
A review of commercial waste recycling policy in Malaysia

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Abstract: Commercial business sectors have an ethical obligation to act responsibly towards the environment. Although Malaysia has developed a National Solid Waste Management Policy, the prioritisation of options for waste management is from reduction, reuse, recovery, treatment and finally to disposal. However, recycling is the most enforceable of the environmentally sound practices that a business can undertake. The recycling rate in Malaysia is only 11% whereas businesses in most European Union countries such as Germany and the UK appear to achieve much higher levels of recycling, more than 50%. Apparently, there is a gap between the policy framework for sustainable waste management in Malaysia and that of developed countries. This study reviews the solid waste management policy frameworks in both developed countries and developing countries. It is critical to understand Malaysia's sustainable development in solid waste management to ensure that responsible disposal of resources that meet the overall sustainability of the business can be attained.

Keywords: commercial; developing countries; Malaysia; policy; recycling; solid waste.

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1 Introduction

Solid wastes are perceived as undesirable, useless, unwanted materials and substances that arise from human and animal activities. Noor et al. (2013) report that the increasing population and rapid urbanisation in Malaysia directly influence municipal solid waste generation, which has increased from 5.6 million tonnes in 1997 to more than eight million in 2010 with a projection of more than nine million tonnes by 2020. The growing urban population in developing countries and the disappointing response of the authorities to the increasing demands for appropriate waste management services have been twin dilemmas facing cities in these countries (Ahmed and Ali, 2006; Gellynck et al., 2011; Owusu et al., 2012). Hence, it is crucial that Malaysia finds a sustainable way of disposing of the numerous wastes generated in the country.

As one of the United Nations (UN) Millennium Declarations 2000 is to ensure environmental sustainability by integrating sustainable development into countries' policies and programs (UN, 2012), governments and organisations worldwide have taken up sustainable development as a desirable goal and developed metrics for sustainable development (UN, 2010). Since business has become more proactive by encouraging the corporate social responsibility (CSR) movement in sustainable development and business success is characterised by the aspects of the environment it maintains, this paper reviews Malaysia's sustainable development in the area of solid waste.

To date, most studies have focused more on the general picture of municipal solid waste recycling practices (Isa et al., 2005; Murad and Siwar, 2007; Saeed et al., 2009; Afroz et al., 2013; MHLG, 2010; Zen et al., 2014), although there is a critical need to highlight other issues such as the need for a solid waste-related policy framework and commercial solid waste management. In fact, Moh and Abd Manaf (2014) highlight that no specific measures have been taken to address the issues of waste minimisation and recycling. However, the Government of Malaysia recognises the importance of waste management and has implemented several policies and standards, for instance the Solid Waste and Public Cleansing Management Act 2007 (Act 672) and MS 2505:2012 Guidelines for Sampling of Household Solid Waste. However, these policies and standards are only applicable to public areas and the household sector. Thus, it is proven that a critical review of the existing commercial solid waste recycling policy is essential to improve solid waste management from a recycling perspective, as it can act as a guideline for policy makers, related institutions and other researchers in future.

The Rio Agenda 20+ stipulates the need to encourage capacity building and knowledge sharing from the best practices used in developed countries to developing countries. The reviews of developed countries' policy frameworks in this study are expected to provide a policy paradigm for Malaysia's commercial solid waste management. The overall aim of this paper is to position Malaysia's sustainable commercial waste disposal development with a focus on establishing a local commercial

recycling policy framework. Current policies and practices are reviewed accordingly to distinguish the current issues.

2 Sustainable waste management

Sustainable development is a complicated task and requires a lot of time and efforts. The dominant view of governments and business is that sustainable development is continued economic growth made more environmentally sensitive to raise living standards globally and break the link between poverty and environmental degradation (UN, 2010). Sustainable solid waste management should balance the need to conserve resources and the equally important responsibility to prevent environment pollution (MHLG, 2005a). Waste minimisation is a central part of the strategy (MHLG, 2005b). Amutenya et al. (2009) assert that recycling is one strategy widely advocated to proliferate efficiencies and to meet the targets for waste reduction.

Solid waste management and recycling practices are ineffective without a well-established policy framework. Through the United Nations Conference on Sustainable Development (Rio+20), the action of restructuring taxation and phasing out any harmful subsidy shall be considered to reflect a country's environmental intentions. Those policies should fully take into account the specific needs and conditions of developing countries, with the aim of minimising the possible adverse impacts on their development (UN, 2012). Implementation of the reduce, reuse and recycle (3Rs) has been a successful strategy in many developed countries. However, its accomplishment among developing nations is yet to be seen (Agamuthu et al., 2011). Agamuthu et al. (2011) further report that approximately 95% of wastes in Malaysia are thrown directly into landfill. This reflects the fact that the recycling rate in Malaysia had only reached 5% prior to 2010. The rate is comparatively low compared to those of developed countries, which appear to achieve much higher levels of recycling: more than 50% (Eurostat, 2009). This discrepancy occurs probably because the policy frameworks adopted by the developed countries and Malaysia are extremely different. Thus, the policy frameworks adopted by the developed countries and Malaysia are discussed separately in this paper.

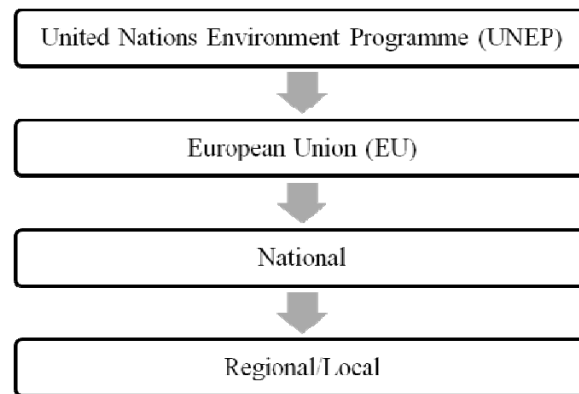
Various solid waste-related policies and legislations have been formulated and implemented since 1988, and the 3Rs principle has been established based on these policies and legislations, and is also strongly publicised by the Malaysian government, but achievement is yet to be seen. This paper also deals with the waste policy frameworks in relation to the commercial solid waste of developed countries and developing countries so that the best practice from the developed countries can be transferred to the developing countries as highlighted in Rio+20.

Since the commercial sector is one of the main sectors that drives a country's economy, it also has an obligation to act responsibly towards the environment, and specifically it will be expected to drive efforts towards responsible waste management. Hence, the commercial waste-related policy will be reviewed first, prior to a strategic solid waste management being planned.

3 Policy framework for commercial solid waste

Rio+20 identifies that solid wastes, such as electronic waste and plastics, pose particular challenges that should be addressed. In principle, a global policy framework has been adopted from the UN perspective and cascaded down to the individual countries and then down to the regional municipalities and corporations involved (Figure 1). The policy framework helps to position the responsibilities and roles of each individual state to execute the policy, for instance, developed countries such as the United Kingdom (UK) and Germany, which also, as European Union (EU) member states, apply the EU Directive for regulating their solid waste management policies and regulations. Looking at a developed island country such as Singapore, it can be seen that its solid waste management is more advanced than that of Malaysia. Later sections of this paper will look at the policy frameworks in a few countries in detail.

Figure 1 Top down policy framework from a Union Nations (UN) perspective



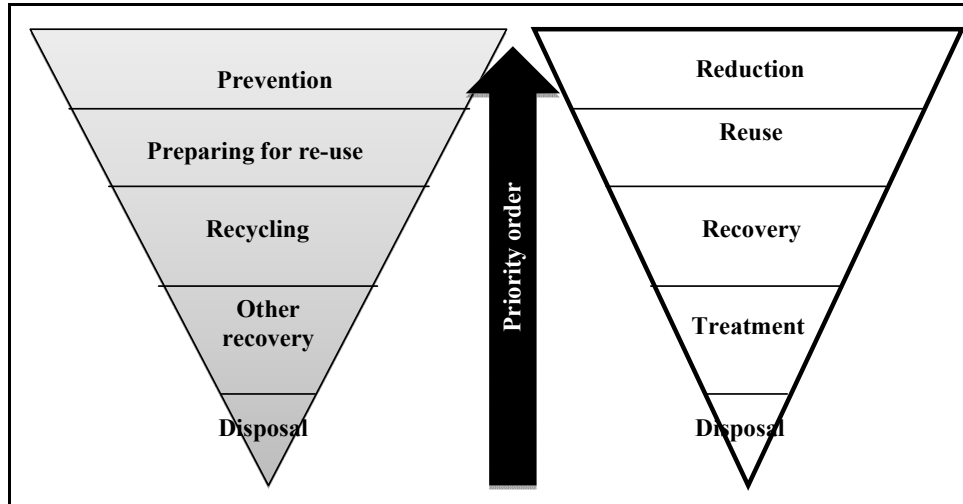
3.1 EU directives

In the European context, the EU has been able to affect policies within the majority of its member countries (EC, 2008: 1999). EU directives are a form of EU legislation which contains deadlines for the implementation of the rights and obligations in the directives into the law of the member states (EC, 2013a). The solid waste-related directives include the waste framework directive, landfill directive, packaging and packaging waste directive, and waste electrical and electronic equipment directive, which are applied in the EU member states' commercial solid waste management policy framework according to their prioritisation, as shown in Table 1. EU directives also lay down certain end results or targets that must be achieved in every member state (Table 1). National authorities have to adapt their laws to meet these goals, but they are free to decide how to do so (EC, 2013a). The directives' implementation into the laws of the member states fulfils the purpose of ensuring the full availability of those rights and obligations to citizens and enterprises.

Table 1 EU directives and the targets

<i>No.</i>	<i>EU directives</i>	<i>Description</i>	<i>Target</i>
1	Waste Framework Directive (2008/98/EC)	<ul style="list-style-type: none"> • Introduce ‘polluter pays principle’ and the ‘extended producer responsibility’ 	<ul style="list-style-type: none"> • By 2020, 50% by weight for preparing the reuse and recycling of certain waste materials from households and other origin similar to households, and 70% by weight for preparing the reuse, recycling and other recovery of construction and demolition (C&D) waste
2	Landfill Directive (1999/31/EC)	<ul style="list-style-type: none"> • All the member states must incorporate the Directive into the national legislation • Ensure the operation of landfill sites complies with the provision of the Directive • Report the implementation of the Directive to the Commission every three years 	<ul style="list-style-type: none"> • The amount of biodegradable municipal waste must be minimised to 50% in 2009 and to 35% in 2016
3	Packaging and Packaging Waste Directive (94/62/EC; 2004/12/EC; 2005/20/EC; 2013/2/EU)	<ul style="list-style-type: none"> • The latest amendment directive illustrates the example for criterion of packaging items 	<ul style="list-style-type: none"> • Recovery target: increasing target by 10% to require that a minimum of 60% by weight of all packaged wastes must be recovered • Recycling target: increasing target by 30% to require that between 55 and 80% by weight of all packaging waste be recycled • Recycling target: 60% by weight for paper and board, 50% for metals, 22.5% by weight for plastics, and 15% for wood
4	Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC; 2012/19/EC) RoHS Directive (2002/95/EC)	<ul style="list-style-type: none"> • Member states must ensure all the waste electrical and electronic equipment (WEEE) collected is transported to authorised treatment facilities • Producers of EEE must apply the best available treatment, recovery and recycling technique 	<ul style="list-style-type: none"> • 85% of WEEE generated will ensure that around 10 million tons, or roughly 20kg per capita, will be separately collected from 2019 onwards

Source: Data adapted from various documents: Afroz et al. (2013), EC (2012a, 2012b, 2013b) and Europa (2011)

Figure 2 Waste hierarchy and approaches

Source: Data adapted from DEFRA (2011c, 2011d), EC (2012a) and MHLG (2005a)

Prevention, re-use, recycling, recovery, composting, incineration and landfill used together represent the major elements of an integrated solid waste management policy following a waste hierarchy (Figure 2). The waste management hierarchy (Figure 2) shall be applied according to its priority order in waste legislation and policy of the EU member states (EC, 2012a). The waste hierarchy options for different countries (Figure 2) differ because of different geography, culture, environment, urban structure, planning system and others (Pitt, 2005). Pitt (2005) further comments that the commercial sector has been slow to initiate waste minimisation schemes. He further highlights that problems cannot be deflected away from poor contract management skills and a failure on the part of the facilities management (FM) discipline to effectively manage outsourced waste management solutions in the commercial sector.

3.2 Developed countries

The waste management legislations of developed countries such as the UK and Germany are based on the European waste policy, but this is not the case in Singapore. Germany is considered one of the most successful countries in respect of waste recovery while the UK's waste recovery is still in its infancy. However, in recent years, the UK has begun to rationalise the need to improve its recycling infrastructure, such as materials recovery/recycling facilities (MRFs) as well as introducing incinerators with recovery features.

In *Germany*, avoidance, recovery and disposal, which are the origins of waste management, have become the main principles of the country's waste hierarchy (BMU, 2013). The provisions regarding landfill in Germany are stricter than the requirements in the EU landfill directive. Germany often takes a pioneering role in shaping EU waste law. Waste management is an important industrial sector and provides high-quality technology for the efficient use of waste as a resource and the

environmentally sound disposal of the remaining residual waste. Hence, German waste management has the highest waste recovery quotas worldwide and is already making a significant contribution to sustainable management (BMU, 2013).

The Government of Germany is aiming to attain almost complete high-quality recovery by 2020. Germany contributes know-how and innovative technology to achieve the targets set at European and international levels. Product responsibility is the focal point of the country's waste management policy (BMU, 2013; LUA NRW, 2006). Through this policy, the conditions for effective, environmentally sound waste avoidance and recovery measures are already created in the production stage (LUA NRW, 2006), and this is under the producers and distributors' responsibility (BMU, 2013). The 1996 Closed Substance Cycle and Waste Management Act and Ensuring Environmentally Compatible Waste Disposal and the Federal Immission Control Act are the legal bases for this policy (BMU, 2013). It is also based on the precautionary principle, the polluter-pays principle and the principle of cooperation (LUA NRW, 2006).

Turning to the UK, over-reliance on landfill as the main waste disposal method has brought the country under pressure to apply a more sustainable waste disposal method as required under EU landfill directives (1999/31/EC) (Pitt, 2005). Applying to all waste management sectors, the EU Waste Framework Directive and associated directives on specific waste streams have become the basis for UK waste management legislation and policy (Costa et al., 2010). The introduction of increasingly stringent UK waste management policies such as the Environmental Protection Act 1990 act as the driver towards greater sustainability in various sectors, including healthcare waste management in the UK (Tudor et al., 2005a) and also commercial waste management.

Strong economic and regulatory instruments in the UK such as the imposition of landfill tax and bans can contribute to making the reuse or recycling economically viable (Costa et al., 2010). The producer responsibility obligations (packaging waste) regulations 2007 is imposed by applying a packaging directive to cover recycling and recovery. The legislation places a 'producer responsibility' on commercial premises based on the 'polluter pays principle', requiring the commercial sector to take back the waste it generates through its supply of goods to the final consumer (Bolaane, 2006).

Looking at an example from Asian developed countries, solid waste management in *Singapore* has traditionally been undertaken by the Ministry of the Environment and Water Resources (MEWR), which formerly known as the Ministry of the Environment (ENV). The statute dealing with solid waste management in Singapore is the Environmental Public Health Act (EPHA) and the regulations passed under the EPHA include environmental public health (public cleansing) regulations and environmental public health (general waste collection) regulations. Under these two regulations, in Singapore all generated solid wastes have to be collected (Bai and Sutanto, 2002). Waste collection for industrial and commercial premises is carried out by licensed waste collectors. As the regulator, the ENV sets guidelines on good practices under its 'code of practice for licensed general waste collectors'; a guideline to which licensed waste collectors must adhere. Singapore has prioritised waste minimisation to reduce the amount of waste generated, albeit the scope for doing so is quite limited in comparison with EU countries. However, incineration began in Singapore prior to EU countries, since there is limited land on the island. The solid waste management hierarchy applied in Singapore is waste minimisation, which comprises the 3Rs, followed by incineration and landfill (Bai and Sutanto, 2002).

3.3 Developing Asian countries

Waste management in developing Asian countries is based on the pertinent international declarations, particularly the Rio+ declaration. These policies are cascaded down to individual countries at regional level to enable them to implement their waste management (Figure 1). This research will look into the policies on commercial solid waste management in developing countries such as Indonesia, Thailand, China and Malaysia.

Inadequate integrated resource management policies lead to inefficient solid waste management in *Indonesia*. Until 2008, the country had no national waste policy describing the concepts, aims and measures for national waste management. In 2008, the Government of Indonesia issued policies via the instrument of the Public Works Regulation No. 21/PRT/M/2006 concerning the national policy and strategy for the development of waste management systems (IndII, 2012). The new national regulation for waste management, Waste Management Law No. 18/2008, was issued in the same year and is a legal tool in forcing all related parties to support the national waste management policy (IndII, 2012; Meidiana and Gamse, 2010). The new waste law, however, does not include the issue of integrated waste management (Meidiana and Gamse, 2010) because the waste management practices in Indonesia still focus on landfilling. Rolling out the 3Rs policy throughout Indonesia is one of the strategic objectives stipulated in the National Mid-term Development for the year 2010–2014 (IndII, 2012). Special efforts are needed to encourage responsible businesses to operate with an extended producer responsibility (EPR) strategy (IndII, 2012).

Open dumping is the most popular solid waste management method in *Thailand*. Solid waste practices in Thailand are mainly dominated by the informal sector (Suttibak and Nitivattananon, 2008). Prior to 1994, most legislation dealt with the general tidiness of refuse in the city areas; there was no legislation relating to the recycling process (Muttamara et al., 1994). Positive signs of recycling promotion in Thailand were begun in 1997 by the Ministry of Science Technology and Environment (MOSTE) (MONRE, 1997). The Government of Thailand implements an environmentally friendly waste disposal system in the national resources and environmental policy, and it will not allow Thailand to become an end receiver of waste – which means a country that has to bear the expenses of industrial waste and pollution (UNEP, 2009). Suttibak and Nitivattananon (2008) identify the indicators used for assessing the local government authorities' performance in solid waste management to improve the recycling initiatives in Thailand. The policy has been developed for integrated solid waste management by aiming to minimise waste generation and promote the 3Rs hierarchy. However, the existing laws lack regulations to cover the whole solid waste management system. Although the national policy emphasises integrated waste management, clear measures to promote waste reduction and public participation in such initiatives are not mentioned (UNEP, 2009).

Solid waste management has been a perennial problem in the *Republic of China* (APO, 2007). With urban residents accounting for more than half of the total population, China is experiencing a rapid increase in solid waste generation and growing pressure for solid waste management in cities. The quantity of municipal solid waste collected and transported is projected to reach 585 million tons in 2030 (World Bank, 2013). The World Bank (2005) reports that solid waste legislative arrangements in China are

complicated and often overlap, or have areas where no agency is responsible. Improved regulation is required due to increasing waste volumes, and increasing sophistication needed for equipment and infrastructure. However, APO (2007) reports that the Republic of China has made great efforts to improve industrial-waste management and made many new policies, including promoting the construction of incineration plants. APO (2007) also reports that the sustainable use of natural resources has become a crucial issue in China; therefore, the nation waste management policies have shifted to reusing and recycling resources.

In *Malaysia*, the Environmental Quality Act (EQA) 1974 is the earliest Act formulated to prevent, abate, and control pollution, which subsequently enhances environment quality (Afroz et al., 2013). The Eighth Malaysia Plan (RM-8) 2001–2005 promulgated the adoption of a comprehensive solid waste management policy to address waste reduction, re-use and recovery (MHLG, 2005b) as a result of rapid development and the scarcity of space for new landfill sites. The National Solid Waste Management Policy, which is the first comprehensive policy on waste management, was formulated in 2006 to implement a waste management hierarchy (Figure 2) by emphasising waste reduction through 3R activities, intermediate treatment and final disposal (Agamuthu et al., 2011). It is entitled the national strategic plan (NSP) for solid waste management, and one of the highlights in the policy is the enacting of the Solid Waste and Public Cleansing Management Act 2007 (Act 672). This act and the Tenth Malaysian Plan (10MP) 2011–2015 clearly integrate elements of EPR (Afroz et al., 2013).

It is recognised that waste reuse and recycling are considered sustainable forms of waste management (MHLG, 2005b), and nowadays solid waste management in Malaysia is at a critical juncture. Although the waste hierarchy (Figure 2) option comprises a broad ranking of preferred solutions, the present recycling rate in Malaysia is only 11%, which has fallen behind the rates in developed countries. Continued efforts need to be made in regard to recycling initiatives in Malaysia, especially in the commercial sector. It is important for businesses to grasp the entire network of the materials they consume and the methods that should be dealt with from infancy to ensure sustainability is reflected in their businesses.

4 Commercial solid waste trends

Commercial waste is the waste generated by small businesses, retail shops, service companies, public institutions or industrial firms (Zhang et al., 2010). Solid waste generation has not only increased but its composition has changed with the rapid increase in industrialisation and population growth. Since Rio+20 encourages developed countries to support developing countries in their efforts towards sustainability by sharing their best practices, the successful commercial solid waste trends in the developed countries will be discussed to identify their best practices in commercial solid waste management.

To date, many international organisations such as the UN, UNEP, EU and Organisation for Economic Cooperation and Development (OCED) are highlighting the strategic policies for responsible business practices. They formulate strategic policies such as CSR and producer responsibility for their member states to adapt in their own policies on business sustainability. Owing to increasing societal expectations about the role of business in society (Golob and Bartlett, 2007), CSR as the actions of businesses that profit the economy, society and the environment has wider responsibilities beyond commerce (Henderson, 2007). These international policy frameworks greatly impact the developed countries' environmental performance in managing their commercial solid waste.

Performance statistics are the best way to evaluate policy implementation. Malaysia has targeted a 22% recycling rate from commercial and industrial industries by 2020 (Agamuthu et al., 2011). It is proven that the target is achievable in other countries, as, for example, England was able to recycle and reuse 52.8% of its commercial wastes in 2009 (DEFRA, 2011a, 2011b). Of this, more than 20% of the wastes from each business sector is recycled and reused in England (DEFRA, 2011a, 2011b). In 2012, the recycling rate in Germany was 74% (Eurostat, 2009), whilst in Singapore in this year it was 60%. It is believed that these high recycling rates are the result of the full implementation of the policies throughout these countries. Therefore, Malaysia should expend more efforts on recycling initiatives, and especially in policy enforcement in all sectors, particularly the commercial sector.

One of the critical challenges faced by developing countries such as Malaysia is the lack of availability of commercial solid waste management performance statistics or data. Recycling initiatives cannot be evaluated and revised for better improvement without reference to these statistics and a measurement and performance-driven waste strategy. In developed countries such as England, all the data or statistics regarding the performance of recycling and reuse initiatives in all sectors are well-managed and can be accessed online (DEFRA 2011a, 2011b). However, Malaysia only records and manages the household solid waste management statistics rather than those for other commercial and industrial sectors. The existing solid waste Acts in Malaysia do not make it mandatory for the commercial sector to report on its recycling performance. With the issues of data availability and loopholes within solid waste management policy, the question of whether the 2020 goals can be met remains unanswered (Moh and Abd Manaf, 2014). Hence, there is an urgent need to review and revise the current state of solid waste-related policy framework across all sectors, including both commercial and industrial sectors, in order to minimise the impact of companies' triple bottom line.

Despite the availability or non-availability of performance statistics, it is important to identify the commercial waste stream prior to planning a good solid waste management strategy. The material types of each commercial waste stream need to be recognised, as illustrated in Table 2, so that facilities managers can manage the wastes in a sustainable way.

Table 2 The material type of each waste stream

<i>Waste stream</i>	<i>Summary of wastes included</i>
Mixed (ordinary) wastes	Undifferentiated wastes and sorting residues
Non-metallic wastes	Glass, paper and paper products, disposable hot beverage cups, rubber and leather, plastic, wood, textiles
Mineral wastes	Combustion residues, contaminated soils, solidified mineral wastes, other mineral wastes
Chemical wastes	Solvents, acid/alkalis, used oil, catalysts, wastes from chemical preparation, residues and sludge
Animal and organic wastes	Organic wastes, food, manure, other animal and vegetable wastes
Metallic wastes	Metallic wastes, ferrous metals and non-ferrous metals
Healthcare wastes	Healthcare wastes, medical devices
Discarded equipment	End of life vehicles (ELVs), batteries, waste electronics (WEEE), 'E' waste, other discarded equipment
Common sludge	Sludges (common) and dredging wastes
Non-wastes	Blast furnace slag and virgin timber, i.e., materials recently declassified as wastes.

Source: Data adapted from Smyth et al. (2010) and DEFRA (2011a)

5 Review of Malaysia's commercial solid waste framework

In the present study, sustainable commercial solid waste management is strongly emphasised through the directives, policies and legislations established either internationally or locally.

Notwithstanding the few authors (de Vega et al., 2008; Barr et al., 2003; Pitt, 2005) who argue that recycling is the most popular environmental initiative and best-established practice worldwide due to economically driven, socially and environmentally sound initiatives, Malaysia lacks a comprehensive and strategic commercial and industrial solid waste policy as stipulated under the Solid Waste and Public Cleansing Management Corporation (2007). Most of the country's commercial wastes are sent to landfill and recycling is conducted in an unofficial manner. This is due to the strained regulatory framework imposed on businesses and lack of resources available for recovery facilities at this juncture.

In addition, the corporation claims that there is no full implementation of the existing solid waste Act throughout Malaysia, causing a very low recycling rate. This contradicts the EU directives that are mandatory for member states to adopt and regulate in their countries in relation to solid waste management policy and legislation. A *goal-setting policy* is essential for achieving sustainable objectives or targets. For example, it has been proven by a few studies (Amutenya et al., 2009; McCaul and Kopp, 1982) that goal setting promotes recycling in universities. Furthermore, some authors (Agamuthu et al., 2011; Bor et al., 2004; Murad and Siwar, 2007; Suttibak and Nitivattananon, 2008) claim

that mandatory recycling is a key influential factor in recycling programs. de Vega et al. (2008) and Golob and Bartlett (2007) emphasise that reporting is an essential communication tool for the transparency of such programs. However, the Corporation has responded that there is no mandatory requirement for the commercial sector in Malaysia to recycle or to report its recycling performance.

Awareness and education are the main focuses of the Corporation's recycling program in Malaysia. Educating the citizens by creating the awareness and habit to recycle is the Corporation's main objective. About 60% of the allocation, RM70 million or US\$18 million, is used to increase awareness among Malaysians annually (Agamuthu et al., 2011). However, Bolaane (2006) argues that failure to translate awareness into practising recycling could limit the success of public awareness programs that intend to promote recycling. Zhang et al. (2010) highlight that knowledge about the specifics of recycling is more closely related to recycling behaviour than general environmental knowledge. Hence, education and awareness are vital to the success of recycling initiatives.

In the aspect of *recovery infrastructure and technology*, it is difficult for the Corporation to manage the wastes collected due to lack of Materials Recycling Facilities and incinerators with recovery features in Malaysia. As a result, most commercial wastes are sent to landfill. Additionally, source separation is not a priority for the recycling initiatives since there is a lack of a waste separation infrastructure in Malaysia. Although many scholars such as Bolaane (2006), Masson et al. (2004), O'Brien (1992), Parkes and Proctor (1992) and Zhang et al. (2010) highlight that source separation initiatives could attain a high recycling rate and fulfil recycling targets set by national or state legislation, the targets cannot be achieved without infrastructure provision in the supply chain.

Facilities management provision of *service provider contracts* for recycling operations is critically important (Pitt, 2005). The Corporation mentions that commercial companies have the right to appoint contractors, outsource the waste collection, source separation schemes to any licensed contractors, or manage all the solid waste themselves. In contrast, municipal wastes are managed by the local authorities. This concurs with Pitt (2005), who describes that municipal waste is being collected centrally by local authorities, enabling waste monitoring. Commercial waste is, however, collected individually by businesses via waste contractors. Therefore, it is hard to quantify. The efforts to minimise commercial waste depend on individual businesses' efforts, while municipal waste minimisation can be undertaken via the local authorities.

To date, commercial wastes still cannot be quantified separately in Malaysia. The Corporation comments that this problem arises because the contractors from all sectors send the wastes to the same recycling factories since there is no proper monitoring of the waste collection in each sector and most of the collections are conducted on an ad hoc basis. The total waste collected for all sectors in 2010 is presented in Table 3. It can be seen that the recycling rate in Malaysia was only 11% in 2010. This is relatively low compared to the EU countries, which appear to achieve much higher levels of recycling: more than 50% (Eurostat, 2009).

Table 3 Total wastes collected in Peninsular Malaysia, 2010

<i>Recyclable materials</i>	<i>Total wastes collected per month (kg)</i>
Plastics	2,531,068.00
Glass	150,088,922.92
Aluminium	1,093,080.00
Paper	24,164,646.00
Other	17,631,863.50
Imported recyclable materials	157,269,220.00
Exported recyclable materials	169,490,650.00
Total/month (kg)	522,269,450.42
Total/year (kg)	5,872,438,634.04
$\frac{\text{Total recyclables collected (TRC)}}{\text{TRC} + \text{Total waste disposed (TWD)}} \times 100 = \text{Recycling rate}$	
From the data obtained, TWD = 4,234,252,000.00 kg	
$\text{Recycling rate} = \frac{522,269,450.42}{522,269,450.42 + 4,234,252,000.00}$	
Recycling rate = 11%	

Source: Data adapted from Solid Waste and Public Cleansing Management Corporation (2010)

The lack of policy implementation throughout Malaysia is the major reason for the relatively low recycling rate. Although mandatory recycling which started in September 2015, this is not definite that this will resolve the issue and it does not include the commercial sector. In contrast, EU directives contain the deadlines for the obligations in the directives to be implemented into the member states' laws (EC, 2013). Therefore, the EU directives have a great impact on the solid waste policies of its member states. Solid wastes cannot be managed sustainably without well-established policies and monitoring of their implementation.

6 Discussion and policy implications

Commercial sectors are capable of providing adequate waste management and recycling services when proper contract arrangements are set. Although there has been limited study of recycling contracts in commercial establishments, the effects of service provider contract provision have not been investigated widely in previous research. Provision for innovative waste management contracts in Malaysia's commercial sector is underdeveloped in comparison to that of developed countries, possibly in two ways. The first is due to the existing solid waste regulatory and policy framework. Secondly, the commercial sector only relies on landfill collection arranged by local authorities. Thus, most formal contract provisions are only for the disposal of controlled waste and its residue, while other recyclables are collected by local recyclables collectors prompted informally by in-house or property managers, due to their significant trade value. In regard to formal contract provisions, service level agreement is vitally important as the appropriate coordination of service level agreements or performance contracts between

private contractor and client determines the success of support services provided to one business (Goyal and Pitt, 2007; Nazali and Pitt, 2009; Baharum and Pitt, 2010). Such contract provision is significant as it sets the overall uniqueness of an institutional recycling program and motivation for innovation. Private waste haulers and contractors require management provision to be made in relation to solid waste and recycling services for collection of recyclable and residual waste if they do not have the capacity and expertise to perform these activities themselves. The pitfalls to an innovative and proactive response to waste and waste contract management entail the application of new multiple contracts (Pitt, 2005), comprehensive individual waste streams, and creativity in contract delivery and service that are missing in the Malaysian context.

Strategic partnering (Nazali and Pitt, 2009) between the commercial business community, government, local authorities, and collection service providers, traders, recycling centre operators, non-governmental organisations and other related stakeholders throughout the supply-chain network will impose fewer constraints on the capital and integrated planning and development of solid waste management and recycling services in this particular sector. However in Malaysia, partnership exists mostly in waste collection services only since there is a lack of supply chain for recycling facilities and infrastructures.

The common barriers faced by waste authorities with informal and low recycling rates include insufficient infrastructure and recycling facilities, challenges of costs and funding, and problems with accessing output markets. Malaysia's 11% recycling rate compared to those of other countries proves that Malaysia has a long way to go, with various setbacks and challenges to be resolved, before a successful recycling strategy can be implemented (Hassan et al., 2000; Tarmudi et al., 2012; Moh and Manaf, 2014). With the current level of development, it remains uncertain as to whether or not the goal-setting target of 22% of solid waste being recycled by 2020 can be met.

To extend the potential in achieving the desired goals of a sustainable recycling community by the commercial sector requires the setting of sensible recycling targets and achievable policy development. To meet the target of 22% by 2020 entails a paradigm shift, as segregation and recycling are already part of the major changes in the current policy implementation, yet are still in their infancy. However, there is the possibility for a successful implementation, particularly if an economically driven policy is forced on commercial and industrial-waste producers. In the UK, for instance, commercial recycling (Pitt, 2005; Baharum and Pitt, 2010) has proved that waste producers from the commercial retail sector are capable of achieving a more than 60% recycling rate, as they are avoiding escalating the rate of landfill (Baharum, 2012).

Improvement and stringent enforcement of the Solid Waste and Public Cleansing Management Act 2007 (Act 672) and waste-related legislations, particularly in the commercial sector, make waste data and monitoring across sectors a viable means for policy change and future campaigns. In addition, there is a pressing need for regulatory compliance among commercial businesses and industries in relation to illegal dumping. Management strategies such as segregation, and imposing fees and penalty charges for not participating are deemed essential, while mandatory recycling could be given serious consideration for implementation when necessary provisions for residual waste treatment infrastructure are made available within the proximity of local businesses. Ideally, the waste authorities could benefit by employing more waste-related initiatives when there is

sufficient funding made available; that is, fines and monetary charges are received from companies which do not participate.

7 Conclusions

This paper attempts to develop an overview of commercial solid waste recycling in Malaysia. It is found that Malaysia relies heavily on landfilling as its waste disposal method, despite the opportunities for solid waste reduction and recycling. Since the Rio Declaration in 1992, Malaysia has committed to attain its environmental sustainability by integrating sustainable development into local policies and programs (UN, 2012). There has been substantial progress made by the government and related authorities in developing a more comprehensive solid waste management, waste disposal and recycling policies, awareness campaigns and relevant projects. Yet the recycling participation has not been as encouraging as predicted – as observed in the previous findings from local policies and campaigns (Moh and Manaf, 2014). The complexity of the waste stream and the escalating per capita waste production and limited recovery infrastructure pose an even greater challenge for waste authorities, facility managers, and the businesses community, particularly in a developing economy like Malaysia. The significant underdevelopment in the information and studies on commercial solid waste management hinder future solid waste policy directions and overall integrated solid waste management objectives. Several recommendations highlighted for possible implementation require the combination of various interventions (Baharum and Pitt, 2009; Moh and Manaf, 2014). Such a concerted effort could increase the effectiveness of institutional recycling strategies. It is of paramount importance to attain meaningful results that embrace both strategic (long-term) and operational (short-term) benefits to waste authorities, and producers.

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