Linking the Malaysia's Solid Waste Management Policy Instruments with Household Recycling Behavior

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Abstract
The environmental problems faced by the world population today is the result of human daily activities. One of the contributing sources to the environmental problems is the growth of solid waste. Solid waste generation increases as a result of economic progress, urbanization, population growth and consumer-based lifestyles. The urban areas of Asia is expected to spend at least US$50 billion per year in 2025 on solid waste management. Malaysia, experiencing rapid economic prosperity, is also faced with challenges in solid waste management. This paper will highlight the present state of waste generation trends, its management, the waste management policies and strategies with specific focus on recycling for the household sector. Recycling has been highlighted for decades as a plausible option for sustainable waste management but still faced with various challenges. This paper will provide a brief classification of the policy instruments adopted in achieving the policy objectives. This provide the basis for future research to analyse the households' perspective on the effectiveness of implemented policy instruments. It is crucial for policymakers to understand the behavioral aspect of the policy instruments in planning future comprehensive strategies.
Keywords: Solid Waste Management, Policy Instruments, Recycling Behavior, Theory of Planned Behavior, Perceived Policy Effectiveness

Background
The world is urbanizing at unprecedented rate particularly for cities in Asia (Moh & Abd. Manaf, 2017; The World Bank, 2012; Anghel, Mirea, Badiu, 2018). Economic progress, population growth, level of affluence have resulted to increase in consumption of goods and services that correspondingly causing increase in waste generation. Globally, the waste generation level is 1.3 billion tonnes per year and is estimated to increase to 2.2 billion tonnes

per year by 2025 (The World Bank, 2012). Asia's waste generation level is estimated to double to about 1.8 million tonnes per day by 2025 (The World Bank, 1999; Hashim, Mahat, Nayan, Saleh, & See, 2019). It is also estimated that the amount spent by the urban areas of Asia will double to at least US$50 billion per year in 2025 (The World Bank, 1999). The urban populace generate almost three times the amount of waste compared to those living in rural areas. Poorly managed waste will have serious implication to health, environment and the economy.

Solid Waste Scenario in Malaysia

Solid waste management is one of the major environmental issue in Malaysia as landfilling remain as the main disposal method of which the solid waste generation continues to increase annually (Johari, Alkali, Hashim, Ahmed, & Mat, 2014; Moh & Abd. Manaf, 2017). In Malaysia, solid waste is defined as any material including scrap material, unwanted substance or rejected products arising from human activity that are required by the authority to be disposed of, excluding scheduled or harzadous wastes, sewage and radioactive wastes (Government of Malaysia, 2007). Malaysia's solid waste generation comprises 64% of municipal solid waste (MSW) while the remaining is composed of industrial waste (25%), commercial waste (8%) and construction waste (3%) (Moh & Manaf, 2014).

Household sector is the main source of MSW (Moh & Manaf, 2017). MSW generation escalated from 21,455 tonnes per day (2000) to 33,000 tonnes per day (2012). Current statistics recorded around 38,000 tonnes of waste is generated per day (Siti Rohana, 2017). The average per capita urban resident generation of solid waste in Malaysia is estimated at about 0.80 kg/person/day in 2005 which increases to 1.17 kg per person per day in 2016 (Mentek, 2017). The estimated waste generation is higher in major cities reaching 1.7 kg per person per day (Jalil, Basri, Ahmad Basri, & AbuShammala, 2015). Table 1 shows the trend of waste generation by state and federal territories in Peninsular Malaysia. MSW waste composition is dominated by organic waste (44.5%) followed by plastic (13.2%), diapers (12.1%), paper (8.5%), garden waste (5.8%), glass (3.3%) and others (12.6%) (SWCorp Malaysia, 2012).

Table 1:
Generation of municipal solid waste by states and federal territories in Peninsular Malaysia (2010 – 2018)

STATES/FEDERAL TERRITORIES	2010	2012	2014	2017*	2018*
	(tonnes/day)			tonnes	
PERLIS	286	307	163	41,894	42,208
KEDAH	1,937	2,078	2,448	456,182	500,975
WP KUALA LUMPUR	3,698	3,968	2,525	773,684	760,174
WP PUTRAJAYA	NA	NA	159	48,633	53,272
NEGERI SEMBILAN	1,107	1,188	1,281	278,697	291,383
MELAKA	752	807	1,030	233,548	248,210
JOHOR	2,800	3,005	4,206	932,494	912,907
PAHANG	1,400	1,502	1,052	302,306	289,524
KELANTAN	1,512	1,623	1,933	NA	NA
TERENGGANU	1,291	1,385	1,306	NA	NA
PULAU PINANG	1,590	1,707	1,959	NA	NA
PERAK	2,233	2,396	2,950	NA	NA
SELANGOR	4,133	4,435	6,855	NA	NA

Source: National Solid Waste Management Department and *SWCorp Malaysia

Landfilling is the least preferred method of managing waste but remain as the main method employed for waste disposal (Johari et al., 2014; Shahul Hamid & Periathamby, 2012). Waste are disposed off at 157 operating disposal sites in the country but only 24 are sanitary landfills (SWCorp Malaysia, 2016). Non-sanitary landfills are controlled dump sites without appropriate system to contain the emissions (Shahul Hamid & Periathamby, 2012). More than 40% of these landfills are reaching its design capacity and are due for closure within less than 5 years (Yahaya & Larsen, 2008). The greenhouse gases emissions (GHG) from the waste sector recorded an upward trend from 223.1 million tonnes (Mt) of CO^2 eq of GHG in 2000 to 292.9 Mt CO_2eq in 2007(United Nations Malaysia, 2016). Malaysia is progressively phasing out unsanitary landfills and imposing strict measures to sanitary landfills. Other than landfilling, there are 4 small incinerators in Peninsular Malaysia with a total capacity of 180 tonnes of waste daily (SWCorp Malaysia, 2016). Acquiring land for new landfills are becoming difficult in the future.

The world trend on SWM has evolved from mere disposal towards sustainable waste management. The waste hierarchy concept of preventive, reuse, recycle, recovery and disposal has shifted to "close-the-loop" or "resource management" concept (Wilson, 2007). Recycling has been accepted globally as a sustainable option as it reduces disposal quantity and costs, turns wastes into resources, reduces the use of virgin materials, reduces health and environmental risks as well as extends the life span of landfills (Ma & Hipel, 2016; Wilson, Rodic, & Velis, 2013). Despite the development of technologies and adopted policies from developed countries, greater emphasis is put to promote waste separation behavior for recycling among individuals. Various researchers has repeatedly reported the poor participation of Malaysian household in performing recycling. The recycling rate recorded a mere amount of 5% in 2005, increasing to 15% in 2015. This is low compared to the neighboring countries like Singapore (61%; 2003) and Thailand (22%; 2009)(SWCorp Malaysia, 2012). The following paragraphs describes the timeline on the evolution of SWM in Malaysia to the current state.

Evolution towards the National Solid Waste Management Policy 2006

The development towards the realization of the National Solid Waste Management Policy 2006 has taken various phases. Reviews by scholars on SWM in Malaysia can be traced from late 1970s due to limited information and documentation (Hassan & Rahman, 2000; Moh & Abd. Manaf, 2017). SWM is a listed item under the concurrent list of the Federal Constitution of Malaysia where both state and the federal government have authority. In the earlier management of solid waste in Malaysia, Section 72 of the Local Government Act 1974 empowers the Local Authority (LA) to manage solid waste and public cleansing in areas under their jurisdiction. The Federal Government, through the Ministry of Housing and Local Government (MHLG), has been involved to provide financial resource for facilities, equipment, policies and awareness programs based on LA's applications (Jalil et al., 2015; Yahaya & Larsen, 2008).

The municipal solid waste management during the 1970s era was quite primitive. Household waste were collected to the LA assigned disposal sites (Periathamby, Hamid, & Khidzir, 2009). The disposal sites were small open-dumping sites which was located near to residential areas. However, these sites were then considered sufficient to manage relatively small amount of waste estimated as 0.5kg per person per day (Periathamby et al., 2009; Shahul Hamid & Periathamby, 2012). The selection of a dumping sites were merely based on convenience rather than environmental considerations and health.

Faced with issues of increasing trend in MSW generation over the years and the need to standardize SWM system for the country, MHLG embarked on Action Plan for a Beautiful and Clean Malaysia (ABC Plan) in 1988, a plan that was neither endorsed nor implemented, earmarking the initial effort to introduce recycling program in Malaysia (Moh & Manaf, 2014; Periathamby et al., 2009). Recycling campaigns were carried out from then on. The Eighth Malaysian Plan (8MP) charting the nation's development plan from 2001 to 2005 highlighted the adoption of a comprehensive waste management policy to address waste issues particularly on waste reduction, reuse and recycling (3Rs) (Government of Malaysia, 2000). The 9th Malaysian Plan (2006 - 2010) emphasizes the continuance of the 3Rs effort through extensive recycling awareness programs with collaboration with LA, private sectors and non-governmental organizations (NGOs). The National Strategic Plan for Solid Waste Management (NSP) adopted in 2005 outlined strategies towards sustainable waste management emphasizing on 3Rs, the use of appropriate technologies and public, private sectors and NGOs participation. Finally, the Master Plan on National Waste Minimization (MWM) 2006 was formulated aiming to strengthen institutional capacity and create a material cycle society to achieving a recycling target of 22 percent by 2020 (Government of Malaysia, 2006).

The Cabinet approved the National Solid Waste Management Policy 2006 (NSWMP 2006) on 13 September 2006 with the objective to enhance the national SWM that is comprehensive, integrated, cost effective, sustainable and acceptable by the community which reduces waste generation through 3Rs. The NSWMP 2006 consists of 6 objectives and 6 thrusts (Jabatan Pengurusan Sisa Pepejal Negara, 2016). In 2016, the NSWMP 2016 was announced to embrace the same principle as NSWMP 2006 with enhanced initiatives on method to increase 3R activities to include waste separation at source, pay-as-you-throw and deposit refund system. The NSWMP 2016 adds in 17 strategies and 50 action plans. The policy now includes the use of various policy instruments including information and awareness raising, regulation, institutional capacity, economic mechanism as well as infrastructure and services.

One of the key policy instruments enabling the implementation of other policy instruments is the regulation. The Solid Waste and Public Cleansing Management Act 2007 (Act 672) or SWMPC Act was passed by the Parliament in July 2007 and gazetted in August 2007. The Act 672 objectives are to regulate the management of solid waste to ensure standardized and high quality SWM services based on waste hierarchy concept(Johari et al., 2014; Moh & Abd. Manaf, 2017; Periathamby et al., 2009). The Act is effective throughout Peninsular Malaysia, Federal Territory of Putrajaya and Labuan and implemented in phased. Currently, the Act is implemented in the states of Kedah, Perlis, Pahang, Negeri Sembilan, Melaka, Johor, the Federal Territories of Kuala Lumpur and Putrajaya. The Department of National Solid Waste Management, initially a division under the MHLG, was entrusted to formulate policies, strategies, action plans and to prepare regulations and agreements. The Solid Waste and Public Cleansing Management Corporation Act 2007 (Act 673) was passed in 2007 establishing Solid Waste Management and Public Cleansing Corporation (SWCorp) as the operational arm to manage the operational and implementation issues. The main implication of the Act is the federalization of the SWM from LAs.

The Act 672 has provided a guiding principle for the SWM sector as a whole. The waste separation at source was launched on 15 September 2015 and enforced effective 1 June 2016. Since its implementation, the recycling rate has gradually increased from 15% in 2015 to 21% in 2016 (Mentek, 2017). However, with ever increasing waste generation volume and envisioning higher recycling target requires refinement and improvements of current policy instruments. Highlighting the importance for policy maker needs to understand the behavioral outcome of the policy tools.

The Behavioral Aspect of Policy Instruments

Public policies are interventions made by the government to alter the governance or social behavior in achieving policy goals. The government exercises policy instruments in their plans and programs in their attempt to affect social change, thus accomplishing the desired policy goals. The complexity of analyzing policy instrument choices has drawn various scholars to develop taxonomies of policy tools with the intention to identify the sets of variables influencing the choice. Based on literature, the classification of policy instruments are subjective and varies according to the scholars as summarized in Table 2. The selection of the policy instruments are based on each national government preference taking into consideration the state-society relations (Howlett, 1991). Therefore, the choice are "nation-bound" as different instruments are used at addressing the same problem (Howlett, 1991; Schneider & Ingram, 1990).

Table 2:
Taxonomies of Policy Instruments

Author	Policy Instrument Categories
Lowi (1972)	Distributive, redistributive, regulatory, constituent
Hood (1984)	Nodality, authority, treasure, organisation
Evert Vedung (1998)	Information, economic means, regulation
McDonnell and Elmore (1986)	Mandate, inducement, capacity-building, system-changing
Linder and Peters (1989)	continuum
Doern and Phidd (1983)	continuum
Schneider and Ingram (1990)	authority, incentives, capacity-building, symbolic & hortatory, learning

Sources: (Bemelmans-Videc, Rist, & Vedung, 2010; Elmore, 1987; Howlett, 1991; Linder & Peters, 1989; Schneider & Ingram, 1990)

The behavioral dimensions of policy tools provides a comparative analysis on the relationship between policy tools and the target policy participants. Schneider and Ingram (1990) in their analysis on policy tools and the underlying behavioral assumptions highlighted that while policy makers are very clear on the policy characteristics and its effect, the outcome is dependent to target policy participation. Therefore, analysis on the behavioral dimension of policy tools is vital at formulating better strategies and plans to comprehend the reaction of the target population to the policy initiative. The paragraphs below deliberate the policy tools based on McDonell and Elmore (1986) categorization.

Authority tools are amongst the oldest method adopted by government to achieve policy goals. Authority tools refers to legitimate government authority preventing or requiring certain actions to be performed under specified circumstances (Schneider & Ingram, 1990). Government uses the "stick" to prescribe the desired human behavior. In the context of NSWMP 2006, Part X of Act 672 requires household to separate their household waste at source accordingly while Part IV provide detail statements on enforcement provisions. The implementation of mandatory separation of waste at source requires the household to separate waste into 6 categories; residual waste, paper, plastic, other, garden waste and bulk waste. The residual waste comprising food waste and soiled waste will be collected twice a week while the recyclable waste will be collected once a week, referring this to the "2+1" collection system.

Inducement or "carrot" refers to the offering of payoffs or resources as the push factor to produce the desired behavior. Individuals are utility maximizers whom in the absence of additional resources will not respond positively to take the policy-relevant action. In the context of Malaysia, the recycling centers and buy back centers operated by private companies and non-governmental organizations (NGOs) provides the economic incentives for residents. The recycling centers and buy back centers are mostly positioned in highly populated middle-high income areas (Safitri Zen, Zainon Noor, & Yusuf, 2014). In the future, "take-back-system" and "deposit-refund-system" may be few feasible options as highlighted by Clause 102 in Act 672.

Capacity–building involves investment made on materials and human resources in meeting long term developmental objectives. The capacity-building tool may include information, knowledge transfer, communication, training, facilities, education, moral suasion and resources to enable individuals to achieve the intended policy results.

Information does not mandate the target group to behave in a certain manner but only reasoning and moral suasion. Information can also act as meta-policy instrument to spread the information about other policy instruments. The SWCorp Strategic Plan 2014–2020 has highlighted its core strategies, among others include 'Communicate, Educate, Engage, Empower, and Enforce' (C4E) in their attempt to increase public awareness through campaigns and publicity programs (Moh & Abd. Manaf, 2017; SWCorp Malaysia, 2012).

System-changing as the policy tools refers to the new arrangements in the transfer of authority of delivering the public goods and services (Elmore, 1987). The bottom-up approach involves deliberative processes to involve broad stakeholders. While the process aggregate the valuable opinion from the public, it also create transparency in the decision making process, in turn improves public satisfaction and support for the policy. In Malaysia, public hearings, meetings and consultations are the common methods for public participation(Suzie et al., 2015).

An effective policy measure increases the desirability for the target population to perform the target behavior (Steg & Vlek, 2009). Each policy instrument plays different role. Regulation would implicate compliance, economic incentives provides the "carrot", capacity-building and information increases awareness while system-changing refers to the collaborative bottom-up approach to gain public support to perform the desired behavior. When the implemented policy instruments are perceived as effective, the higher is the motivation of the target population to perform the behavior. Perceived policy effectiveness is an important aspect to be studied to assess the relationship of the implemented policies in explaining recycling behavioral.

Theory of Planned Behavior

Recycling is an activity that requires considerable effort from the individual has to distinguish the recyclable items, cleaning them before collection, store them in the right categories for collection or to drop-off collection centre (Boldero, 1995; Varotto & Spagnolli, 2017). Participating in waste separation program requires individual significant amount of time, storage area, money and effort. Consequently, the household decision to participate in a recycling activity is complex as it is influenced by a number of factors. Although recycling is part of pro-environmental behavior, due to its uniqueness, it has different antecedents from pro-environmental behaviors (Tonglet, Phillips, & Read, 2004). It is also the most studied environmentally responsible behavior (Boldero, 1995; Lizin, Dael, & Passel, 2017).

The Theory of Planned Behavior (TPB), as proposed by Ajzen (1991), provides a theoretical framework to systematically identify the socio-psychological determinants of recycling behavior (Ajzen, 1991; M. Chen & Tung, 2010; Tonglet et al., 2004). Based on the theory, the individual behavior is dependent of the person intention which in turn is being influenced by three other independent variables. Attitude reflects the positive or negative evaluation of performing the behavior, subjective norm reflect the perceived social pressure in engaging to the behavior and perceived behavior control refers to individual evaluation on the individual ability of performing the behavior (Graham-rowe, Jessop, & Sparks, 2015; Oztekin, Teksöz, Pamuk, Sahin, & Sultan, 2017). The individual intention to perform a particular behavior is not only influenced by the person attitude about the behavior but also affected by the social pressure and the perceived ease of performing it. The TPB assumes the existence of conscious reasoning in the formation of the intention to perform a behavior (M. Chen & Tung, 2010).

The intention to undertake various types of behavior has been empirically tested by scholars with considerable success, particularly on sustainable and pro-environment lifestyle. The theory has been applied by many scholars to explain different behaviors related to physical activities (Úbeda-colomer, Martin, Monforte, Perez-Samaniego, & Devís-Devís, 2019), environmental travel (Liu, Snow, & Che, 2019), energy saving (Fan, Xu, & Nie, 2019; Wang, Zhang, Yin, & Zhang, 2011), moral obligation(M. F. Chen, 2016; Zhang, Huang, Yin, & Gong, 2015), food wastage (Goh & Jie, 2019; Werf, Seabrook, & Gilliland, 2019) and low carbon society (Kaffashi & Nasir, 2019). The theory has also been successfully used to examine the factors influencing behavior in the field of waste management (Lizin et al., 2017; Tonglet et al., 2004; Wan, Qiping, & Choi, 2017; Wan, Shen, & Yu, 2014b).

Researchers has suggested that successful recycling programs requires a comprehensive understanding of the household attitude towards recycling and their perception on the barriers in undertaking recycling (M. Chen & Tung, 2010; Knussen, Yule, Mackenzie, & Wells, 2004). Among the early research on waste recycling includes (Boldero, 1995) on newspaper recycling and (Taylor & Todd, 1995) on integrated model on household waste recycling and composting behavior. While researchers has confirmed the predictive validity of the TPB (Valle, Reis, Menezes, & Rebelo, 2004; Tonglet et al., 2004), its adequacy to explain recycling behavior has been debated (Boldero, 1995; Tonglet et al., 2004). The TPB is a flexible model as it allows the inclusion of additional variables provided that the variables contribute to the explanation of the behavior (Ajzen, 1991; Tonglet et al., 2004; Wan et al., 2017). Among the additional variables incorporated were moral norm, past experience, situational factors and consequences of recycling (Tonglet et al., 2004); past behavior, perceived habit, and perceived lack of facilities (Knussen et al., 2004); environmental awareness (Ramayah, Lee, & Lim, 2012) and perceived policy effectiveness (Wan et al., 2014b).

Wan and Shen (2013) discussed the significance of incorporating perceived policy effectiveness (PPE) in understanding the factors that influences recycling behavior. The PPE is defined as "individual's favorable or unfavorable evaluation on a specific policy measure" (Wan et al., 2014b, p. 144). A policy measure functions as a stimulation means, thus a positive perception on policy effectiveness will provide a positive relationship to perform certain behavior (Wan, Shen, & Yu, 2014a). Scholars have incorporated PPE variable in the research to better understand the recycling behavior (Liao, Zhao, Zhang, & Chen, 2018; Wan et al., 2014b, 2014a; Xu, Ling, Lu, & Shen, 2017). The PPE has proven to have significant relationship to understand recycling behavior (Liao et al., 2018; Wan et al., 2014b; Xu et al., 2017). As each government policy instruments provides a different type of stimulus to individuals, study to investigate the relationships of each policy tools at influencing individual recycling behavior is an important area to be researched. Figure 1 provides the conceptual framework.
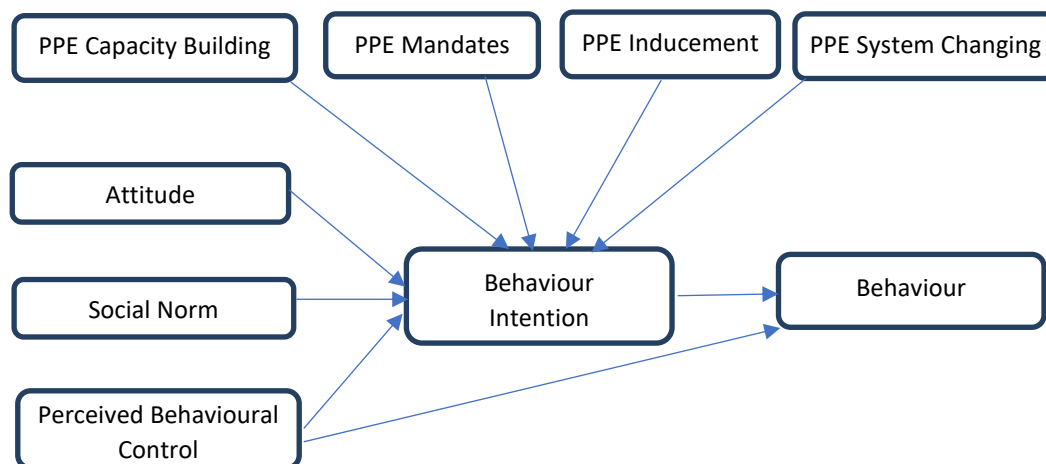
Figure 1: The Conceptual Framework

Conclusions

The main challenge facing Malaysia is to effectively and sustainably manage the continuous increasing of MSW. Globally, the SWM is progressively transforming from the primitive type of landfilling to managing waste based on the waste hierarchy. The most critical challenge in managing waste efficiently is inculcating the community to practice the cleanliness culture and actively perform waste separation at source. The target population behavior is a significant factor to be considered in order to achieve higher level of recycling rate. The success of SWM is beyond technological scope but is heavily dependent on public participation in performing the desired behavior. Government policy tools can act as a motivational factor to the desired behavior that understanding the behavioral aspect of the policy instruments will provide the policymaker indication to further enhance its strategies.

The TPB variables lays the foundation to explain recycling intention and behavior. This paper provides the conceptual framework to analyses the relationship of each policy tools to recycling intention. The additional variables, PPE Capacity Building, PPE Mandates, PPE Inducement and PPE System Changing, are expected to increase the predictive power of TPB. It is hypothesized that the positive perception on implemented policies will have positive relationship to recycling behavior. The results will be informational for the government to strategies their policy to encourage recycling. This will also enable the government to allocate their resources in accordance to the specific target group needs. Practical solutions are "nation-bound". The passage for a modernized solid waste management system should "identify simple, appropriate and affordable solutions that can be implemented progressively, giving the inhabitants the best system they can afford and laying the basis for future improvements" (Wilson & Scheinberg, 2010, p. 1056).

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