

Survey of Household Solid Waste Management and Waste Minimization in Malaysia: Awareness, Issues and Practices

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Abstract— *Effective solid waste management (SWM) is very crucial in every nation as it determines the sustainability of the environment and ensures the health of the society. This study examines households' awareness on household solid waste management and their opinion on the services provided by a solid waste management concessionaire in one of the regions in Malaysia. A survey on 398 respondents among households finds that the awareness on the privatization of SWM is acceptable and a majority of them are ignorant about the frequency of waste collection. However, the respondents' knowledge on waste and their understanding on the health consequences of waste are relatively good. The main problem expressed by respondents with respect to waste disposal is that collection schedules are not adhered to by the collectors. Disorderly disposal of rubbish is also perceived to be a problem, and a majority of the respondents believe that lack of awareness, knowledge and enforcement are the major causes of the problem. As far as waste minimization is concerned, respondents feel that the facilities and services provided are not adequate. Other than using the waste collection service, the households rarely practice other means of waste minimization such as to reuse, recycle, and compost. The role of regulators and concessionaires in educating the community so that the latter can play their role effectively is very crucial.*

Keywords— *solid waste management, waste minimization, awareness.*

I. INTRODUCTION

Malaysia is among the successful developing economy in terms of political stability and economic growth. However, the increase in urban population and rapid economic growth lead to the increase in solid waste generation (Tarmiji, Usman & Hassan, 2011). Similarly, the characteristics of solid waste have changed in the country due to the rapid industrialization and urbanization (Manaf, Samah & Zukki, 2009). It has also been noted globally that developing Asia are among the largest solid waste generators (UNCRD, 2011). Hence, there is a need for an effective practice of solid waste management to control the current waste generation in the region. This is because in any economy, the solid waste management is an important aspect of citizens' lifestyle and country's economic status (Baud, 2001). According to the United Nations Development Programme in 2008, waste management is a crucial aspect of sustaining the national development.

Not until 2007, when Solid Waste and Public Cleansing Management Corporation Act 2007 (SWMPC Act 2007) came into place, solid waste management was the responsibility of local authorities in Malaysia. The Act, enforced in 2011, vests executive power to the Federal Government to implement solid waste management and public cleansing. It was enacted to ensure the uniformity of law relating to the management of solid waste and public cleansing throughout Peninsular Malaysia and the Federal Territories of Kuala Lumpur, Putrajaya and Labuan. On 20th September 2011, the Federal Government and several state governments sealed the 22-year concession agreement for solid waste management with three companies across Malaysia. All solid waste collection and urban cleansing services would now be under the purview of three concessionaires overseeing three zones, Federal Territory of Kuala Lumpur and Putrajaya and Pahang; Kedah and Perlis; and Johor, Malacca and Negeri Sembilan.

The privatization of solid waste management in Malaysia is aimed to solve the challenges faced by local authorities in managing solid waste, namely finance and cost management, lack of expertise and advanced technology, illegal dumping and lack of management skills on disposal and landfill system. The concessionaires are expected to improve and ensure high-quality services in solid waste management, and provide recommendation and implementation policies and strategies pertaining to solid waste management services, as well as promoting participation and awareness among the public.

In order to achieve the abovementioned goal, there is a need for enhancement in solid waste management practices (Zeeda & Keng, 2014). For example, several waste recycling campaigns have been launched by the Malaysian government to involve the participation of different community groups and non-governmental organizations. However, the campaigns received very low responses from the public. Therefore, public awareness and enlightenment are the key factors of reducing the solid waste (Zainu & Songip, 2017). There have also been complaints from the general public about the services provided by the

concessionaires. One of the complaints is that the household waste has not been collected as scheduled and was not properly managed (*Kedah Hari Ini*, May 3rd, 2012). The uncollected household wastes, resulted in a disgusting phenomenon and nauseating smell, further welcomes the unwanted flies and garbage worms. This phenomenon can always be spotted during long public holidays, school holidays or during festive seasons. The potential causes for such phenomena are limited number of garbage trucks, limited number of contractors, improper collection schedules and solid waste disposal dump that are situated too far.

One of the concessionaires is FreshAir Sdn Bhd (not the real name), being the case organization of this study. This study focuses on household awareness and their perception on household solid waste management practices in Malaysia, particularly in FreshAir. The first objective of this study is to examine household awareness of the privatization of solid waste management, waste issues and concerns, and waste management. Next, we examine household satisfaction on waste collection and customer service, and finally we examine household perception and practice on waste minimization

II. LITERATURE REVIEW

Solid waste management is a way of controlling, collecting, storing, generating, transferring and transporting, processing and disposing solid waste (Tchobanoglous, 1993). Previous studies have identified the organizations or stakeholders that may have concern in effective and efficient system of solid waste management. These include authorities of national and local government (Shekdar, 2009); non-governmental organizations, municipal authorities, households (Sujauddin, Huda, & Hoque, 2008); Ministry of Health, private contractors (Geng, Zhu, Doberstein, & Fujita, 2009) and recycling companies (Tai, et al., 2011). Despite the involvement of these stakeholders in the waste management practice, there are factors that influence the effectiveness of solid waste management. For instance, Sujauddin et al. (2008) argued that waste generation is influenced by the size of the family, their income and their level of education. Similarly, the location of household, land size, peer influence, gender and separation behavior are also the factors affecting the effective management of solid waste (Ekere, Mugisha, & Drake, 2009). In a related study, Abdullah (2013) highlighted some of the challenges associated with the management of solid waste by local authorities in Malaysia; they include squatter villages, uncollected area, lack of finance and human resources as well as immigrants.

Moreover, Otitoju and Seng (2014) surveyed the militating factors of waste segregation among the household in Malaysia. The result revealed that methods of collecting the waste and easy access to waste facilities are the key factors which prevent the segregation of waste among households. Similar findings were reported by Tadesse, Ruijs & Hagos (2008) in the context of Africa. They found that the household decision on waste disposal is significantly influenced by facilities. Inadequate supply and long distance of waste containers increase likelihood of dumping the waste in the roadside and other open area. Alike, Saxena, Srivastava & Samaddar (2010) found in their study that the approach of solid waste management is highly unprofessional and unscientific because of the improper collection, treatment and disposal of solid waste. Most of the waste dropped in an open area lead to air, water and land pollution.

On the other hand, Budhiarta, Siwar, & Basri (2012) in their survey of the current status of Malaysian solid waste generation found that government involvement in waste campaign programs has not yielded a fruitful result to the communities because the daily volume of waste generated has not declined. Thus, in order to ensure a healthy and clean nation, Behzad et al. (2011) argued that solid waste management practice needs to be improved to achieve environmental quality and socio-economic development of the nation. Similarly, Jereme et al. (2015) observed that an effective service of solid waste management is an essential device for ensuring environmental protection, both urban and rural communities' health, employment and revenue generation.

A study carried out by the Solid Waste And Public Cleansing Management Corporation (SWCorp) in 2009 found that the public perceived waste issues and concern as not that serious and a majority of the respondents believed the cause of the issues is due to lack of enforcement. Although 80% were satisfied with the collection service, 90% agreed that the federal or local government should enforce strict laws on waste management. A majority of the respondents agreed that there is a need for involvement of private sector and NGOs in waste management.

In a related study, Saat (2013) argued that for a sustainable solid waste management, there is a need for transformation in the environmental governance, specifically in solid waste management. This is because transformation is one of the main aspects that would ensure the sustainability of solid waste management in Malaysia. At the same time, Osmi et al. (2013) investigated how to enhance solid waste management in Malaysia. The study identified several action plans which include

Pay as You Throw, Refused Derived Fuel, Incinerator and Dual System as the best strategies for immediate and long-term improvement of solid waste management.

In the context of Africa, Peprah, Amoah & Achana (2015) assessed the effects of 3Rs model on solid waste management. Their investigation revealed that the model is effective and efficient for the management of solid waste. This is due to the fact that the model is in accordance with the tenets of achieving environmental sustainability. Nonetheless, Samah et al. (2013) in their study of trend and management of household solid waste in Malaysia discovered that the trend of solid waste management in Malaysia is like in other parts of the world, i.e. it depends mostly on changes in the pattern of consumption, seasonal variation and climate. Consequently, the management of solid waste must be improved to ensure the suitability of the technology used with the current development of solid waste.

Furthermore, Teyet al. (2013) focused on the current practice of waste management system in Malaysia. They noted that there is a lack of proper system of waste management among the construction practitioners because the predominant disposal technique used for dumping construction waste is landfill and the concept of 3Rs is adopted by only a few construction practitioners. Likewise, Visvanathan (2006), in their study of management of solid waste in Asia, argued that appropriate management of solid waste is a crucial aspect of reducing the environmental pollution. Hence, awareness on the impacts and problems of generating solid waste must be promoted among the public through enlightenment campaigns and education. In a related study, Lau (2004) found the policy on management of solid waste in Malaysia is inefficient due to improper guidance. In addition, most of the households in the country lack sufficient knowledge about waste management practices.

III. RESEARCH METHODS

This study conducted a questionnaire survey to seek households' awareness and satisfaction of the services provided by the case organization, FreshAir. In developing the questionnaire, we refer to the literature and a questionnaire developed by A-N-D Consultants. A pilot test was conducted before the questionnaires were distributed to the intended target respondents. Thirty individuals comprising of academic and administrative staff of a higher education institution in Malaysia became the respondents of the pilot test.

The questionnaire consists of three sections. The first section seeks the background information of the respondents, namely gender, race, tenancy, employment and education. The second section seeks respondents' level of awareness on solid waste management, perceptions on key waste issues, and concerns, as well as solutions to the issues and concerns. The last section deals with the household's satisfaction with customer services and garbage collection, as well as their perceptions on solutions to waste management and waste minimization.

The sampling frame of this study covers households residing in three big districts of one of the states in the region under study. The districts were identified as FSA1, FSA2, and FSA3. Within each of the districts, one housing area served by FreshAir was selected. A total of 400 households were finally sampled; 200 sets of questionnaires were distributed in FSA1, and 100 in each FSA2 and FSA3. The distribution was uneven because of the higher population density in FSA1. In order to ensure a high response, the questionnaires were distributed by hand, by eight enumerators. In most cases, a face-to-face approach was taken. This is important because some of the respondents need the assistance and clarification from the enumerators in answering the questions. In other cases, respondents were given a few days to answer the questionnaires, and the enumerators would later come back to collect the questionnaires. Out of 400 sets of questionnaires distributed, 398 were returned. This shows that almost all the sampled respondents (99.5%) responded.

IV. RESULTS AND FINDINGS

4.1 Respondent's Profile

Table 1 shows the distribution of respondents according to district, gender, race, highest education level, employment status, and tenancy. It is observed that 50.2% of the respondents are residents of district FSA 1, while 24.9% belong to each FSA 2 and FSA 3 districts. Male respondents (53.8%) are slightly more than the female respondents (46.2%). A majority of the respondents (52.8%) are Malays, followed by Chinese (35.2%), Indians (10.8%) and others (1.2%). With regards to the level of education, a majority of the respondents had at least a secondary school qualification (83.1%). Only 3.8% of the respondents had no formal education, while 13.1% attended primary school only.

A majority of the respondents are either employed or self-employed (64.3%). Students and housewives represent 18.3% and 16.1% of the sample, respectively. In terms of tenancy, 73.1% owned the house, while the remaining 26.9% rented the house.

TABLE 1
DEMOGRAPHIC BACKGROUND OF RESPONDENTS

		Frequency	Percentage (%)
District	FSA1	200	50.2
	FSA2	99	24.9
	FSA3	99	24.9
	Total	398	100.0
Gender	Male	214	53.8
	Female	184	46.2
	Total	398	100.0
Race	Malay	210	52.8
	Chinese	140	35.2
	Indian	43	10.8
	Others	5	1.2
	Total	398	100.0
Highest education	No Formal Education	15	3.8
	Primary	52	13.1
	Secondary/ Certificate	185	46.5
	Diploma/ Degree	130	32.6
	Postgraduate	16	4.0
	Total	398	100.0
Employment status	Employed	174	43.7
	Self-employed	82	20.6
	Student	73	18.3
	Housewife	64	16.1
	Unemployed	5	1.3
	Total	398	100
Tenancy	Self-owned	291	73.1
	Rented	107	26.9
	Total	398	100.0

4.2 Household Awareness, Knowledge and Understanding of Waste

Table 2 shows the level of awareness of the respondents about the company that collects and manages the waste, as well as their awareness in managing household waste. It is observed that a majority of the respondents (74.4%) are aware that waste management in their area has been privatized, with two-thirds of them are able to name the company. The remaining 25.6% of the respondents still believe that their local councils collect the waste. Considering that privatization of solid waste is quite new in Malaysia, the level of awareness is acceptable.

As far as we are concerned, the collection days for every housing-area are fixed, and there is a notice posted in the area. It is the practice of FreshAir to collect waste twice a week in residential areas. However, less than half of the respondents (43.2%) are aware that waste is collected twice a week. The responses from the remaining respondents are mixed between once, three times and four times a week. About 20% of the households could not guess the frequency of waste collection. The statistics may give two different interpretations. First, it may imply that a majority of the households are ignorant about the frequency of waste collection in a week. This may be because a majority of the respondents are working and students; thus, they are not at home when the garbage is collected. Second, it may imply that the schedule is not adhered to by the garbage collectors, causing confusion among households.

In respect of payments for waste collection, the table indicates that 40% of the respondents agree that house-owners pay the bill, while 7.0% believe that tenants are responsible for the payment of the bills. Another 19.8% believe that the government pays the bill while 33.2% have no idea about who makes the payment. This implies that a majority of the households are not aware that the home-owners are responsible for the payment of waste collection. This payment is actually included in their assessment tax paid to local councils.

The table also shows that a majority of the respondents are conscious about how their waste should be disposed, in which 94.0% believe that waste should not be thrown anywhere, such as in the sea or river. There are still some people (6.0%) who have the negative attitude by believing that waste can be thrown in the sea and river.

This study also shows that a majority of the respondents (84.7%) believe that rubbish can be useful for other things while 15.3% do not subscribe to this idea. Further, many of the respondents are aware of the health consequence of poor waste collection; 87.4% believe that poor waste collection can have a negative impact on residents' health, while 12.3% do not agree with the idea.

In addition, respondents were asked on what they can do with waste. Here, respondents were allowed to choose more than one answer. Table 2 reveals that a majority of the households (72.1%) believe that waste can be recycled. Many also believe that waste can be used for compost (56.3%). This is followed by beliefs that waste can be reused (42.0%), waste can be used for animal feed (30.9%) and that energy can be generated from waste (26.6%).

TABLE 2
HOUSEHOLD AWARENESS, KNOWLEDGE AND UNDERSTANDING OF WASTE

		Frequency	Percentage (%)
Company that collects waste	FreshAir	268	67.3
	Local council/ Authority	102	25.6
	Private Entity	27	7.1
	Total	398	100.0
Frequency of collection	Once a week	59	14.8
	Twice a week	172	43.2
	Three times a week	66	16.6
	Four times a week	21	5.3
	Don't know	80	20.1
	Total	398	100.0
Payee	House Owner	159	40.0
	Tenant	28	7.0
	Government	79	19.8
	Don't know	132	33.2
	Total	398	100.0
Rubbish can be thrown in the sea and river	Yes	24	6.0
	No	374	94.0
	Total	398	100.0
Rubbish can be useful	Yes	337	84.7
	No	61	15.3
	Total	398	100.0
Poor collection affects our health	Yes	348	87.4
	No	50	12.6
	Total	398	100.0
What we do with waste	Recycle	287	72.1
	Compost	224	56.3
	Reuse	167	42.0
	Animal feed	123	30.9
	Energy product	106	26.6

4.3 Waste Disposal and Collection Problems

With respect to waste disposal problems, respondents express mixed opinions. Table 3 shows different levels of responses for five identified problems. Generally, respondents have between slight and serious problems with all the issues. The most serious issue is that collection schedules are not adhered to by the collectors. Related to this issue is that rubbish collection is irregular.

The next problem is that the number of bins is not enough to accommodate the amount of waste to be disposed. When this happens, there is a disorderly disposal of rubbish. Respondents also face more than a slight problem of no specific rubbish disposal spot.

Respondents were also asked about the causes of the disorderly disposal of waste. A majority of the respondents (74.1%) reveal that lack of awareness and knowledge is the major cause of the problem. Another factor is that there is a lack of enforcement from the government (57.8%). This is in line with the findings by Solid Waste and Public Cleansing Management Corporation (SWCorp, 2009). In addition, a number of respondents (32.9%) believe that non-human factors such as cats, dogs and monkeys may create the problem. This shows that waste management operators should put more effort in educating and training their staff in dealing with their job and in handling the public. Measures should also be taken to deter animals from scavenging in rubbish and digging through the bins.

TABLE 3
SERIOUSNESS OF WASTE DISPOSAL AND COLLECTION PROBLEMS (n = 398)

			No problem (1)	Slight problem (2)	Serious problem (3)	Very serious problem (4)	Extremely serious problem (5)	Mean score
1.	No specific rubbish disposal spot (n=390)	Freq.	132	95	60	31	72	2.53
		%	(33.8)	(24.4)	(15.4)	(7.9)	(18.5)	
2.	Number of bins not enough (n=388)	Freq.	68	99	102	69	50	2.83
		%	(17.5)	(25.5)	(26.3)	(17.8)	(12.9)	
3.	Irregular rubbish collection (389)	Freq.	78	85	126	72	28	2.71
		%	(20.1)	(21.9)	(32.4)	(18.5)	(7.2)	
4.	Collection schedule not adhered to (n=390)	Freq.	72	82	98	68	70	2.95
		%	(18.5)	(21.0)	(25.1)	(17.4)	(17.9)	
5.	Disorderly disposal of rubbish (389)	Freq.	116	91	77	36	69	2.62
		%	(29.8)	(23.4)	(19.8)	(9.3)	(17.7)	
						Freq.	%	
Causes of disorderly disposal			Lack awareness/ knowledge			295	74.1	
			Lack of enforcement			230	57.8	
			Other than human factors			131	32.9	

4.4 Satisfaction with the Conduct of Waste Collectors

This study also seeks household satisfaction with respect to the conduct of waste collectors. The responses are depicted in Table 4. Overall, the mean scores show that respondents are moderately satisfied with waste collections in their area. Generally, respondents believe that the collection service at curbs and alleys is good.

As far as safe driving is concerned, more respondents feel that they are satisfied rather than dissatisfied with the drivers of garbage trucks. The respondents have mixed opinion on whether the workers are friendly and helpful. Their opinion of whether the service areas are left clean are also divided; however, more respondents say that they are satisfied than not satisfied. Further, respondents are moderately satisfied that garbage carts and containers are placed at their original location.

In addition, respondents were asked whether they had ever contacted their waste management company to pick up large, used items. Only 178 had used the service, and out of that, 100 (56.2%) are satisfied with the service. The remaining 43.8% are not satisfied with the service. However, this study did not further investigate the reasons for their dissatisfaction.

TABLE 4
HOUSEHOLD SATISFACTION - WASTE COLLECTORS

		Excellent (1)	Good (2)	Average (3)	Poor (4)		
Collection service at curbs and alleys (n=394)	Freq.	34	169	156	35		
	%	(8.6)	(42.9)	(39.6)	(8.9)		
Customer Satisfaction - Waste Collection		Not at all satisfied (1)	Not satisfied (2)	Undecided (3)	Satisfied (4)	Extremely satisfied (5)	Mean Score
1. Safe driver (n=390)	Freq.	45	68	122	86	69	3.17
	%	(11.5)	(17.4)	(31.3)	(22.1)	(17.7)	
2. Friendly and helpful workers (n=390)	Freq.	62	69	135	67	57	2.97
	%	(15.9)	(17.7)	(34.6)	(17.2)	(14.6)	
3. Service area left clean (n=388)	Freq.	44	61	138	84	61	3.15
	%	(11.3)	(15.7)	(35.6)	(21.6)	(15.7)	
4. Garbage carts placed at original location (n=387)	Freq.	40	68	130	91	58	3.15
	%	(10.3)	(17.6)	(33.6)	(23.5)	(15.0)	
5. Waste containers placed at original location (n=392)	Freq.	46	48	137	64	97	3.30
	%	(11.7)	(12.2)	(34.9)	(16.3)	(24.7)	
Satisfied with service performed in collecting large items (n=387)		Freq.				%	
	Yes	100				56.2	
	No	78				43.8	

4.5 Household Satisfaction - Customer Service

Customer service is very important in the management of waste. One of the major channels used for customer service is through telephones. In this study, respondents were asked whether they have ever contacted customer service through telephones for enquiries related to waste management in their area. Only 68 respondents (16.8%) had used the service, and a majority of them (54.4%) had made one to two phone calls as indicated in Table 5. Further, the respondents that had made phone calls are asked to rate their satisfaction with the over-the-phone service that they received. Generally, they are between undecided and unsatisfied with the service received on the phone, the friendliness of staff, the helpfulness of staff and the staff's ability to answer questions. This shows that the waste management company needs to give adequate training to their staff to be courteous in handling inquiries and complaints in ways that create improved relationships with clients.

TABLE 5
HOUSEHOLD SATISFACTION – CUSTOMER SERVICE

			Freq.	%				
Frequency calls made (n = 68)	1-2 times		37	54.4				
	3-5 times		25	36.8				
	More than 5 times		6	8.8				
		Not at all satisfied (1)	Not satisfied (2)	Undecided (3)	Satisfied (4)	Extremely satisfied (5)	Mean Score	
1.	Service received on the phone (n = 68)	Freq.	16	15	23	12	2	2.54
		%	(23.5)	(22.1)	(33.8)	(17.6)	(2.9)	
2.	Friendliness of staff (n = 68)	Freq.	8	17	24	15	4	2.85
		%	(11.8)	(25.0)	(35.3)	(22.0)	(5.9)	
3.	Helpfulness of staff (n = 68)	Freq.	8	21	25	10	4	2.72
		%	(11.8)	(30.9)	(36.8)	(14.7)	(5.9)	
4.	Ability to answer question (n = 68)	Freq.	9	16	22	13	8	2.93
		%	(13.2)	(23.5)	(32.4)	(19.1)	(11.8)	
5.	Overall satisfaction (n = 68)	Freq.	13	14	21	13	7	2.81
		%	(19.1)	(20.6)	(30.9)	(19.1)	(10.3)	

4.6 Waste Management and Waste Minimization Solutions

In addition to the series of questions that were asked on solid waste management, the level of awareness and practice of households about waste minimization, that is reducing the amount of waste sent to landfill, were also measured. The results are reported in Table 6. Overall, a majority of the respondents (60.3%) believe that the facilities and services provided by the waste management company in managing waste are inadequate. Among the facilities and services that can improve waste management, in descending order of importance are regular collection (63.8%), enforcement (60.3%), creating awareness (44.2%), sanitary dumping (25.4%), and strict standards (24.4%).

TABLE 6
HOUSEHOLD AWARENESS –WASTE MINIMIZATION

		Frequency	Percentage (%)
Facilities and services are adequate	Yes	158	39.7
	No	240	60.3
Facilities and services to improve	Regular collection	272	63.8
	Enforcement	240	60.3
	Awareness	176	44.2
	Sanitary dumping	101	25.4
	Strict standards	97	24.4
How dispose-off household waste	Collection service	289	72.6
	Reuse/ recycle	136	34.2
	Compost	99	24.9
	Animal food	65	16.3
	Burn/bury/dump backyard	53	13.3
	Sell	49	12.3
	As fill material	43	10.8
	Return to shop	28	7.0
	Dump on beach/ sea/drain/river	19	4.8
Make compost at home	Yes	99	24.9
	No	299	75.1
Agree if compost demonstrated	Yes	322	80.9
	No	76	18.3
Support centralized composting	Yes	331	83.2
	No	67	16.1

In addition to the above, the ways in which households dispose-off their waste in addition to regular collections are solicited. Respondents are allowed to give more than one answer. Table 6 indicates that a majority of the respondents (72.6%) use the collection services provided by the concession company. Other acceptable ways of minimizing waste are by reusing or recycling the waste, composting, feeding the animals, selling, using as fill materials, and returning waste to shops. However, there are some respondents who dumped the waste on the beach or in the sea, drain and river. Burning, burying or dumping in the backyard is not commonly practiced by the respondents. The activity may not be appropriate, depending on the housing location and density of the population. It can be unhealthy and non-acceptable if practiced in housing areas in which houses are linked or close to each other with limited vacant land.

This study shows that about 34% of the respondents reuse or recycle the waste, in an effort to minimize the disposing of waste in landfills. The percentage is relatively small considering that various campaigns have been conducted to educate the society on the benefit of waste recycling, and the fact that recycling bins have been placed at various strategic locations. Our finding supports the study by Zainu & Songip (2017) who found that recycling campaigns receive low response from the public.

We also find that one-fourth of the respondents made compost at their respective homes. However, it appears that a high majority of the respondents (81%) welcome the idea of demonstrating composting and support centralized composting (83.2%). This shows that many respondents are interested but do not have the knowledge to compost. We believe that given proper and continuous demonstrations on composting, waste disposal can be minimized.

V. DISCUSSION AND CONCLUSION

This study surveys households on the issues pertaining to household waste management in one of the regions in Malaysia. By and large, households are aware that waste management in their region has been privatized even though some of them could name the concessionaire company. Considering that privatization of solid waste is quite new in Malaysia, the awareness is acceptable. What is more important is that the households or society understand their role in managing waste, not by just passing the responsibility to the organization in charge of waste management. Instead, the society should work hand in hand with the government and concessionaires in realizing a sustainable and healthy environment.

Our study shows that households' knowledge and understanding of waste is reasonably good, namely in terms of health consequences and how waste can be of benefit to the society and environment. However, households are ignorant towards the frequency of garbage collection. Knowing the right schedule is very important because it helps the household to plan their disposing of rubbish in the bin. On the other hand, we find that the respondents are putting the blame on the garbage collectors; generally the household agree that not adhering to the collection schedule and irregular rubbish collection are giving them problems. It is not the intention of this study to put the blame on anyone. Both ignorance on the part of the society and irregular waste collection by the service provider can lead to serious consequences, such as overflow of bins, rubbish left uncollected for a long time, and smelly environment, which would subsequently attract flies and other insects and animals. Thus, it is the duty of the concessionaires to ensure that the waste is collected as being scheduled, and of the households not to be ignorant of the schedule. This will thus contribute to a clean and healthy environment. The respondents also agree that there is a lack of awareness, knowledge and enforcement that causes disorderly waste disposal.

Generally, respondents are moderately satisfied with the attitude of waste collectors during waste collection. Improvements are recommended in terms of safe driving, friendliness, cleanliness of service areas, and proper placing of garbage carts and bins after collection. As far as customer service is concerned, more training should be given to the staffs who handle customer service. It appears that generally, the respondents are not satisfied with customer service.

Waste minimization is one of the issues surveyed in this study. Among the various ways by which waste can be minimized, reusing and recycling have been practiced by about one-third of the respondents. The figure is still not promising; more and continuous programs and campaigns, especially by the government and concessionaires, to educate and discipline the society are very much needed, in addition to providing recycling bins at various strategic locations. The campaigns should be able to instill the feeling of guilt among the society if they do not recycle their household waste. The social media, mass media, schools and colleges, as well as places of worship should act as channels in educating the public about the importance of recycling.

Another method of waste of minimization that can be practiced is composting. Although not many respondents compost their household waste, a majority of the respondents are keen in doing it if demonstrated, and are very supportive of the idea of centralized composting. Again, educating the public on the know-how is an important element of waste minimization.

Although this study is conducted in only one of the regions in Malaysia, it may be applicable and generalized to other parts of the country. We believe that the society would benefit most if all parties would be able to work hand in hand both on the technical and behavioral elements. Continuous campaigns, more in-depth knowledge sharing, motivation and training would be among the immediate initiatives required of the concessionaires, the local councils, the state, and the federal government for a cleaner, greener and environmentally safer Malaysia. Besides, enforcement mechanisms should be in place and authorities should enforce whatever rules and regulations that have been implemented.

At the time this survey was conducted, campaigns on household waste separation, another means of waste minimization, have not been widespread. Beginning September 2015, some states under the three concessionaires enforced waste separation, in pursuant to regulations under Solid Waste and Public Cleansing Management Act 2007 (Act 672). The process of separating solid waste involves separating solid waste according to waste composition such as recyclable waste, residual waste and bulky/garden waste. The separated waste will be collected every week based on fixed schedules. The success of this campaign has yet to be investigated, and this can be an avenue for future research in Malaysia.

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