terraced A
AL09
AL10
Seksyen 4
Seksyen 6
Bangi Golf Resort
AL12
Terraced B
AL11
Seksyen 1
AL16
AL15
AL17
Flats
AL18
AL22
AL14
Taman Persiaran Bangi
AL21
AL19
Seksyen 16
Kawasan Perindustrian Bangi
Seksyen 2
Seksyen 3
Bungalows
AL30
AL23
AL13
Bandar Baru Bangi
Seksyen 9
Taman Desa Sri Melor
Persiaran Bangi
Persiaran Jaya
Persiaran Usahawan
Persiaran Kemajuan
Persiaran Pusat Bandar 1
Persiaran Bandar
Jalan Golf
Sungai Langat

Questionnaire Survey

Students visited each house and conducted structured interviews

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Borang Kaji Selidik:

Sisa Pepejal dan Kitar Semula di Kediaman

Nama Penemuramah _____ Tarikh_____ Seksyen ____

Jalan _____ Nombor rumah _____ Jenis rumah (Bungalow / Semi-D / Teres / Flat / Lain[2] _____)

Jantina responden: (Lelaki / Perempuan) Lingkungan umur: (~29 30~39 40~49 50~59 60~)

Bangsa:(Melayu / Cina / India / Lain[2]) Pekerjaaan:(Sektor Kerajaan/ Universiti/ Sektor swasta/ Perniagaan Sendiri)

Tahap pendidikan tertinggi: (Sekolah rendah / Sekolah Menengah / Pendidikan tinggi di kolej atau universiti)

Q1. Berapa orang yang tinggal di rumah? _____ orang. Berapa orang berumur kurang dari 12 tahun? _____orang. Berapa orang berumur lebih dari 65 tahun? _____orang.

Q2. Adakah anda melakukan kitar semula di rumah? (Ya / Tidak)

Jika YA, bahan apa yang telah anda kitar semula dalam masa 2 minggu yang lepas?

Bahan (nyatakan yang bertanda *)	Kuantiti	Unit	Kaedah
Suratkhabar / majalah			
Lain-lain kertas *			

(Waste Composition (%)

Composition Analysis

x

Amount of waste / household

Weighing Survey

+

Amount Recycled / household)

Questionnaire Survey

÷

Person / household

=

Item per person per day (weight and volume)

B.B.Bangi average – average weight/composition of 5 results

Number of samples

Waste sampling:

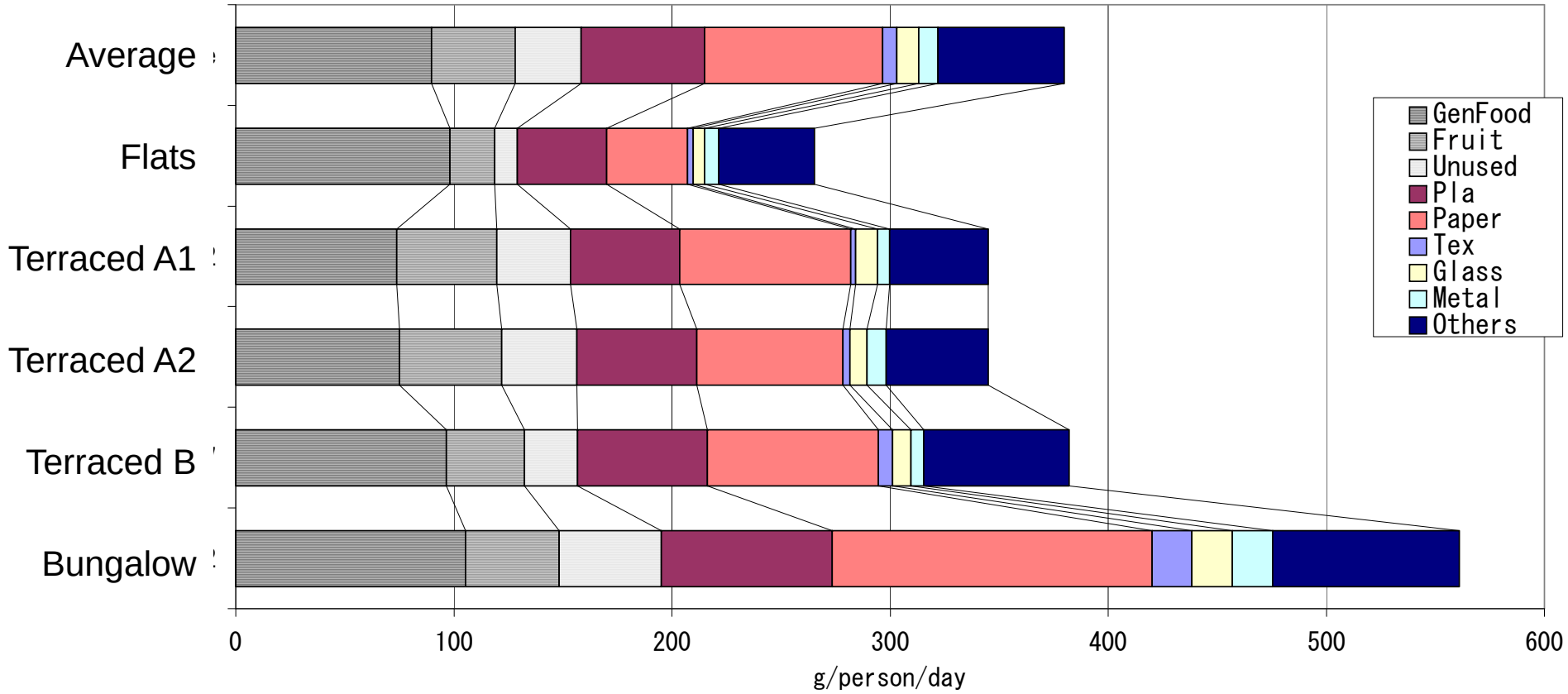
29 Jan Sek4/3 (Terraced A) 44 houses 215kg
15 Mar Sek2/1 (Bungalow) 36 houses 282kg
16 Mar Sek4/7 (Terraced B) 34 houses 164kg
17 Mar Sek4/3 (Terraced A) 46 houses 177kg
18 Mar Sek1/9 (Flats) 3 blocks (122 units?) 167kg
Total 1005 kg

Questionnaire survey
(8-31 Mar)
Sek2/1 55 houses
(valid response: 44)
Sek4/3 82 houses (66)
Sek4/7 83 houses (63)
Sek1/9 109 units (75)
Total 329 (248)

Weighing Survey
(7-19 Feb)
Sek2/1 47 houses
Sek4/3 71 houses
Sek4/7 67 houses
Sek1/9 5 blocks (212 units)

Composition Results

•Difference between housing types



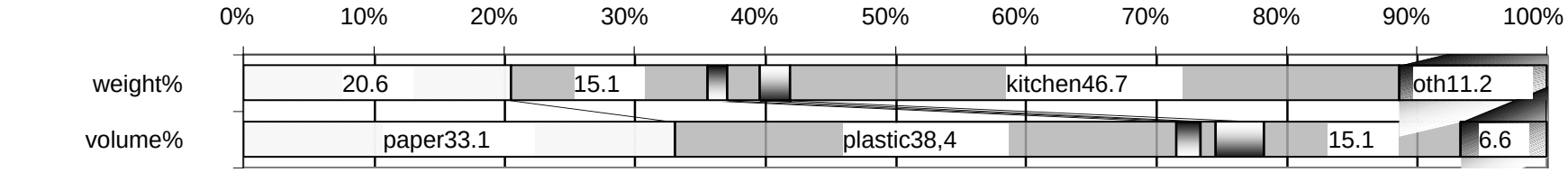
All housing types produce about the same amount of general kitchen waste (ca.100g/d/p)

Flats produce less of all other items

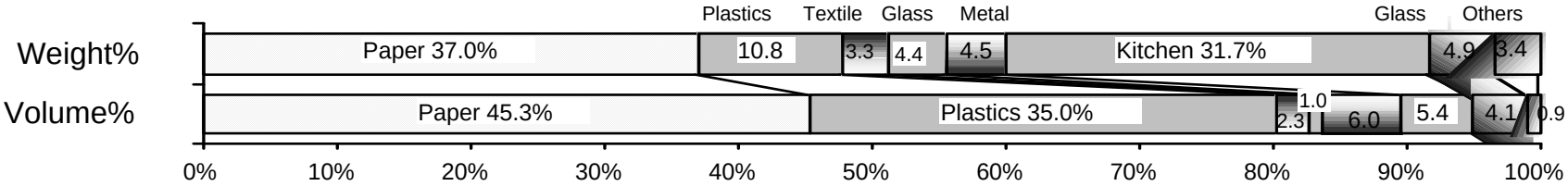
Bungalows produce more recyclable materials (paper/textile/glass/metal)

Average Composition

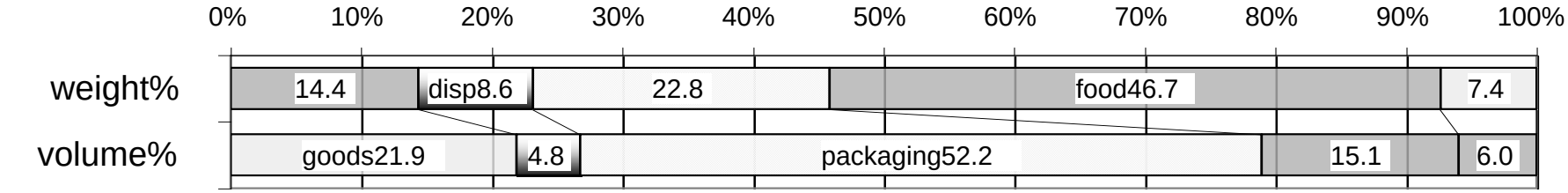
B.B.Bang i: by material



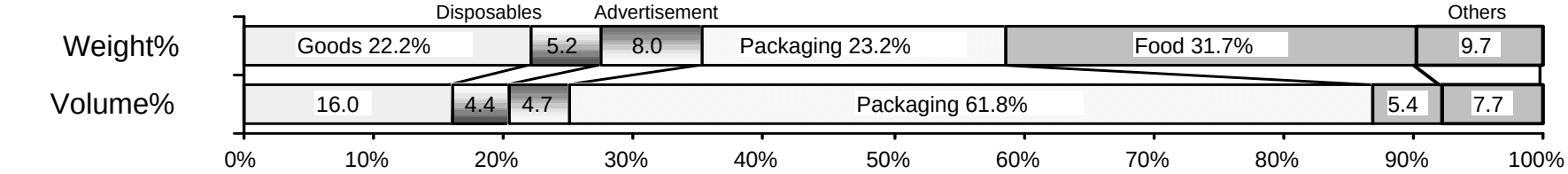
Neyagawa



B.B.Bang i: by function



Neyagawa



Focus on packaging

Stages when packaging is added (B.B.Bangi, incl. recycled)

	Production	Distribution	Retail	Consumer	Food	Non-food	total
Paper	9.96	6.05	5.78	0.00	12.24	9.54	21.78
Plastic	23.97	0.58	31.94	3.46	41.41	18.53	59.95
Glass	10.59	0.00	0.00	0.00	8.99	1.60	10.59
Metal	6.47	0.00	0.03	0.00	5.61	0.89	6.49
Others	0.59	0.00	0.59	0.00	0.59	0.59	1.18
Total	51.58	6.63	38.33	3.46	68.85	31.15	100.00

(Weight% of total packaging - volume is similar, as all packaging is bulky, plastic +10%)

[comparison] Stages when packaging is added (Neyagawa)

	Production	Distribution	Retail	Consumer	Food	Non-food	total
Paper	12.01	15.51	5.00	0	18.33	14.19	32.52
Plastic	16.24	1.31	20.63	2.69	30.21	10.66	40.87
Glass	16.28	0	0	0	15.39	0.89	16.28
Metal	10.25	0	0	0	9.00	1.26	10.26
Others	0.07	0	0	0	0.04	0.04	0.08
Total	54.85	16.83	25.63	2.69	72.96	27.04	100.00

Table [6.12]: Stages when packaging is added (Cambridge)

	Production	Distribution	Retail	Consumer	Food	Non-food
Paper	9.82%	9.42%	4.30%	0.29%	12.16%	11.67%
Plastic	14.00%	0.42%	7.92%	2.29%	15.51%	9.12%
Glass	37.48%	0%	0%	0%	35.62%	1.85%
Metal	12.82%	0.86%	0.20%	0%	12.13%	1.75%
Others	0.05%	0.14%	0%	0%	0.09%	0.09%
Total	74.16%	10.84%	12.41%	2.58%	75.52%	24.48%

(Weight% of total packaging, including the amount recycled)

Table [6.12]: Stages when packaging is added (Aarhus)

	Production	Distribution	Retail	Consumer	Food	Non-food
Paper	20.49%	7.60%	3.64%	0.03%	22.68%	9.09%
Plastic	16.51%	3.79%	3.32%	3.39%	16.60%	10.40%
Glass	32.92%	0%	0%	0%	31.47%	1.45%
Metal	7.00%	0.45%	0.52%	0%	6.75%	1.21%
Others	0.33%	0%	0%	0%	0.17%	0.17%
Total	77.25%	11.84%	7.49%	3.42%	77.68%	22.32%

3R Potentials

Minimisation and Recycling potential (by weight%) (B.B.Bangi)

Weight %	Total Waste	Currently Recycled	Additionally Recyclable	Reduce Industry	Reduce Consumer
Paper	20.57%	5.72%	6.44%	6.05%	2.23%
Plastic	15.07%	0.29%	4.05%	13.65%	0.04%
Glass	2.52%	0%	2.27%	2.41%	0%
Metal	2.28%	0.42%	1.66%	1.49%	0.05%
Others	59.56%	0.13%	2.12%	0.26%	^14.32%
Total	100.00%	6.56%	16.54%	23.86%	16.64%

^unused food 7.71%, diaper 6.33%

Minimisation and Recycling potential (by volume%) (B.B.Bangi)

Volume %	Total Waste	Currently Recycled	Additionally Recyclable	Reduce Industry	Reduce Consumer
Paper	33.11%	13.41%	11.78%	12.04%	1.61%
Plastic	38.44%	1.17%	13.93%	36.62%	0.19%
Glass	1.17%	0%	1.05%	1.09%	0%
Metal	3.72%	0.86%	2.54%	2.92%	0.01%
Others	23.56%	0.12%	1.79%	0.36%	^6.53%
Total	100.00%	15.56%	31.66%	53.03%	8.34%

^unused food 3.32%, diaper 2.98%

3R Potentials - comparison1

Minimisation and Recycling potential (by weight%) (Cambridge)

Weight %	Total Waste	Currently Recycled	Additionally Recyclable	Reduce Industry	Reduce Consumer
Paper	32.11%	5.46%	13.20%	~13.78%	1.68%
Plastic	7.36%	0%	0.01%	6.13%	0.06%
Glass	9.52%	3.26%	6.07%	9.34%	0%
Metal	6.18%	0.16%	2.78%	3.46%	0.20%
Others	44.35%	*9.20%	1.41%	0.05%	^10.34%
Total	100.00%	18.08%	23.47%	32.75%	12.27%

~includes advertisement 7.91% ^unused food 5.73%, diaper 4.61%

Minimisation and recycling potentials (by weight%) (Neyagawa)

Weight %	total waste	currently recycled	additionally recyclable	reduce industry	reduce consumer
Paper	35.08%	13.01%	13.08%	~15.72%	2.98%
Plastic	10.82%	0.15%	0.74%	9.51%	0.08%
Glass	4.41%	2.85%	0.99%	3.77%	0%
Metal	4.49%	0.75%	0.65%	2.38%	0.13%
Others	43.33%	0.68%	1.14%	0.03%	^6.23%
Total	100.00%	17.44%	16.60%	31.40%	9.41%

~includes advertisement 8.04% ^unused food 4.16%, diaper 1.96%

3R Potentials - comparison2

Table [6.13a] Minimisation and Recycling potential (by weight%) (Freiburg)

Weight%	Total Waste	Currently Recycled	Additionally Recyclable	Compost-able	Reduce Industry	Reduce Consumer
Paper	31.86%	*25.98%	1.61%	4.11%	~11.36%	3.45%
Plastic	5.11%	2.84%	1.18%	0%	3.93%	0.08%
Glass	13.34%	10.42%	1.87%	0%	12.28%	0%
Metal	2.49%	1.86%	0.41%	0%	1.71%	0.04%
Others	47.20%	*1.46%	0.04%	33.73%	0.12%	^4.08%
Total	100.00%	42.56%	5.11%	37.84%	29.40%	7.65%

*includes currently composted 1.41% ~includes advertisement 6.05% ^unused food

Table [6.13a] Minimisation and Recycling potential (by weight%) (Aarhus)

Weight%	Total Waste	Currently Recycled	Additionally Recyclable	Compost-able	Reduce Industry	Reduce Consumer
Paper	38.80%	19.01%	6.84%	12.33%	~14.02%	9.91%
Plastic	7.01%	0%	0%	0%	5.71%	0.16%
Glass	7.12%	4.55%	2.37%	0%	6.92%	0%
Metal	2.23%	0%	0%	0%	1.68%	0.20%
Others	44.84%	3.06%	0.36%	35.29%	0.07%	^6.18%
Total	100.00%	26.62%	9.57%	47.62%	28.40%	16.45%

*includes currently composted 9.01% ~includes advertisement 7.91%

Recycling rates of items

(Household waste, Bring to Centres & Sell to Collectors.)

(Not included: pre-collection scavenging, sorting at MRF, scavenging at landfill (now rare))

96% Clean Newspaper (60% incl. soiled reused as wrappers)

47% Total recyclable paper (incl. tetrapack, paper boxes etc)

10% Plastic bottles

7% Total "hard" plastics (some "soft" plastics are also recyclable)

19% Clothing

0% Glass

28% Metal containers (mostly cans)

6.5% Total waste

Summary of Findings

Quantitatively indicated potentials for reduce and recycle
- useful for designing schemes / setting targets

Many of the issues faced in high income countries are also applicable to urban areas in Malaysia (some variation).

Reduce - Unused food (7.7%) - similar to EU/JP
Packaging (22.8%wt 52.2%vol) - still lower than EU/JP
high % of plastic packaging at retail

Recycle - Newspaper recycling is present - needs no intervention
Other paper / Metal / Plastic bottles
- public involvement effective
Other Plastics - what is the best way to deal with this?
(plastics recycling is facing difficulty also in EU/JP)

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