

Management of Coastal Litter: The Way Forward¹

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Abstract

It was probably a common conception that litter consists of just a few pieces of rubbish scattered along the coastal areas and causes no harm to anyone. Unfortunately this is no longer the case. Coastal litter has become a global pervasive pollution problem. Along these lines, the increasing problem of litter at coastal areas in Malaysia has also been recognised over the last decade to be occurring at a dramatic and alarming rate. However, efforts undertaken to address this problem have not matched the anticipated results. In general, this increase has been in parallel to the raise in urbanisation, industrialisation, tourism activities, and population growth in the country. Coastal litter not only impacts the aesthetics of a beach or coastal area, but also has economic repercussions. For example, litter often makes a beach look very unattractive and dirty and implies that the surrounding water is contaminated by sewage. This not only pose health risk to the users of the beach but also deters visitors; indirectly impacting on revenue earned by local economy through tourism. Furthermore, litter affects the fishing industry through lost revenue as a result of time and effort spent clearing debris from nets and from damaged fishing gear caused by litter washed into the sea. In addition to its effects on local communities and visitors, coastal litter can also have devastating effects on marine wildlife. Birds, turtles and marine mammals have been reported to die as a result of ingestion or entanglement. Furthermore, coastal litter also costs local authorities thousands of ringgits each year through clean-up efforts. As such, this paper aims to highlight the amount and composition, assess distribution, and point out the possible sources of litter along the coastal areas in Malaysia. This would be based on available secondary data from various agencies, non-governmental organisations (NGOs), and other private institutions. These data and reports will be used to

¹ Paper presented at the 8th UMT International Annual Symposium on Sustainability Science and Management (UMTAS) 2009. [Kuala Terengganu: 3 - 4 May 2009]. (Scope: Maritime Management).

MIMA is a policy research institute set up by the Malaysian government.

Views expressed in this paper are those of the authors' and should not be regarded as necessarily reflecting the views of MIMA.

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recommend potential options and workable solutions for decision-makers and environmental managers to curb the problem. For instance, a new approach for beach cleanliness assessment based on the *Clean-Coast Index* (CCI) will be introduced in this study as a tool for evaluation of the actual coast cleanliness, as well as the prospects of applying the *Indifferent Consumers-pay Principle* (ICP) for waste management in Malaysia. Besides that, benchmarking analysis will also be carried out to compare practices and policies in other countries; besides evaluating existing management strategies to address threats from litter in Malaysia.

KEYWORDS: Beach, Cleanliness tool, Litter management; Clean-Coast Index (CCI), Economic instrument; Indifferent Consumers-pay Principle (ICP).

INTRODUCTION

Litter is found everywhere in the marine and coastal environment, all around the world. It has a truly global distribution and is in fact a global problem. Litter includes all objects that do not naturally occur in the marine and coastal environment, but are nevertheless found there.⁴ Generally, litter consists of items that have been made or used by people and, subsequently, deliberately discarded or accidentally lost. In most cases, it is a result of careless handling or disposal of items of solid waste, including containers of liquid waste. Although a big percentage of waste originates from the land-based sources, it can also include material lost at sea (for example fishing gear) that could get washed onto beaches.^{5,6} For instance, a study by Omar *et al.*, 2009 highlighted that solid waste stranded on the coastline can be brought ashore by waves and currents.

Basically, major sources of litter can be divided into two main categories: (i) sea-based, and (ii) land-based.⁷ In general, sea-based litter originates from activities carried out at sea. For example materials such as discarded waste from fishing vessels, fishing gears lost from commercial fishing vessels, recreational boats, illegal dumping; as well as other shipping activities, ports and oil platforms are among the main sources of litter. On the other hand, land-based sources of litter commonly occurs when waste is carried to the sea via rivers and streams which are subsequently washed up on local beaches. Composition, abundance, distribution and quantification of the types and amount of marine debris on beaches have been studied and reported from many parts of the world (as listed in Table 1). In many circumstance, tourism and recreational activities along coastal areas have also

⁴ The Environmental Protection Agency, Queensland Park and Wildlife Services (*in: Don't Rubbish Queensland* - available at <http://www.epa.qld.gov.au/publications/p02233aa.pdf/Litter.pdf>) defines litter as 'any domestic or commercial waste and any material a person might reasonably believe is refuse, debris or rubbish. Litter can be almost any material that is disposed off incorrectly. Litter includes cigarette butts and drink bottles dropped on the ground, fast food wrappers thrown out of the car window, poorly secured material from a trailer or grass clippings swept into the gutter. Litter can also be abandoned vehicle or an abandoned part of a vehicle. Litter, however does not include any gas, dust, smoke, or material emitted or produced during, or because of, the normal operations of a building, manufacturing, mining, or primary industry'.

⁵ According to the United Nations Environment Programme (UNEP) – Regional Seas Programme; municipal, industrial and agricultural wastes and run-off account for as much as 80% of all marine pollution.

⁶ The UNEP - Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) defines marine litter (marine debris) 'any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment'. Coastal litter includes items and material that are either discarded directly or brought to the coastal areas indirectly by rivers, sewage, storm water or winds, or left by people on beaches and shores. The GPA was adopted in 1995 at an intergovernmental conference in Washington to identify the sources of land-based pollution or harmful activities, and prepare priority action programmes of measures to reduce them.

⁷ The main sources of marine litter at a coastal site are (i) offshore sources which include industrial and domestic waste disposed off at sea, fishing and shipping waste, and sewage related debris, and (ii) land-based sources which include litter originating from visitors to the coast, or those originating from the unauthorized dumping of large items such as landfill materials (Horsman, 1982; Jones, 1995; Coe and Rogers, 1997; Derraik, 2002; Lee *et al.*, 2006; and Santos *et al.* 2005. *In: Ahmad and Tariq*, 2003).

been identified as one of the major contributors to coastal litter as well. Land-based sources of litter, once ending up in water; can remain floating on the water surface, drift in the water column, get entangled in algae on shallow bottoms, sink to the deeper seabed, or be washed up onto beaches sometimes many miles away from the place of its origin. From a wide range of litter, one can easily find items such as plastic and polystyrene, rubber, wood, metal, paper and cardboard, textile and leather, glass, pottery, and ceramic objects. All these impose great threats on the environment, human, and aquatic life.

Table 1. Submerged and beach debris densities (counts and weights) and proportion (%) of plastic and fishing related items reported from various parts of the world

Region/ country	Type of survey	Density	Plastic (%)	Fishing-related items (%)	Reference
Gulf of Aqaba/ Red Sea	Beach	1.64-7.38 items/m ²	38.8-56.7	1.2-5.4	Abu Hilal and Al-Najjar (2004)
Gulf of Oman	Beach	0.43-6.0 items/m: mean 1.79 items/m 7.8-75.44 g/m; mean 27.02 g/m	61 30	0.0-34.95 mean 25.36 0.0-9.62 mean 4.27	Claerboudt (2004)
Arabian Gulf, UAE	Beach	0.84 items/m ²	60	16.9	Khordagui and Abu Hilal (1994)
Northern New South Wales, Australia	Beach	10.9 items/km ² ; 0.11 x 10 ⁻³ items/m ²	39	7.23	Frost and Cullen (1997)
Cliffwood beach, New Jersey, USA	Beach	2.7-3.7 items/m ²	42.5	-	Thornton and Jackson (1998)
Sea of Japan, Japan	Beach	0.46-12.72 items/m ² ; mean 3.41 items/m ²	55-93.4	-	Kusui and Noda (2003)
Coasts of Panama	Beach	3.6 items/m ² (180/50 m ²)	56 (counts) 57 (weight)	3 n.a	Garrity and Levings (1993)
St. Lucia	Beach	4.5-11.2 items/m 8.2-109.2 g/m	51.2 38.6	12 18	Corbin and Singh (1993)
Dominica	Beach	1.9-6.2 items/m 51.5-153.7 g/m	16 4.9	3.2 1.1	n.r
Transkei Coast/S. Africa	Beach	19.6-72.5 items/m 42.8-164.1 g/m	83.4 46.8	0.3 0.1	Madzena and Lasiak -1997
New Jersey, USA	Beach	0.36-0.64 items/m	73	n.a	Ribic (1998)
Tasmania/Australia	Beach	300 items/km 0.09-0.35 items/m	65 51-77	20 23-68	Jones (1995)
WA, Marmion Marine Park, Australia	Beach	3.66 items/m 0.12 g/m	n.a n.a	n.a 41	n.r
Bird Island, South Georgia	Beach	0.014-0.21 items/m	~88	76	Walker <i>et al.</i> (1997)
Orange Country/ California, USA	Beach, 43 site x 22.9 m	1709 items/m	99 (counts) 51 (weight)	n.a	Moore <i>et al.</i> (2001)
East Falkland Island	Beach	0.08 items/m 13.3 g/m	75	42	Otley and Ingham (2003)
German Bight, Germany	Beach	142.3 items/m (8539 items/60 m) 22.7 kg/m (1360 kg/60 m)	75 11.9	0.7 6.5	Vauk and Schrey (1987)
Indonesia	Beach	0.0-0.4 items/m (1985) 0.0-29.1 items/m (1995)	45 (bottles and bags 36.2 (bottles and bags	1 1.2	Willoughby <i>et al.</i> (1997)
Great Barrier Reef/ Australia	Beach	0.69-3.63 items/m; mean 0.92 items/m	20.5	n.a	Haynes (1997)

	Benthic, Nearshore cays	0.02-0.16 items/m; mean 0.09 items/m	51.2	2.9	
	Benthic, offshore	0.04-0.81 items/m; mean 0.054 items/m	17	0.7	
Eastern Mediterranean	Benthic, deep sea	0.2×10^{-3} - 8.5×10^{-3} items/m ²	36	n.a	Galil <i>et al.</i> (1995)
East China Sea	Benthic, offshore, Seabed	0.0 - 1.1×10^{-3} kg/m ²	0.0-12.7	42-72	Lee <i>et al.</i> (2006)
Korea South East Sea	Benthic, offshore, seabed	0.15×10^{-3} - 2.56×10^{-3} kg/m ²	27-Mar	38-62	n.r

Source: *Ahmad and Tariq, 2003.*

GLOBAL SCENARIO OF THE PROBLEM

Effects from litter has become an increasingly serious environmental, economic, health and aesthetic problem around the world. Litter from coastal areas travel widely, over long distances, with ocean currents and winds. It is found not only in the water, on seabeds, or on the beaches of densely populated regions, but also in remote places far away from obvious sources. Litter consists mostly of very slowly degradable waste items from different sources. For instance, in the North Sea, it has been estimated that some 70 percent of the marine litter ends up on the seabeds. Half of the remaining amount is found on beaches and half is floating on the water surface. Assessments made in the Dutch sector of the North Sea have indicated an average of over 110 pieces of litter per km² of seabed. During a survey in the Mediterranean, 300 million pieces of garbage were found at a depth of 2,500 metres between France and Corsica. This illustrates that consequently; large quantities of the entire input of litter into oceans around the world could be sinking to the bottom and be found on the seabed, both in coastal areas and in much deeper parts of seas and oceans. During the 2000 International Coastal Cleanup, about 7,000 tonnes of litter were removed from 30,000 km of beaches in 73 countries in all parts of the world.

Besides that, on Livingston Island in Antarctica, over 1,600 pieces of litter (almost all of them plastic) were found in a survey made in 1997. In addition to that, the U.S. Academy of Sciences has estimated as much as eight million items of litter enter oceans and seas every day, and that in many regions, plastics today constitute as much as 90-95 percent of the total amount of litter. Furthermore, the use of plastics and other synthetic materials has increased dramatically during the past 30 years. For example, data released by the United States Environmental Protection Agency shows that somewhere between 500 billion and a trillion plastic bags are consumed worldwide each year (National Geographic News, 2003). This trend is reflected also in the composition of marine litter, which consists to about 60-80 percent of plastic items on average, and up to 90-95 percent in some regions. These large amounts of plastics usage definitely constitute a significant pollution source with wide-ranging ecological and economic impacts. For instance, in a 1998 survey, 89 percent of the litter observed floating in the North Pacific Ocean was plastic. Table 2 provides an illustration of the major items found during beach survey activities in 2008 in the United Kingdom.

Table 2. Top 20 litter items found during Beachwatch 2008 Surveys in the UK

Position 2007	Position 2008	Item	% of Total Litter	Items/km
1	1	Plastic pieces > 1 cm-50 cm	14.51	318.61
2	2	Plastic pieces < 1 cm	7.69	168.73
6	3	polystyrene pieces	6.47	142.04
3	4	Plastic rope	5.79	127.07
4	5	Plastic Caps / Lids	5.72	125.46
5	6	Cris/sweet/lolly wrappers	5.21	114.32
7	7	Cotton bud sticks	4.58	100.49
9	8	Fishing net < 50 cm	4.05	88.83
10	9	Glass pieces	3.5	76.8
10	10	Plastic drinks bottles	3.24	71.02
		TOP 10 ITEM	60.74	1333.37
12	11	Cloth pieces/string	2.75	60.34
8	12	Cigarette stubs	2.74	60.04
14	13	Fishing line (from anglers)	2.51	55.16
15	14	Plastic bags (including supermarket)	2.12	46.53
13	15	Paper pieces	2.01	44.02
17	16	Plastic cutlery / trays/ straws	1.74	38.22
16	17	Metal drink cans	1.72	37.82

19	18	Foam/ Sponge	1.62	35.46
20	19	Wood pieces	1.33	29.22
18	20	Rubber pieces < 50 cm	1.07	23.48
TOP 20 ITEM			80.34	1763.65

Source: Marine Conservation Society. Retrieved http://www.adoptabeach.org.uk/pages/page.php?cust_id=10

In addition to environmental and health effects, litter also causes significant economic repercussions on coastal and fishing communities. For example, according to studies from Bering Sea and the Gulf of Alaska, 40-60 percent of bottom trawls collected plastic and metal litter. Besides that, in the Shetland Islands, 92 percent of the fishermen have reported recurring problems with accumulated litter in nets. It is estimated that each boat could lose between £6,000 and £30,000 per year due to the negative effects of marine litter. In a survey in the U.S. (Oregon), 58 percent of the fishermen indicated vessel problems due to plastic litter, at an average expense of \$2,725 per vessel. Furthermore, floating litter as well as litter stranded on beaches and shorelines reduces the aesthetic values of the coast significantly. Therefore, coastal communities may lose substantial revenues from tourism every. Not only do communities lose revenues, they must also clean up the beaches at high costs. Beach cleaning operations are necessary in many coastal communities around the world to maintain the recreational values of beaches and other coastal areas. The total annual beach clean-up as reported by 64 local communities in the North Sea region (56 of which are in the U.K.) has been estimated at £2.9 million.

STATUS OF WASTE IN MALAYSIA

Litter is not only a local issue, but also a global pervasive pollution problem. For example, the increasing problem of litter in Malaysia has been recognised over the last decade (as shown in Figure 1). The type, amount and composition of waste in the country vary with the type of activity; be they domestic, industrial or agricultural in nature (Figure 2). However, efforts undertaken to address this problem have not matched the anticipated results.

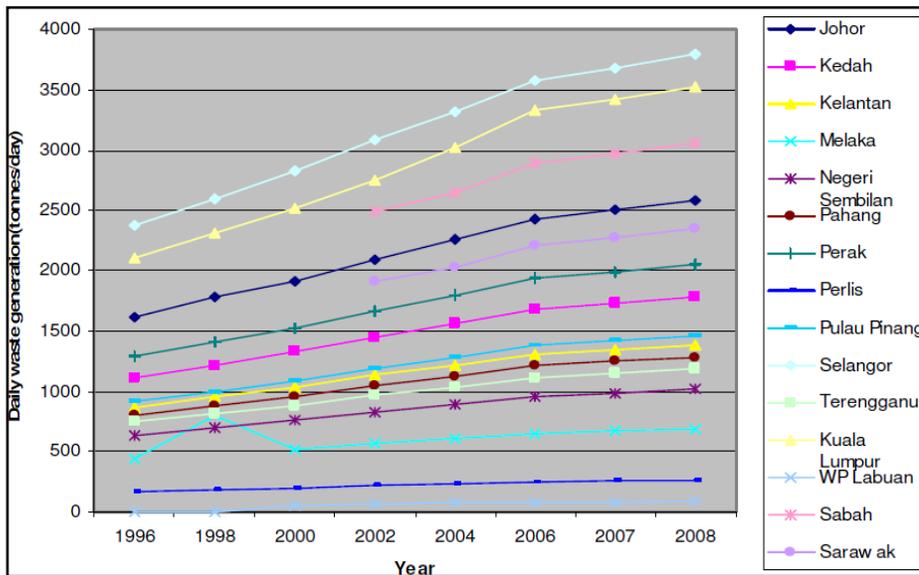


Figure 1. Daily waste generation according to states in Malaysia (1990 – 2008)
 Source: Agamuthu and Fauziah, 2008.⁸

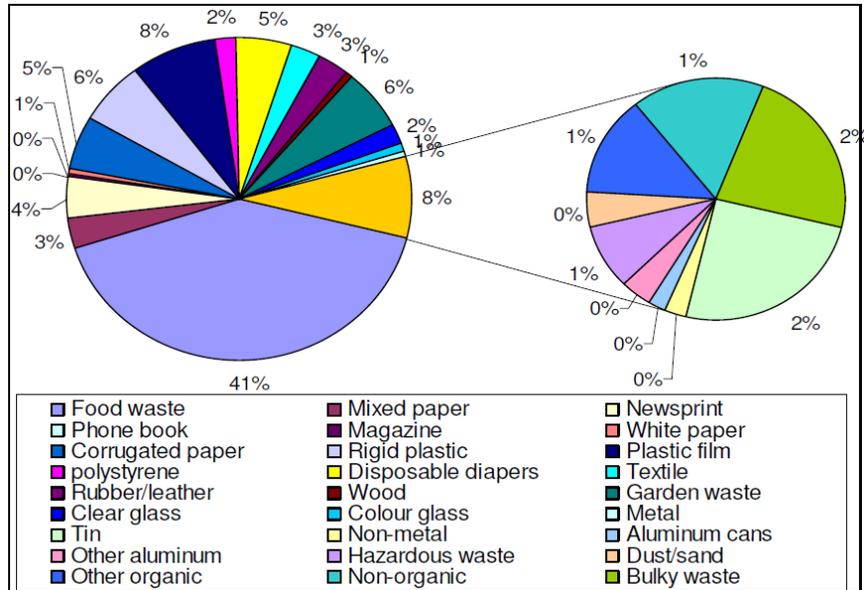


Figure 2. Average concentration of municipal solid waste generated by Malaysian
 Source: Agamuthu and Fauziah, 2008.

Besides that, the Maritime Institute of Malaysia (MIMA) carried out a research on *Marine Tourism in Malaysia: Assessing Potentials and Avoiding Pitfalls* (2006-2007); aiming to identify the potential of beach tourism in Malaysia, describe and analyze characteristics of beach tourism sites, and identify issues that may affect beach tourism. Site visits were conducted to 108 sites (including beaches and islands) in Peninsular Malaysia as well as Sabah. The study found that rubbish seems to be the major problem at nearly 95 percent of the sites visited (Basiron *et al.*, 2007). Prior to this, a clean-up team of 70 volunteer divers collected more than 100 kg of rubbish during a two-day cleanliness campaign on the Tenggol Island in Terengganu (New Straits Times, 8 September 2005). Tenggol Island, being a small island far from the mainland, is supposed to be better preserved but, unfortunately, this was not the case. The dive team retrieved various garbage from the coral reef areas around the island; which included cooking pots, frying pans, broken plates, shoes, gas canisters, biscuit containers and many other items.⁹

Litter is also known to pose severe environmental impacts on the ecology and wildlife such as birds, mammals and turtles. Basically, entanglement and ingestion are two primary kinds of damage to wildlife caused by litter washed into the sea. For instance, a dead whale (Pygmy sperm – *Kogia breviceps*) found at the Batu Buruk beach in Terengganu on 20 January 2009, had starved to death because it swallowed plastics (Mohd Lazim, 2009).¹⁰ In addition to this, litter can sometimes be a culprit directing to ghost-fishing, especially by discarded or lost fishing nets.

⁸ Besides population increase, the increase in waste generation could be mainly attributed to rural-urban migration, increase in per capita income, and changes in consumption patterns. In general, municipal solid waste in the country composes of mainly 40% organic waste, 14% paper, 15% plastic, and others.

⁹ This illustrates that not only heavily used beaches are affected by litter/waste. Similarly, a 1991 survey of 26 remote islands at the Great Barrier Reef found 5,656 items of rubbish – among these included plastic, glass, and metal debris.

¹⁰ Plastics were discovered in its' stomach from a dissect result.

SOURCES OF LITTER IN MALAYSIA

Major factors of litter in the country are from the land-based sources (as listed in Table 3). Indiscriminate dumping of solid waste causes pollution and hampers efforts to utilise the services of river and coastal waters. Coastal and marine litter is an eyesore, and a nuisance for fishing vessels, fish cages, tourism and recreational activities and sea-based aquaculture. On land, indiscriminate dumping of rubbish causes health problems in the community, blocks rivers and drainage systems and is a source of land and water pollution.

Table 3. Litter from the land-based sources in the country

Source	Description
Municipal landfills located on the coast	Solid household waste and other items from open waste dumps (landfills) on the coast. The waste can either blow to the sea or reach the sea when dumps are flooded. These landfills could be legal but poorly managed, or illegal.
Transport of waste by rivers from landfills or other sources along rivers and other inland waterways	Solid household waste and other items from open waste dumps (landfills) along rivers. Waste can either be flushed into the river when the water level rises or when there are heavy rains. Waste can also blow from the dump into the river. Dumps could be legal but poorly managed, or illegal.
Discharge of untreated municipal sewage and storm water	Advanced primary, secondary and tertiary municipal sewage treatment, including treatment of storm water, is still the exception rather than the rule in a majority of cities and municipalities around the world. Consequently, untreated or insufficiently treated sewage and storm water is discharged into rivers and directly into the sea. In the case of combined sewage and storm water pipe systems, heavy rainstorms can also cause overflow in the treatment plant. Storm water carries with it literally all the solid items and liquids thrown on streets and other hard surfaces in municipalities that can be flushed away.
Industrial facilities	Solid waste from landfills, and untreated wastewater. The enormous amounts of plastic resin pellets found in the sea today originate from industrial facilities.
Tourism	People leave more than their footprints behind when they have been on the beach. They do not mind carrying or transporting plastic bags, various kinds of food packaging, beverage cans and cartons, toys and cigarettes to the beach, but seem to find it too difficult to dispose of the remains in litter bins or back home. Food packaging also blows onto beaches from bins.

Source: Adapted from *Annual Environmental Quality Reports* (<http://www.doe.gov.my/en/eqr>), Department of Environment Malaysia; and the *United Nations Environment Programme* (<http://www.unep.org/regionalseas/marinelitter/about/sources/default.asp>).

WASTE MANAGEMENT IN MALAYSIA

Disposal of wastes is an inevitable component of every solid waste management system. Providing adequate disposal facilities is a challenge faced by waste managers. Disposal of solid waste in inadequate or poorly designed disposal sites may cause various environmental problems and affect human health. Basically, waste disposal sites in the country falls under the jurisdiction of the respective city/municipal/district councils. As such, improper management of solid waste on land could also contribute to serious litter problem in an area. Basically, solid waste is generated from residential areas, recreational areas, public amenities, commercial centers, industrial areas, landfill sites, as well as agricultural activities. It is also important to acknowledge the fact that good practice in solid waste management and handling (this encompass pick-up, collection, transport and transfer, disposal, landfill) is of paramount importance. In line with this, waste management in Malaysia has been fully privatized at municipal level and municipal waste management is regulated by local governments.¹¹

Nevertheless, solid waste management remains a challenge on islands in the country. For instance, there are three main categories of islands in Malaysia (development islands, tourism islands, and marine park islands/protected areas). Existing treatment facilities (mini incinerator plants) on some of these islands need refurbishment (as listed in Table 4).

Table 4. Existing treatment facilities since 1996¹²

Location	Plant capacity (tonne/day)	SW generation rate (tonne/day)
P. Langkawi	20	80 – 100
P. Pangkor	10	20 – 30
P. Tioman	6	6 – 8
Labuan	20	80

Source: Ministry of Housing and Local Government (MHLG) Malaysia

In parallel to the National Strategic Plan in Solid Waste Management, it has also been targeted to reduce sources and prevent generation of waste, to have waste diversion which includes recycling and composting, conversion technologies, and having other means of solid waste facilities like transfer stations, rail loading facilities, material recovery facilities and waste-to-energy facilities. For example, based on the waste composition analysis and market prices of the major recyclable materials, some general estimation on potential value of recyclable materials in the waste stream of Malaysia is shown in Table 5 (Theng and Mohd Nasir, 2005).

¹¹ Privatization of waste management/garbage collection have an advantage edge over public services, because since Malaysia has adopted the privatization system, garbage collection standards and customer satisfaction have been raised.

¹² Sewage and litter has been identified as the main pollution sources on islands in Malaysia (Cheryl, 2006). Along these lines, the refurbishment of these incinerators projects have been planned by the National Department of Solid Waste, MHLG for the coming years:

- The propose site for this incinerator is located at Kampung Belanga Pecah, Bandar Kuah, Langkawi with 5 acres width. This incinerator is expected to accommodate 100 tonnes solid waste per day once it completed. This project is expected to accomplish on 17th March 2010 for the construction period of 24 months.
- The propose site for this incinerator is located Teluk Cempedak, Pulau Pangkor with 5 acres width. This incinerator is expected to accommodate 20 tonnes solid waste per day once it completed. This project is expected to accomplish on 17th September 2009 for the construction period of 18 months.
- The propose site for this incinerator is located Pelabuhan Bersepadu, Labuan with 2.4 acres width. This incinerator is expected to accommodate 50 tonnes solid waste per day once it completed. This project is expected to accomplish on 20th October 2010 for the construction period of 24 months.
- The propose site for this incinerator is located Kampung Tekek, Mukim Tioman with 2 acres width. This incinerator is expected to accommodate 15 tonnes solid waste per day once it completed. This project is expected to accomplish on 14th August 2010 for the construction period of 24 months.

Table 5. Values of recyclable materials in the waste stream¹³

Composition	Percentage (%)	Amount (tonnes/year)	Market price (RM/year)	Values (Million RM)
Papers	17.1	1,026,000	0.20	205.2
Plastics	9.1	546,000	0.30	163.8
Glass	3.7	222,000	0.05	11.1
Aluminium	0.4	24,000	2.00	48.0
Scrap metals	1.6	96,000	0.50	48.0
Other non-recyclables	68.1	4,086,000	-	-
TOTAL	100.0	6,000,000	-	476.1

- Note: i) Data obtained from Ministry of Housing and Local Government (2005).
 ii) Total waste generation was estimated at 6 million tonnes per year.
 iii) Average market prices were based on prices at recycling centre as of September 2005; actual prices at recyclable agents, middlemen and end buyers (industries) are usually much higher.

¹³ It is basically important to get a right picture to plan for an effective waste management plan. However, there is definitely a lack of actual data recording on waste problem in the country (especially data on coastal litter), when compared to some of the international initiatives on the matter. In line with this effort, the National Solid Waste Management Department recognizes the discrepancy in the figures and hopes to clear doubt under the 10th Malaysian Plan with better data collation system.

EXISTING MANAGEMENT STRATEGIES IN MALAYSIA

Over the years the management of waste in Malaysia and in many other parts of the world has essentially evolved around the last three functional aspects: generation, collection, and disposal (Lohani, 1978; Pfeffer, 1992). The aim of the management has always been “to ensure that ... waste is collected, handled, and disposed as efficiently, economically, and with as little environmental impact as practical” (Bidwell, 1978). The other aspect of the waste management is recycling or resource recovery. But the opportunity and extent of such a measure is still limited despite all the laws in place and numerous voluntary programmes being promoted by both government agencies and non-governmental organizations (NGOs).

In Malaysia, the responsibility to manage the waste rests with the Local Authorities: Cities and Municipalities¹⁴ by the Guidelines of the Ministry of Housing and Local Government¹⁵; and other non-urban or rural areas by the supervision of the Ministry of Health, through their appointed contractors, or as an interim measure prior to the enforcement¹⁶ of the Solid Waste and Public Cleansing Management Act 2007¹⁷, through their respective designated concessionaires: Idaman Bersih Sdn Bhd (formerly Northern Waste Industries¹⁸, Alam Flora Sdn Bhd¹⁹, SWM Environment Sdn Bhd (Formerly known as Southern Waste Management Sdn Bhd, and Eastern Waste Management (Mohd Nazeri Salleh, 2001). Issues and problems arising from the current practice were highlighted by Jamaludin Md. Jahi (2001), but the suggestions to address these issues were confined to institutional measures, but short of recommending an application of economic instruments other than that “the residents be made to pay extra” for having generated more than an allowable amount of waste. Continuing search by Jamal et al (2001:185-199) discover the “deposit and refund” scheme was the most preferred policy instrument by 369 respondents of various socio-economic background, over two other competing instruments: “fee per bag”, and “tradable discharge permits”. But “the problem with all such deposit-refund systems is that they require a second waste collection that duplicates the first system” (Porter, 2002:210). Furthermore, the “deposit” is imposed on every purchaser or consumer, whether or not one cares to “recycle”.

The national perspective on solid “waste collection and disposal” has changed at least since 1972 Statement of Malaysia at the UN Conference on Human Environment in Stockholm from a simplified version to increasingly ever a challenging one: *In urban areas “solid waste collection was satisfactory but the disposal system was largely by controlled tipping and burning. The disposal of waste was like those in many countries, and an organized programme in this direction was needed. The local authorities in many cases were hampered by lack of trained and experienced personnel, financial resources and knowledge of the effects of health.” In rural areas, “solid wastes were buried or burnt but there was room for considerable improvement in this area (Malaysia, 1971:10, 12).* The present challenge, as posed in the Outline Perspective Plan (2001-2010) (OPP3), is the need for the Government of Malaysia to adopt “a comprehensive waste management policy ... as well as to formulate strategies for waste reduction, reuse, and recycling.” (Malaysia, 2001:187). In other words, the 3R

¹⁴ For example Datuk Zahri Abdul Ghani, the chief executive officer of Alam Flora Sdn Bhd, confirmed that solid waste management responsibilities such as providing the mechanics like garbage collection from household to transfer station to landfill have been privatised to Alam Flora, while the Kuala Lumpur City Hall (DBKL) (<http://www.dbkl.gov.my/>) will handle the enforcement aspect (Bavani, 2009).

¹⁵ http://www.kpkt.gov.my/kpkt_en/main.php

¹⁶ With the passing of the Act, the local by-laws on garbage collection are currently being streamlined.

¹⁷ Under the provisions of the Act, solid waste management; including the collection of garbage, road cleaning, grass cutting, and drain sweeping, will be under the jurisdiction of the National Solid Waste Management Department of the Housing and Local Government Ministry.

¹⁸ <http://idamanbersih.com.my/default.asp>

¹⁹ <http://www.alamflora.com.my/V3/index.htm>

strategies (Reduce, Reuse, and Recycle) have to be in place with the other equally critical 2Rs: Recovery for Energy, and Repository of “non-marketable” materials for future use, and not dumped into and buried forever in landfills.

During the Eighth Malaysia Plan Period (2001-2005) (8MP), the local authorities had to handle an estimated 16.2 million tonnes of waste throughout the country ... a nationwide recycling campaign was launched in December 2000 “to promote greater awareness among the public on the need to recycle and reuse waste so as to reduce the amount of waste generated” and to be disposed off (Malaysia, 2001:506). However, it was “estimated that about 76 per cent of the generated municipal solid waste were collected, while the remainder deposited in illegal dumps, drains, watercourses, or rivers. Of the collected waste, only about 1-2 per cent, was recycled, and the remainder taken to disposal sites” (Mohamad Saib, 2004:3). In other words, over 20 percent of waste generated remain uncollected or littered about, and there has been hardly any waste-materials sorted at-source, which explains the very low rate of recycling in Malaysia compared to 62 per cent in Flanders, 47 per cent in the Netherlands, 30 per cent in USA, and 15 per cent in Japan (PSDC, 2004). Thus, one of the key aspects in the continuing search for an improved management of the waste was for the local authorities to take up the challenge of the 8th Malaysia Plan (MP) *inter alia* “to introduce various initiatives and appropriate economic approaches such as incentives and collection charges to reduce the amount of solid waste” (8th MP: 550). Unfortunately, it was not taken up. It is therefore the aim of this memorandum as much to reflect the potential use of various economic instruments in solid waste management, as to propose the most appropriate set of instruments in the case of a fast developing economy like Malaysia. Major points underlined under the 8MP included:

- (i) “the adoption of a comprehensive waste management policy to address the issues of waste reduction, reuse and recycling”;
- (ii) “the conduct of “relevant studies and demonstration projects to ascertain the viability and the acceptability of a waste recycling industry”;
- (iii) “the introduction by local authorities of “various initiatives and appropriate economic approaches such as incentives and collection charges to reduce the amount of household waste”;
- (iv) “a clearing house mechanism be established to facilitate industrial symbiosis, whereby one industry’s waste could be another’s resource” (8MP:550).

In addition to that, the Third Outline Perspective Plan (OPP3) (2001-2010) also highlights the need to further improve the management of solid waste “... the government will consider the adoption of a comprehensive waste management policy ... as well as to formulate strategies for waste reduction, reuse, and recycling”.

In line with all these aims highlighted in the national policies, the Department of National Solid Waste Management is a newly formed government department under Ministry of Housing and Local Government.²⁰ The Department is coming up with various regulations to ensure the effective implementation of the Solid Waste and Public Cleansing Management Act 2007. Its main functions include: (i) to formulate policies, plans and strategies; (ii) to set up regulations, specifications, standards and code of practices; and (c) to grant licences and approvals. As such, its overall objective is to establish a solid waste management (SWM) system which is holistic, integrated, cost effective and implementing waste management hierarchy giving priority to minimizing solid waste through the 5R concept.

²⁰ <http://www.kpkt.gov.my/kpkt/main.php>

OPTIONS FOR DECISION MAKERS AND ENVIRONMENTAL MANAGERS: NEW APPROACHES

The Third Outline Perspective Plan of Malaysia (2001-2010) has highlighted that “the Government will consider the adoption of a comprehensive waste management policy including the installation of [facilities including] incinerators for safe and efficient disposal of waste as well as to formulate strategies for waste reduction, reuse, and recycling”. Therefore, there is an essential need to administer solid waste policy, planning and management in a holistic manner. Some suggestions for improvement of waste management in Malaysia are as follows:

(a) Adopting the Indifferent Consumers-Pay (ICP) Principle

In Malaysia, as outlined since the 8th Malaysia Plan (2001-2005), “Polluters’-pay” Principle has been contemplated: the more one generates waste, the more one has to pay. This Principle has been successfully implemented in the management of toxic and hazardous waste, where should industrial waste generators find that it would no longer be economical to treat fully their own waste, they have a legal obligation under the Environmental Quality Act of 1974 and related Regulations made there under (www.doe.gov.my) either to export their untreated or partially treated waste to approved facilities in developed countries, and not in other developing countries, or to treat them the fully at the only integrated waste treatment facilities for Peninsular Malaysia operated by Kualiti Alam Sdn Bhd in Bukit Nenas, Negeri Sembilan.

However, this Principle has yet to be considered in the management of non-toxic and non-hazardous waste, namely, domestic and commercial waste. Even it were to be implemented for the domestic waste particularly, it would raise an equity issue, due to the fact that the poor generate as much, if not more, waste that is largely perishable than the rich do. It would tantamount to the poor would subsidise the rich in waste management. Thus, an innovative economic instrument that is sensitive to the question of equity especially in developing economy, like Malaysia, has to be explored.

The continuing struggle by the local authorities in addressing the waste problems would call for a close examination of the economics of waste management and the need to search for the most appropriate enviro-economic policy instrument that can be introduced in the context of a fast developing economy of Malaysia. A number of instruments had been put into practice by various authorities in Malaysia and in other countries, but the effectiveness of each one of them is being questioned. It is hereby proposed that a new instrument be introduced in Malaysia, which is a variation of the “Polluters-Pay” Principle, as outlined in the 9th Malaysia Plan (2006-2010), whose first target ought to be the consumers, not necessarily the producers: those who participate in a recycling scheme are not required to pay a certain levy, when purchasing new goods; in return, when they deposit the unwanted items into recycling bins designated for different types of material, they will be rewarded with equivalent credit points which can be redeemed at points of sale. The anticipated positive impact of the application of the proposed instrument would be as follows: (i) waste-materials will be sorted at source into: “dry”, “wet”, and “toxic”; (ii) any litter in the streets or drains will be somehow picked up by “poor” souls, because of its value on redemption; (iii) those indifferent consumers would in effect pay for the “collection” services; (iv) the costs of collection and sorting will be greatly reduced; (v) thus, the costs of production of packaging materials containing recyclables will be lower, (vi) the recycled goods will be more competitively priced; and (vii) any Waste-to-Energy scheme will become more viable now than ever. Thus, the waste recycling industry, as envisaged since the 8th Malaysia Plan (2001-2005), would soon be realized.

It is, hereby, argued and proposed that, those who care to recycle, do not have to leave a deposit-for-refund; and those who do not care or are indifferent toward any recycling programme or efforts, instead, have to pay a certain form of “levy” at points of sales. Those who return unwanted items at designated collection centres are to be rewarded with “levy-equivalent credit points” which can be redeemed at the time of purchase of controlled items or goods. The List of Controlled Goods, with Published Levy-

Equivalent Credit Points, could be developed based on the nature and extent of different types of waste being generated, or littered about, as per jurisdictional area of local authority.

The immediate effect of the proposed “Indifferent Consumers-Pay” Principle and its application as a socio-enviro-economic policy Instrument, would be that any litter on land, in the street, drains, streams, rivers, or in the seas would be picked up by “poor” souls, as “waste” and “resource” are essentially the same substance, except in value (A. Bakar Jaafar, 2001). In other words, the application of the proposed Principle has the effect of adding value to the “waste” substance into becoming “resource”.

The proposed Policy, with its Scheme of policy measures, is in line with the current Outline Perspective Plan (OPP3): “... the Government will consider the adoption of a comprehensive waste management policy ... as well as to formulate strategies for waste reduction, reuse, and recycling.” (Malaysia, 2001:187); and in support of the provisions of the 8MP: (i) “The adoption of a comprehensive waste management policy to address the issues of waste reduction, reuse, and recycling”; (ii) “the conduct of relevant studies and demonstration projects to ascertain the viability and the acceptability of a waste recycling industry”; (iii) “the introduction by local authorities of various initiatives and appropriate economic approaches such as incentives and collection charges to reduce the amount of household waste”; (iv) “A clearing house mechanism be established to facilitate industrial symbiosis, whereby one industry’s waste could be another’s resource.” (8MP:550).

(b) Waste Separation at Source

A Multi-stakeholders’ Consultative Workshop in Ipoh, Perak, on 31 October 2008 concluded that “waste separation at source” is a key intervention that is necessarily required in any efforts toward the creation of “waste recycling industry” as envisaged in the Outline Perspective Plan (2001-2010) (OPP3) of Malaysia, and as articulated in the last two 5-year Malaysia Plans (A. Bakar Jaafar, 2008). The workshop also identified at least 13 enviro-economic instruments and other regulatory measures would have to be in place, in order for the country to realize its general policy relating to solid waste management, as follows:

First Order of Policy and Regulatory Intervention

The first order of intervention would be a regulatory requirement that “a waste generator shall separate its waste into at least three separate streams: “perishable”, “toxic and hazardous waste”, and “non-perishable”. In order to promote such an intervention, it is recommended that every household is provided with the first set of 3-types of bin, “free”, and a programme be launched at various levels of government or by political constituency.

It is also recommended that a promotion is to be undertaken among interested manufacturers, distributors, and retailers to make such types of bins readily available in the market place.²¹

²¹ An initiative towards this direction has been recently taken up by the Alam Flora Sdn Bhd. Starting 1 June 2009, waste concessionaire Alam Flora will provide each household in Kuala Lumpur with two bins for them to throw the two categories of waste separately – one for organic waste and the other for inorganic stuff. The new ruling is part of the steps taken by the federal government to have a more orderly and effective management of waste and to encourage people to recycle. According to a statement made by Alam Flora chief executive officer, Datuk Zahri Abdul Ghani; this step is also important towards educating the people to separate their waste at source, which is a key to proper waste management (Bavani, 2009). This scheme had already been implemented in Putrajaya since last year and has contributed towards higher recycling rate there compared to Kuala Lumpur. Basically, Alam Flora serves 8.7 million people in Kuala Lumpur, Putrajaya, Selangor, and Pahang.

Those who collect and sort out “toxic and hazardous waste” from other streams of waste should be rewarded “financially”, through Scheduled Waste Trust Fund managed by the Department of Environment, when they deposit such materials at designated “waste recovery centres”.

Second Order of Policy and Technological Intervention

By the “Proximity Principle”²², the supply of in-situ composters be introduced to those households with landed-properties in order to recover their “perishable waste” as “compost-materials” which could be marketed for plant-nursery and landscaping. This measure would help reduce the frequency of waste collection, and thus, reduce energy and operational costs.

In the case of “perishable waste” generated by others including condominiums, apartments, restaurants, hawker-centres, and canteens, anaerobic digestion technology could be introduced in order to generate methane gas or compressed natural gas “renewable energy”. Such an innovation would also attract “carbon credit” under the Kyoto Protocol.

Third Order of Policy, Regulatory, and Market Intervention

For non-perishable waste, it could be further sorted out at source, should there be a market demand for recyclables such as “plastics”, “paper”, “glass”, and “metals” including aluminium and steel. To create demand for such recyclables, it would require another set of policy interventions, including the policy that would require “manufacturers producing new goods containing some amount of recyclables” with the necessary “product labeling with mobius loop” through Product Stewardship.²³

Thus, to facilitate “not backyard” but a very “healthy” trade of recyclables, it is also recommended that, like Malaysia Commodity Exchange (MCE), “Recyclable Exchange” be established.

In order to institute some discipline, and to promote “waste separation at source”, it is highly recommended that the proposed “Indifferent Consumers-pay” (ICP) Principle be introduced, but those consumers practice “recycling” be rewarded with some credit-points with equivalent monetary value, in lieu of paying a levy for having avoided such a practice²⁴ As the US President-Elect Barack Hussein Obama put it; “... money is not the only answer, but it makes a difference”.²⁵

²² The proximity principle advocates that waste should be disposed of (or otherwise managed) close to the point at which it is generated, thus aiming to achieve responsible self-sufficiency at a regional/or sub regional level. Where this is not possible priority should be given to transportation by rail or water.

²³ Product stewardship is a concept whereby environmental protection centers around the product itself, and everyone involved in the lifespan of the product is called upon to take up responsibility to reduce its environmental impact. For manufacturers, this includes planning for, and if necessary, paying for the recycling or disposal of the product at the end of its useful life. This may be achieved, in part, by redesigning products to use fewer harmful substances, to be more durable, reuseable and recycleable, and to make products from recycled materials. For retailers and consumers, this means taking an active role in ensuring the proper disposal or recycling of an end-of-life product.
(http://en.wikipedia.org/wiki/Product_stewardship)

²⁴ www.malaysianbar.org.my/echoes_of_the_past/datuk_a_bakar_jaafar_consumers_pay_for_indifference.html
<http://www.ea-swmc.org/download/seminar1papers/DatoDrAbuBakar.pdf>
http://www.inta-aivn.org/downloads/waste/presentation_bakar.pdf

²⁵ http://www.brainyquote.com/quotes/authors/b/barack_obama.html

Fourth Order of Policy Intervention

There is a limit to the extent of which certain types of waste could be recycled. Instead of these materials be sent to landfills for disposal, it is highly recommended that “resource recovery” and “waste-to-energy” plants be promoted and established. Thus, a very attractive electricity tariff ought to be given to such facilities which essentially generate “renewable energy”.

Fifth Order of Intervention

There shall be no more landfills, sanitary or otherwise, to be built. Instead, those “unwanted” materials should be put in a nearby “repository”. These materials would be easily “recoverable” once they command some economic values.

(c) Paradigm Shift in Waste Management

There is a need to further explore the prospects of an alternative management of waste in Malaysia, by focusing more on the first three functions in waste management: Reduction, Reuse and Recycle than on the last three: Collection, Treatment and Disposal, as illustrated in Figure 3.

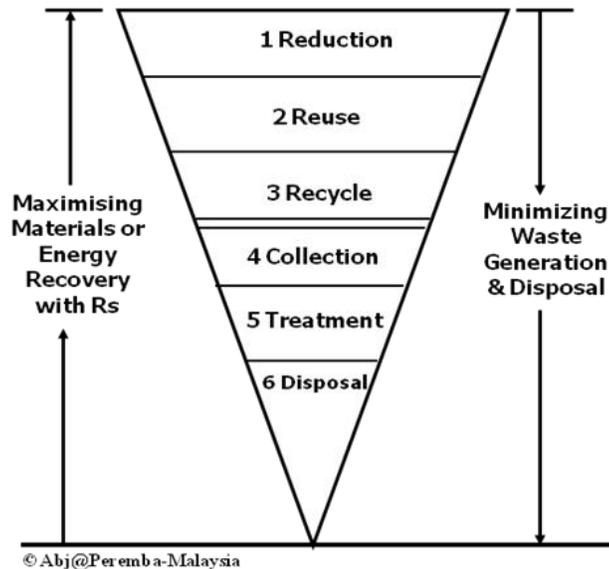


Figure 3. The First 3 and the last 3 Functions in Waste Management

Note: Instead of carrying on only with the current 3R programme: *Reduce, Reuse, and Recycle*; the programme should be extended to 5R Scheme: *Reduce, Reuse, Recycle, Recovery of Energy, and Repository*, and not landfilling.

MEASURES OF POLICY-TO-PROGRAMME IMPLEMENTATION EFFECTIVENESS

Clean-Cost Index (CCI) – An Approach for Beach Cleanliness Assessment

There are various tools in place to indicate environmental quality standards in relation to litter management. One good example used widely is the “Blue Flag beach”, which is a maritime or freshwater recreational beach that has met stringent quality standards. Blue Flag status has been awarded to beaches in more than 30 countries in Europe, South Africa, New Zealand, Canada, and the Caribbean based on the standards and criteria set. In general, compliance with Blue Flag criteria requires adherence to water quality standards, safety, the provision of services and general environmental management.²⁶ For instance, the right to fly a Blue Flag at a beach or recreational water is a strong indication of high environmental standards and is a much sought after accolade by local authorities. In 2008, Spain had 455 Blue Flag beaches. Greece was second at 258.²⁷

The more recent tool is the Clean-Cost Index (CCI). CCI was developed and is suggested as a tool for evaluation of the actual coast cleanliness. It measures plastic debris as a beach cleanliness indicator, in an easy way precluding bias by the assessor. Furthermore, the CCI is the measuring tool of the “Clean Coast” program - a new, long-term approach for cleaner beaches by various activities such as an increase in the public awareness. The CCI was proved to be a useful tool for measuring progress and the success of activities such as education campaigns, media coverage and enforcement actions (Alkalay, *et al.*, 2007).

There were basically no accepted indexes of whether a beach was clean or dirty for many years.²⁸ The only measure was the amount of waste removed from a beach by measuring the tonnage of litter cleared from the beach or the number of trash bags collected at the end of any operations. However, these parameters emphasize more on the cleanup operation, rather than the real cleanliness of the beach. As such, the CCI method was developed to measure the actual cleanliness of a beach through an easy way.

Transects are used to measure the CCI for a beach area. The main calculation of the CCI is presented in the following equation:

$$\frac{\text{Total plastic parts counted in } Z \text{ lines}}{Z \times 2[\text{m}] \times \text{beach width} [\text{m}]} = \text{Plastic parts/m}^2$$

Following to this, the index for the final CCI number is as follows:

Coast index	Very clean	Clean	Moderate	Dirty	Extremely dirty
Numeric index	0–2	2–5	5–10	10–20	20+

²⁶ The Blue Flag Programme 2008/2009 (<http://www.blueflag.org/>)

²⁷ Blue Flag beach (http://en.wikipedia.org/wiki/Blue_Flag_beach)

²⁸ There have been no actual surveys or monitoring of coastal litter problem in Malaysia. In addition to this, there is also no data currently on the sources of litter (proportion that comes from land-based sources versus ship-based sources). Basically, Malaysia has ratified the IMO MARPOL Annex VI to address ship-based pollution sources of garbage (thus far, 15 ports have waste reception facilities of garbage in Malaysia). However, control and reduction of litter from land-based sources has not been covered by any single global convention, initiative or programme. Moreover, the increasing severity of the problem indicates that the various existing but un-coordinated initiatives are not currently effective in the country.

DISCUSSION

The volume of wastes generated has increased over the years due to increase in population, socioeconomic activities and physical development. Therefore, if improperly handled, these wastes will be a source of pollution. Waste must also be collected, treated and/or disposed off properly. In order to achieve this, a good management system will have to be implemented and sufficient funds as well as skilled manpower be made available. With increasing costs of wastes handling, one of the attractive options of managing such wastes is to look into the possibility of wastes minimization and recovery. Besides that, one of the important steps in wastes management is collection, which may take the form of sewer in the case of liquid wastes or some form of transportation system in the form of solid wastes. Such collection systems are very costly. The collection of solid waste, for example, is estimated to represent 60-80 percent of the total management costs.

Nevertheless, the unsustainable trends in waste generation and the policy issues remain causes for concern. Waste volumes continue to grow and the potential for waste prevention and recycling is not yet fully tapped and, the emerging knowledge about the environmental impact of resource use is not yet fully reflected in waste policy. This is especially a case in countries, where growing prosperity inevitably also means growing consumption – and thus more waste. It is a problem that will continue to grow and ignoring it would be a serious mistake, leading to grave problems for public health and the environment. As such, measures to reduce or prevent coastal litter are part of a larger issue – waste management in society as a whole. Indirectly, minimizing wastes will also have the effect of reducing the strain on the carrying capacity of natural systems to receive or assimilate wastes. Good waste management must begin with preventing waste being generated in the first place. Waste that is never produced does not have to be disposed of and cannot become coastal litter. Second step is to collect waste that has been generated and make sure that it is being taken care of properly, either for reuse and recycling of materials and products or environmentally safe disposal. For instance education, information and training are vital components in all efforts towards more waste-wise thinking in society as a whole.

For instance, waste management is a major environmental issue that has become the focus of attention in Japan. Japan practices the 3R's strategy (*Reduce, Reuse, and Recycle*), which has been specifically extended to 5R's in some parts in Japan (with the addition of *Refuse* and *Repair*).²⁹ Overall, the reduction of waste generated has been highlighted as the main priority under the local waste management strategy in Japan. In line with this, the approach used in many areas in Japan includes setting the target of waste reduction and informing people of the consequences of their actions. This is done by introducing the initiative of installing meters on the local waste collection trucks. The use of meters secured to the waste collection trucks enables the calculation of the total sum of daily waste collection in specific areas in the city. In addition to this, the trucks are also equipped with the Global Positioning System (GPS). This basically allows data collected to be sent via internet to a computer server as soon as the waste collection takes place at any one collection point. This information is then made available to the general public. The main idea behind this is to inform the local communities on the actual amount of waste produced in their area, so that they would eventually become more engaged in establishing their local waste reduction targets. In addition to this, this system also benefits the people in terms of cost effectiveness of the waste collection services. Less waste means less cost.³⁰ On the other hand, non-recyclable waste is turned into compost after processing, and recyclable items are turned into usable goods after undertaking the necessary repair processes. Usable goods (furniture, electrical goods, bicycles, etc.) are then given away free to the local community (Kaur Cheryl, 2008).

²⁹ Although basically these principles have already been adopted in Malaysia, the implementation is not as wide as the current practice in Japan. For example, the practice of repairing damaged items (such as furniture) and recycling it back to the local community have not been undertaken in Malaysia.

³⁰ The Petaling Jaya City Council (MBPJ) secretary, Mr. Puasa Mohd Taib had estimated that if the local authority's expenditure on solid waste management is reduced by about 20%, RM10mil would be saved and allocated for other programmes (for example, for construction and management of infrastructures) (Chan, 2008).

In addition to all these, policy and management decisions concerning litter must be based on solid information about quantities, trends and sources. As such, there is a need to assess the extent of the marine litter problem specific to areas. Only by gathering the real extent of the problem by monitoring activities, can a systematic public awareness and actions be initiated to address and probably manage litter problem in the country.³¹ For instance, the main problem issue is the plastic bag menace that Malaysians can identify with. Moreover, the clarion call to do away with plastic bags has echoed around the world for environmental reasons. In Malaysia, the call to ban its use has been mooted now and then with little success. The latest was the Subang Jaya Municipal Council's plastic-free campaign launched last August with a declared aim of turning the Selangor municipality into the first place in the country to eliminate the use of plastic bags by 2010. The public is encouraged to switch to paper bags, biodegradable carriers or their own shopping bags. However, the success rate is yet to be ascertained.

CONCLUSION

New approaches, including an adoption of the most appropriate mix of regulatory and economic policy instruments are prerequisite of any solid waste management. Policy instruments including the *Indifferent Consumers-pay Principle* (ICP) should be adopted as an enviro-economic instrument in Malaysia to tackle the issue 'once for all'. Besides that, effective monitoring must also be taken into consideration to ensure the environment is not affected. For example, in relation to coastal litter management, beach cleanliness assessment based on the *Clean-Coast Index* (CCI) can be utilised as a tool for evaluation of the local coast cleanliness and make improvements when required. These would serve as more concerted and systematic efforts put in place in the country, compared to the present approaches.

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³¹ For instance, such information may be generated through regular region-wide monitoring programmes. In 1999, an OSPAR Pilot Project on Monitoring Marine Beach Litter was endorsed. The project was coordinated by Sweden, through the Swedish Environmental Protection Agency, as part of Sweden's responsibility as Lead Country within OSPAR for marine litter issues. The agreed methodology is based on the identification of reference beaches and upon executing surveys, preferably four times a year, on the beaches.

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