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Review on Awareness and Practices in Malaysia Land-Use Planning on Municipal Solid Waste Management

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ABSTRACT

In 2016, almost 95% of the collected waste were taken to about 156 treatment disposal facilities that are distributed throughout Peninsular Malaysia, yet municipal solid waste (MSW) open dumping is common wherever land is available. Previous studies show that the land-use activities influenced the waste generation. The issue of non-compliance such as illegal change of land-use zoning and conflicts in development plans are among others that affect environmental sustainability. Hence, this paper focuses on how land-use planners include MSW management (MSWM) in their development planning. As a case study, the research considers 30 government town planners and 30 registered town planning consultants with the Malaysian Institute of Planners. A close-ended questionnaire method was adopted in this research. To design the questions, three aspects were considered: technical, management, and behaviour and the questions were structured based on literature review, books, and personal experience of the people involved. This research further identifies the issue concerning the reasons for the lack of involvement of land-use planners to include MSWM. Results show that land-use planners are aware of the regulations, national plans, and policies regarding MSWM in Malaysia but lack actions in their planning due to several reasons, such as inadequate expertise and insufficient funding. The findings in this research are expected to provide useful guidelines for policy makers.

Keywords: Land use; municipal solid waste management; behaviour; town planner

INTRODUCTION

One of the worldwide issues concerned is municipal solid waste (MSW). 42 672 tons per day of municipal solid waste (MSW) are generated in Malaysia and the value is increasing each year. Besides the increase in population, land-use activity is another major waste generation factor due to economic activities (Tarmudi et al. 2009) and social activities (Haji Ali & Siong 2016). A study revealed that residential-based land use is a major generator of solid waste (Anilkumar & Chithra 2016). Table 1 shows the critical land use and its weightage from the MSW perspective. The research also found that the waste generation values are different amongst residential areas due to the differences of housing typology, lifestyle of the residents, and household areas. According to Samsudin et al. (2019) there are seven main indicators of land use planning to ensure the sustainability of waste management. There is waste collection, landfill, 3R, governance, education, stakeholders, and services. In addition, Foziah Johar (2004) in her paper on sustainability development management concluded that local planning attention to the environment was significantly less than traditional measures in land use planning. Activities in the solid waste hierarchy such as waste reduction, reuse, recycling, treatment, and disposal should be included in the land use plan. Inadequate waste management also can be impacted by poor urban planning. This issue was highlighted in the research by (Onu et al. 2014). Unplanned settlement can cause indiscriminate waste disposal. The main waste

management practice in a country is one of the factors that cause inefficient waste management (Leal Filho et al. 2016). The practice of open dumping provides very high environmental impact, but it can be lowered with the implementation of sanitary landfills. On the other hand, the practice of incineration provides medium impact to the environment. Material recycling is suggested to be the one of the best MSWM practices, as it has low impact. In addition, the presence of landfills always appears on land-use planning maps. However, the least desirable action in the waste management hierarchy, a process tool which represents an order from most to least preferred actions in managing solid waste, is the disposal of waste at landfills. Soler et al. (2017) did a research on the relationships between land-use management and MSW in the Province of Malaga. The results show negative relationships between waste production and financial assets. This scenario creates an unproductive land and the production of hazardous waste.

Before further discussion, it is important to know the differences of MSWM from the perspectives of waste managers and land planners. Waste managers' role is to deal with waste management programme from the generating point until the disposal point, which comprises population growth, treatment capacity, treatment prices, and more. On the other hand, land planners deal with strategic planning, and regional characteristics such as land-use zoning, routing, and future development. The parameters of their roles include land price, economic growth, settlement concentration, and more. They also have common parameters taken into account such as environmental impacts and population growth, which consider the implications toward residents, as well as flora and fauna, and provide adequate facilities for waste storage and collection (Dewi et al. 2012). In relation to the above issues, land-use planning is commonly related to zoning and leads to land-use regulations. Zoning determines suitable activities, amount of space, as well as types and shapes of building that can be accommodated on a given space. A land-use activity impacts the economic, social, and environmental aspects, which are the three pillars of sustainability. Some related journals on sustainability development rooted from land-use planning can be reviewed from research by (Piuchan et al. 2017; Lishchuk 2014; Michelsen 2008).

This paper focuses on three main objectives which are; (1) to study the level of knowledge and practice of Malaysian land-use planners towards including MSWM; (2) to identify the problems on non-involvement in MSWM initiatives; and (3) to prescribe some recommendations for better MSWM through land-use planning.

TABLE 1. Relative weightages of land uses from MSW perspective

Land Use	Relative Weightage
Residential Land use	0.349
Commercial Land use	0.216
Industrial Land use	0.145
Recreation and open space Land use	0.122
Transportation Land use	0.065
Public Land use	0.058
Agriculture Land use	0.045

Source: Anilkumar and Chithra (2016)

RESEARCH BACKGROUND

In order to improve waste management, there have been some research specifically on previous urban planning works towards including MSWM. Bamonti et al. (2011) has proposed a strategy to reserve space for waste collection in apartments and flats, to be acknowledged in the local urban plan, since door-to-door waste collection is one of the best methods for guaranteeing high standards of separate waste collection in Bologna municipalities. In terms of technical hygienic conditions, the proposed tool is considered as a desirable strategy for better urban planning, but economically inconvenient since it may cause competitiveness among 250 users. Ghiani et al. (2014) studied the impact of an efficient collection site location, including bin allocation, on the zoning phase in MSWM which also includes the zoning of service territory. They proposed homogeneous zones that can be served by a single collection vehicle so that the travel distance can be reduced by 25% on average. They also concluded that an efficient location is fundamental in order to achieve consistent monetary savings and reduce the environmental impact. Maring & Blauw (2018) studied the Asset Management of the Subsurface (AMS) to make subsurface space more functional for land management, including MSW, and to reduce the urban area pressure due to climate change. (Xue et al. 2015) proposed a spatial incineration allocation model to optimize the incineration capacities of waste generation points for overall cost minimization. The incineration should be 10 km (maximum) from the waste generation point and 8 km (maximum) from the landfill. The landfill is the final location for this model. While incineration tools have been used widely, there are concerns about the health impact of this waste management tools. Another study by Patil, Kulkarni & Patil (2014) shows that the site location, dimensions of the facility, operation and maintenance costs and investment issues also should be considered as well. A study by Hu (2016) shows that potential disease and illness caused by incineration process

such as lung cancer, laryngeal cancer, ischemic heart disease, urinary mutagens and pro-mutagens are still inconsistent. It is all depends on the individual's immunity level. On the other hand, El Ghorab & Shalaby (2016), proposed an opening of a new city to make an existing town or a city work more efficiently and sustainably. This suggestion was based on the opening of a new sustainable city in Suhag, Egypt, with a modern and highly technological infrastructure, which could reduce solid waste generation and increase social, economic, and environmental sustainability. Last but not least, an expert system prototype.

The green rating tools were also created in order to assist those policies, as well as to facilitate architects, planners, designers, builders, property owners, government bodies, developers and end users into understanding the impact of each design chosen, and to provide a solution towards becoming more environmentally friendly. Many indices were created to improve environmental efficiency. Parallel with The National Green Technology Policy by the Ministry of Energy, Green Technology and Water, the Malaysian Institute of Architecture (PAM) and the Association of Consulting Engineers Malaysia (ACEM) have set up the Green Building Index Sdn Bhd in 2009 to create the Green Building Index (GBI). In 2010, the GBI Township Tool has been created to deliver sustainable township by emphasizing six criteria, which are climate, energy, and water; environment and ecology; community planning and design; transportation and connectivity; buildings and resources; and business and innovation (GBI Organization n.d.). Zaman & Lehmann (2013) suggested that Zero Waste Index (ZWI) could bring a city or a township to another level of green living, as the ZWI covers almost all aspects such as management, technical, behaviour, and performance. Those aspects would achieve their highest performance if an area, a city, or a country fulfils all the ZWI indicators, which include awareness and education; new infrastructure and system thinking; sustainable consumption and behaviour; transformed industrial design; 100% recycling and recovery; and zero depletion legislation and policies. The Environmental Index has been used to evaluate Malaysia's environment based on the quality of air, water, and green areas. As a result, the environmental index has shown to be at an unsatisfactory level, where it declined by a 5.86 index, based on data from 1985 to 2002.

SUCCESSFUL PRACTICE KEY TO A SUCCESSFUL MANAGEMENT AND DEVELOPMENT

Much research has been done to investigate the commitments and barriers in achieving an organization's goals. Ikediashi et al. (2013) studied the level of commitment to sustainable facilities management in Nigeria and suggested that the government should create awareness on sustainability in general. Elmualim et al. (2010) in the same type of research concluded that lack of knowledge and the lack of senior management commitment are the main barriers for the implementation of reliable and comprehensive sustainable policy and practice. Jingkuang & Yousong (2011) studied about waste management performance in an architectural engineering project. They found that the main influential factor of waste management in construction site is the "commitment of contractor's representative on site, collecting packed material back by suppliers, and appointment of labourers solely for waste disposal". They also suggested that the government should promote sustainable environmental development of architectural industry. Another research regarding construction site was by Crawford et al. (2017). Brunet et al. (2018) in their study revealed that actionable knowledge is a key for land-use planning in order to make ecosystem services (ES) operational. They mentioned the techniques that can be practiced to achieve actionable knowledge which are: (1) Measures of ES in specific units; (2) Visualization of the results; (3) Story-telling to discuss future options; and (4) Gamification to enact a culture of cooperation.

They identified that the lack of education and the lack of financial incentives are some of the barriers to improving environmental performance of construction waste management in remote communities. Coker et al. (2016) did a research on the solid waste management practice by a private institution in Nigeria, and discovered that positioning the mobile bin at strategic corners of the university, using appropriate waste collection bags, and segregating all collected waste are some of the strategies for a successful solid waste management. Zaman (2014) through his feedback research for the key areas of his study on ZWI development found that behavioural change aspects, public participation, optimum recycling, cradle-to-cradle design, and market creation for waste were rated as the key areas for future waste strategies. Reliable waste data for assessment, rules and regulations, and public awareness were evaluated as moderately important.

EXISTING NATIONAL PLANS, REGULATIONS AND POLICY

There are numerous national plans, regulations, and policies for MSWM in Malaysia (Table 3), but the implementation effort by local authorities should be accounted for as well, because a successful planning and management is closely related with the reliability of human factor (Dragan & Isaic-maniu, 2014). It is important to measure the level of local authorities' commitment in

carrying out duties and responsibilities towards sustainability. The action should be parallel with the national plan guidelines; hence, waste management knowledge by the land planners should be firm as well. In Malaysia, all development plans, policies, and regulations related to town planning are based on the Town and Country Planning Act 1976 (Act 172). In fact, the Malaysia Federal Department of Town and Country Planning National is established under the act. Currently, MSWM is carried out by the Ministry of Housing and Local Government, with the support from the private sector. The federal government plays its roles in three different levels of administration, which are federal, state, and local. The functions of the town planning department can be divided into three phases as shown in Table 2. One of its roles is to advise local authorities regarding policies and control of land use and buildings. Note that waste management system in Malaysia is also controlled or audited by ISO 14001, as it is a part of authority's requirement. ISO 14001 is a planning and management tool to protect the environment. The ISO 14000 toolkit provides a training presentation, checklists and a comprehensive implementation guide that determine the performances of the waste management process as the results.

In 2005, the National Strategic Plan for Solid Waste Management planned a strategy to secure land for the development of sanitary landfills and transfer stations. Moreover, it also made master plans to determine the facilities proposed, i.e., specific sites, technologies, and operational plans. World Wide Fund for Nature (WWF) policy supported the National Strategic Plan Tools in preventing conflict surrounding the land-use planning development. National Physical Plans suggested the same strategies; with an additional plan: to close old landfills properly. National Urbanization Policy 2 has made a policy on providing a systematic and safe infrastructure for the disposal and treatment of solid waste and toxic waste. It is expected that no one is left to receive the facilities in Malaysia by 2030. Besides the strategic plan, there were also specific land-use planning guidelines concerning MSWM. Some of them are Guidelines for Siting and Zoning of Industry and Residential Areas developed by the Ministry of Water, Land and Natural Resources; and specific guidelines for former solid waste disposal sites developed by the Ministry of Housing and Local Government. All development plans and policies have been summarized in Table 3.

There are only a few penalties and regulations concerning waste management while developing a building in a land. The closest regulations and penalty that are related to considering waste management while developing a project planning is by the Ministry of Natural Resources and Environment that considering environmental factors during the early stages of project planning for investors. One of the penalties is the maximum penalty of RM50 000 or imprisonment for a period not exceeding two years or both if the investor or the owner of a place or building failed to submit the waste handled plans. Meanwhile in Town and County planning Act, there is only one regulation about municipal waste management that is to forbid any building development in a site or land that is already used for waste management purpose. Most of the penalties are separable between developing a place and waste management sector such as public penalties that related to waste management and public cleansing as stated in Act 672 (Town And Country Planning Laws Of Malaysia 1976, 2006), the primary and secondary Key Performance Indicator (KPI) by The Solid Waste Management and Public Cleansing Corporation (SWCorp Malaysia) in determining the penalty points and penalties that will be imposed on the company who failed to follow their rules and regulations (Perbadanan Pengurusan Sisa Pepejal dan Pembersihan Awam 2012) and guidelines and regulations for constructions waste management by CIDB Malaysia (CIDB Malaysia, 2008).

TABLE 2. The three functions of the town planning department

Development Planning	Plan Coordination	Management
• Structure Planning • Local Plans • Development plans • Structural design • Rural area growth centre • State master plan	• Land conversion • Zoning • Site planning • Site investigation • Service and policies advisor	• Financial • General affairs • Services • Trainings • Productivity

TABLE 3. Malaysia MSW development plans and policies related to town planning

Year	Responsible Body	Statutory Development Plan/ Policy/ Regulations/	Contents Related
2005	Ministry of Housing and Local Government	National Strategic Plan for Solid Waste Management	● Securing land for the development of sanitary landfills and transfer station

Countinue ...

Countinued ...

2010	Ministry of Housing and Local Government	National Physical Plan	● Securing land for transfer station and sanitary landfill ● Closing old landfill properly
2012	Ministry of Water, Land and Natural Resources	Guidelines for Siting and Zoning of Industry and Residential Areas	● Siting and zoning for waste collection, treatment, and disposal activities; materials recovery
2016	Ministry of Housing and Local Government	National Urbanization Policy 2	● Providing a systematic and safe infrastructure zone for the disposal and treatment of solid waste and toxic waste.
2017	Ministry of Housing and Local Government	Conservation and Development of Environmental Sensitive Areas (KSAS)	● Specific Guidelines for Former Solid Waste Disposal Site

APPLICATION OF STRUCTURED QUESTIONNAIRE AS RESEARCH INSTRUMENT

Structured questionnaire or close-ended questions is a document containing questions and other types of items designed to collect and assemble appropriate information for analysis. Respondents' answers are limited to a fixed set of responses. The first part of the questionnaire usually includes sections to discover the respondents' background such as age, gender, and education. The first part is then followed by questions relevant to the research. The structured questionnaire survey can be submitted personally using current technologies such as google documents or e-mail. Payne, Geoff & Payne (2004) suggest that electronic questionnaire may be a useful way of contacting dispersed groups of people, or those who might not wish to be questioned face-to-face, although the interview method is also included as a structured questionnaire survey. Existing knowledge and participant of certain typology are also important to suggest a specific method based on the level of knowledge. Survey method is one of the best strategies in order to investigate the level of knowledge, behaviour, practice, or participation. However, like any other methods, this method does have advantages and disadvantages. The tendency of the respondent to answer questions based on what the interviewer wants (reflexivity) is one of the limitations in this method (Yin 2006). Moreover, the respondent might react inadequately due to poorly constructed questions, as well as non-responding answers. On the other hand, this method can gather a variety of information within a short time. In addition, the respondent can be in a large number of people (Robson 2002). Table 4 proposes a summary of the principal characteristics of several questionnaire surveys present in research. The target respondent and the sample number are important characteristics needed by this method because they affect the results for the research.

Typically, this method aims to investigate and explore human perceptions, knowledge, opinion, and behaviour of the related research. For example, a relationship of attitude and behaviour studied by Kallgren & Wood (1986) showed results that behaviour and attitude is only consistent with at least a little demonstration. Samiha (2013) analysed the importance of 3R principles in MSWM to achieve sustainable development and stated that although citizens are educated on 3R, they lack participation. Studies done by De Feo & De Gisi (2010) analysed peoples' knowledge on the environment and public opinion on waste management. Surprisingly, the percentage of people pointing their fingers at politicians on inadequate waste management increases with the average age of the respondents. Desa et al. (2011) surveyed the relationship between knowledge and attitude among first degree students in a Malaysian university. Based on the results, environmental awareness needs to be pursued regularly since no actions have been taken towards recycling despite the students' possessing the relevant knowledge. Also in Malaysia, a social study conducted by Karim Ghani et al. (2013) revealed that people have a positive intention in participating in source separation of food waste in the household if the facilities for source separation are provided.

METHOD

To design the questions, three aspects were considered: technical, management, and behaviour. Those aspects were based on a research by Ibrahim & Jaafar (2016), which stated that the combination of Theory of Planned Behaviour (TPB) and the Technology–Organization–Environment model (TOE) is theoretically suitable for environment and innovation studies. This study coincides with research by Brzozowska et al. (2015) which addressed that the technical systems play a very important element in environmental management. Other research on the aspects can be reviewed in journals by (Jabbour et al. 2015; Magdalena 2014; Knobloch & Mercure 2016).

The first step of the research was to identify the list of

TABLE 4. Summary of the principal characteristics of several questionnaire surveys present in research

Reference	Research	Place	Respondent	Sample	Survey's Type
Tonglet et al. (2004)	determinants of recycling behaviour	Brixworth, UK	Household	191	Postal
Jones et al. (2010)	perceptions and willingness to pay for a market-based policy aiming on solid waste management	Mytilene, Greece	Public	140	Telephone Interview and Postal
De Feo and De Gisi (2010b)	Public opinion and awareness towards MSW and separate collection programmes	Nocera Inferiore, Italy	Public	903	Interview
Desa et al. (2011)	relationship between knowledge and attitude among first degree students in a Malaysian university	Nocera Inferiore, Italy	First year Students	589	E-mail
Refsgaard and Magnussen (2009	Household behaviour and attitudes with respect to recycling food waste	Norway	Household	21	Group Session and Postal
Onu et al. (2014)	impact of inadequate urban planning on municipal solid waste management	Niger Delta, Nigeria	Village, slums	810	Observations and Questionnaires
Karim Ghani et al., (2013)	influencing factors of participation in source separation of food waste	UPM, Malaysia	University Staff	204	Postal
Mei et al. (2016)	need of indicating the social-psychological factors among Malaysians in qualifying the level of public environmental awareness and behaviour.	13 states, Malaysia	Malaysians	400	Postal
Rahardyan et al. (2004)	Resident's concerns and attitudes towards Solid Waste Management facilities	Sapporo, Japan	Household	51	Postal

town planners in Malaysia. There are two main town planning bodies in Malaysia: Board of Town Planners Malaysia (LPBM) and Malaysian Institute of Planners (MIP) that control all registered government and private town planners, respectively. Both bodies work under related acts such as the Town Planning Act 1995 (Act 538), Town and Country Planning Act 1976 (Act 172), Amendment 2007, and National Land Code 1965 (Act 56). They also have two main roles of forwarding future town development planning and developing control in the present planning in terms of land use and buildings. The only difference between the sectors is their placement. The public sector town planners are placed for government departments, ministry, local authorities, and universities, while private town planners are placed for developers, contractors, Property Companies, and financial institutions. The list contains 143 registered town planning consultants with MIP. In this research, the questionnaires were distributed to 100 LPBM and MIP town planners in total, but only 30 government town planners and 30 private town planners responded.

The second step was to design structured questions based on literature review, books, and personal experience of the people involved. The questionnaire is divided into four parts:

1. Personal attributes

The first part of the questionnaire is about personal attributes. Since there are two main bodies of town planners, it is essential to know in which sector do the respondents work. The respondents are also asked about the number of years that they have been working in order to obtain the range of Malaysian town planners' experience in this research.

2. Knowledge and Awareness

The questions aim to verify the town planners' environmental knowledge, especially related to land use and town planning. Q_1 to Q_3 need correct answers while Q_4 and Q_5 are generic opinion questions to identify the level of responsibilities amongst town planners.

3. Practice

The questions aim to verify the town planners' practice in relation to the adopted programme, regulations, or any consideration on waste management during town planning.

4.Challenges

Q_{13} aims to identify the challenges of waste management in town planning.

The third step was to distribute the questionnaires using google documents (Supplementary Information 1) and the final step was to analyse the responses from the town planners. Table 5 shows the overall questions and answers. The highlighted responses in Table 5 indicate positive answers towards MSW knowledge and practice level. If the percentage of positive answers is higher than that of negative answers, the result is considered positive and will indicate the highest level of awareness or MSW practice, and vice versa.

RESULTS AND DISCUSSIONS

In Table 6, it can be seen that the government sector has the most experienced town planners, with 37% out of 30 people compared to the private sector. Most of the employees from the private sector switched to the public sector after gaining some experience, for they needed a secure job before retirement (DeSantis & Durst 1996). Town planners with experience less than one year make up only 10% for both sectors since most town planning departments require at least one or two years of experience before workers are hired. The first question (Q1) was aimed to identify the respondents' knowledge on Malaysian departments and MSW stakeholder's functions and responsibilities. Both sectors need to be more aware of stakeholder's functions; the result shows that incorrect responses represent the highest percentage. According to Joseph (2006), stakeholder is a key factor for sustainable waste management. Each role is important for every aspect of waste management, so it is important to refer to the right one. Positive answers were given by respondents for the rest of the questions on the knowledge and awareness

TABLE 5. Research questions and answers

Aspects	No	Questions	Answers
Personal Attributes		Bodies Working	Government, Private
		Experience	Less than 1 year; 2-5 years; 6-9 years; 10 years and above
Knowledge and Awareness	Q1	In Malaysia, which stakeholder is responsible in finding a location for building a landfill site when the current landfill site has reached its limit in the planning stage?	A1 Department of National Solid Waste; A2 Department of Environment; A3 Town and Country Planning Department; A4 State Economic Planning Unit.
	Q2	Which type of land use is a major generator of solid waste?	A1 Residential land use; A2 Commercial land use; A3 Industrial land use; A4 Agriculture land use.
	Q3	Which of the following MSW practice needs to involve town planners?	A1 Waste collection; A2 Landfilling; A3 Waste management routing; A4 All of the above.
	Q4	Are you aware of the legislations and regulations regarding waste management made for town planners?	Yes; No`
	Q5	Do you agree that poor urban planning is one of the factors of inadequate waste management?	Yes; No; I don't know
Practice	Q6	Which of the following do you include as relevant factors for landfill suitability during the evaluation of Environmental Impact Assessment?	A1 Waste*; A2 Waste and environment; A3 Waste* and society; A4 Waste*, environment, and society.

Countinue ...

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	Q7	Which of the following do you include in your town planning? (Answer can be more than 1)	A1 Landfills; A2 Transfer station; A3 Waste collection route; A4 Recycle Centre
	Q8	Can you identify the overall requirement for waste management capacity in a city and indicate how this requirement will be met in a town development?	Yes; No
	Q9	Do you refer to any regulations or policy tools regarding waste management such as Town Planning Act 1995 (Act 538), Town and Country Planning Act 1976 (Act 172) and National Strategic Plan Tools in any planning development?	Yes; No
	Q10	Personally, do you consider residents' health when planning a town?	Yes, No
	Q11	Are you willing to stand up for any wrongdoings concerning MSWM plan in town planning?	Yes, No
	Q12	Does your department provide programmes to educate and raise town planners' awareness on waste management?	Yes; No; I do not know
Challenge	Q13	What are the obstacles in making waste management development as important as other development?	Clients need, inadequate funding, complicated procedure, Lack of experts, Beyond responsibilities (answers can be more than one)

*waste quality, waste generation pattern, waste quantity

aspects (Q2 to Q5). They are aware about the major waste producers, as well as the legislations and regulations regarding waste management made for town planners. Even though only 23% of town planners from the government sector and 33% from the private sector answered 'NO' for Q4, respective employers still need to provide attention to legislations and regulations, as they are important issues for development. Zaman & Lehmann (2011), in their research, have put waste regulations as one of the indicators for waste management towards 'zero waste city' and concluded that regulations and policies influence and drive waste management systems.

TABLE 6. Personal attributes' results

Experience Years	Government Sector (%)	Private Sector (%)
<1	10	10
2-5	33	23
6-9	20	40
>10	37	27

Respondents also acknowledged their responsibilities towards waste management, as seen in Q3. As a matter of fact, in 1984, Hills in his paper stated that all three practices given in Q3 answer's selection are very important for urban planning. One thing for sure is that 100% from the government sector and 93% from the private sector agreed that excellent urban planning produces the best quality of waste management. Unfortunately, the town planners' actual practice does not portray their responses. Although they are aware of waste management and have knowledge on it, their actions are not parallel with those aspects. For example, they have been asked about the factors for landfill suitability during the evaluation of environmental impact assessment. For the government sector, 50% out of 30 town planners only included waste and society factors while 40% from the private sector only included waste and environment. However, the result is unsurprising since political issues always take place when it comes to the environment and society. Based on Mcallister (2015), political barrier is one of the major factors in solid-waste management in the developing world. However, the impact of inadequate SWM practices on natural and human environment is now being acknowledged and it is just a

TABLE 7. Knowledge and awareness, and practice questionnaires results.

Aspects	No	Sector	A_1	A_2	A_3	A_4	Yes	No	I do not know	Positive (+)/ Negative (-)	Average
			(%)								
Knowledge and Awareness	Q_1	G	37	20	43	0	•	•	•	-	+
		P	23	30	47	0	•	•	•	-	
	Q_2	G	53	13	27	7	•	•	•	+	
		P	57	13	27	3	•	•	•	+	
	Q_3	G	0	0	0	100	•	•	•	+	
		P	0	0	0	100	•	•	•	+	
	Q_4	G	•	•	•	•	77	23		+	
		P	•	•	•	•	67	33		+	
	Q_5	G	•	•	•	•	93	4	2	+	
		P	•	•	•	•	100	0	0	+	
Practice	Q_6	G	3	13	50	34	•	•	•	-	-
		P	0	40	27	33	•	•	•	-	
	Q_7	G	31	37	26	6	•	•	•	-	
		P	24	36	14	26	•	•	•	-	
	Q_8	G	•	•	•	•	10	90	•	-	
		P	•	•	•	•	33	67	•	-	
	Q_9	G	•	•	•	•	53	47	•	+	
		P	•	•	•	•	60	40	•	+	
	Q_{10}	G	•	•	•	•	40	60	•	-	
		P	•	•	•	•	47	53	•	-	
	Q_{11}	G	•	•	•	•	53	47	•	+	
		P	•	•	•	•	87	13	•	+	
	Q_{12}	G	•	•	•	•	7	60	33	-	
		P	•	•	•	•	33	47	3	-	

matter of time for the new generation to act. Q9 showed the only results from the practice aspect parallel to the respondents' awareness level. However, the value of the result is still not promising, with only 6% difference between 'YES' and 'NO' from the government sector. Q11 was actually a personal question that shows individual integrity. Willingness to stand up for any wrongdoings will make a different for a company, no matter if it is in the government sector or the private sector. Chen (2018) reviewed the influencing factors of employees' willingness

FIGURE 1. Challenges in the inclusion of waste management in town planning (Number: No of town planners).

to blow whistle. Some of the factors are personality, positive emotions, age, tenure, and education. For this research, town planners from the private sector have more tendency for "whistle-blowing' since they are not afraid of losing their job. Q12 is about employers' awareness to educate and raise town planners' awareness of waste management. 33% from the private sector and only 7% from the government sector agreed that their respective employers provide such programmes.

Figure 1 shows the results of challenges of including waste management in town planning. The numbers indicate the number of positive from both sectors of town planners. Lack of experts has the highest votes for both sectors, 54 out of 60 votes, followed by inadequate funding, with 49 votes. These two factors are related since waste management needs three important lenses, which are land-use planning, economic development, and environmental planning (Ai 2011). Malaysia's geographic characteristics and demographic data are reasons that such funding is really important toward waste management development. 19 out of 60 town planners considered that the inclusion of waste management in town planning is beyond the scope of their responsibilities. 21 government and 20 private town planners agreed that complicated procedure is one of the challenges in the inclusion of waste management in town planning. Policy tools, indices, and guidelines for waste management in town planning are not focused as much as waste management programmes for residential areas such as waste recycling at home.

Three issues can be highlighted from this research. Firstly, there are gaps in existing policy tools and regulations that can delay the actual implementation. Town planners are not able to see the whole picture or concept and future projection of waste management development. Secondly, town planners have medium level knowledge on the importance of waste management for town planning, and high awareness level which is only sufficient for a developing country. However, they do not practice their knowledge during actual town planning due to several issues. Thirdly, waste management targets cannot be met as there are insufficient manpower, technical expertise, and financial resources. A delay in funding signifies a delay in implementation. Moreover, funding is needed to train the town planners to be experts in at least one subject of waste management system or for waste managers to understand more about town planning. Several recommendations can be made:

1. Waste management development index is to be made available for town planners to gather data information of management practice. The use of the index in managing the environment is vital as in any development planning; specific benchmark, indicators, impact, and quality should be considered. Moreover, the index principle itself is easy to use and well organized; it is useful and handy to the user. According to Dizdaroglu (2017), sustainability assessment is needed in order to regulate natural processes and control the scale of human activities. In fact, it needs to be integrated into urban planning. For example, research shows that 3R (reduce, re-use and recycle) 3R activities need to be focused in land use planning by providing space area for these activities regardless whether the zone is small or large. It was based on the index results of identifying the most important MSW management indicator that should be focused by the land use planner (Samsudin et al. 2018). Hence, the data handover of waste managers may become easier. National Solid Waste Management department and National Town Planning Department are suggested to develop this index with the helps of government policy maker.

2. Adding expertise in MSWM areas among urban planners is one of the best strategies for Malaysia's MSWM development. According to Mukhtar et al. (2016), the emergence of waste management in urban town planning needs reliable and accurate data to avoid inaccuracies in

planning for future waste management. Adding more MSW experts among urban planners can be useful for the development. The human resources in Town Planning Department should be more particular and responsible in determining their town planners.

3. By increasing the competition between urban planning consultants, commitment to environmental stability can be increased.

4. To avoid illegal change of land-use zoning and conflicts in development plans, strict enforcement is needed in adhering to current laws.

CONCLUSION

The Malaysian government has launched and promoted a series of municipal waste management awareness, policies, and programmes. Despite policies and programmes initiated by government agencies, it is still insufficient and few are fully applied by waste management practitioners including stakeholders. One such case is the land-use planning for MSWM. The results from this research show that government and private town planners have medium level knowledge and awareness in average towards MSWM in town planning. Moreover, town planners show only little commitment to include MSWM during town planning due to several reasons, such as lack of experts and inadequate funding. The results also imply that city councils need to focus on the commitment in land-use planning by providing the developer, MSW service manager, and town planners with a formal or certified education and training for related matters suitable with their responsibilities.

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DECLARATION OF COMPETING INTEREST

None.

SUPPLIMENTARY INFORMATION 1

https://docs.google.com/forms/d/e/1FAIpQLSelX90YNOuayOtccU-0BHmZIhYO5keXuP8TXynKX6lXXbQYOA/viewform?c=0andw=1

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