Household Knowledge and Practices in Solid Waste Segregation and Recycling in Malaysia

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Abstract

Solid household waste management has been identified as a major problem at all over the world. The failure of managing household waste may lead to increased operation cost and effected the environment entirely. There is a tremendous amount of loss in terms of environmental degradation, health hazards and economic descend due to direct disposal of waste. This study will concentrate on solid waste management among household at Taman Desa Sinaran Dengkel Selangor Malaysia. In this study, a quantitative method based on survey questionnaire was implemented. The data collected, calculated and analyzed using SmartPLS. The results of the study revealed that knowledge is the domain factor in the relationship between solid household waste management behaviour among resident of Desa Sinar Harapan. This paper able to enrich understanding of household regarding the factors that most contribute to waste management.

Keywords: Waste Management, PLS-SEM, Solid Household Waste Management, Malaysia, Knowledge, Practices.

INTRODUCTION

The high rate of urbanization, the rising standard of living and rapid population growth have resulted in the increased generation of solid waste. Solid waste as including non-hazardous industrial, commercial land domestic refuse including household organic trash, street sweepings, hospital and institutional garbage, and construction wastes; sludge and human waste. Household waste are major contributors of municipal solid west and environmental health hazards. Malaysia is a developing country where the population has crossed the 30 million mark in 2018.

Rapid urbanisation involves the improvement of economics and a better life for households, but it also affects the rate of solid household waste contribution in Malaysia. That is also leading factor to an increase of food waste produce by households and business outlets, such as restaurants, hotels, and resorts. Food waste contributed as much as 44.5% out of Malaysian solid household waste [1]. Everyday Malaysia will contribute up to 930 tonnes of unconsumed food, which is equivalent to 93,000 x 10 kg of rice each day [2]. Household waste retains an absolute majority of municipal solid waste sources to which most costs of municipal waste management are allocated. Failure of managing waste may lead to increased operational costs and an overall detrimental impact on the environment. Poor waste management and disposal could lead to various diseases, infection, and infestation. Regarding the disposal of waste, 42% of municipal solid waste in Malaysia is incinerated or burned, and just 2% is recycled, while another 56% is dumped in landfills. However according to [1] households in rural areas are unwilling to implement new methods to manage waste because they prefer open dumping and open burning as the daily option of eliminating waste. Unfortunately, open burning practices can cause haze and contribute to dangerous atmospheric pollution levels in Malaysia. This situation occurs due to poor understanding of resource conservation and recycling [3]

The process of eliminating waste is extremely challenging as the flow of garbage has increased drastically over the years. There is a tremendous amount of loss in terms of environmental degradation, health hazards, and economic descent due to direct disposal of waste. It is better to segregate the waste at the initial generation stages rather than going for a latter option that is inconvenient and expensive as well. By using segregation methods, such as recycling, it can reduce half household waste [4].

In many countries, recycling activities have gained increasing attention of protecting the environment. This practices also offers solutions for every country both economically and ecologically for managing solid waste disposal. The enhancement of waste recycling activities saves resources by reducing on purchase of raw materials, lowers the cost of the final disposal of the residues, produces cheaper goods that help low-income households, and create new jobs. Despite these advantages, recycling activities have not become a major way of managing solid waste disposal in Malaysia.

Knowledge and practices of Malaysian households need to be aligned with the Malaysian government to achieve a greener environment. [5] stated that good knowledge is useless if it is not implemented properly. Knowledge can make a big difference to a society. Developed countries such as the United States, United Kingdom, and European countries, have gained attention for recycling activities as means to protect the environment. For Malaysia, acknowledgement about solid waste management is still limited among Malaysians. Solid waste is continuously generated daily and has reached a level of concern due to high consumption from high number of populations, rapid urbanisation, and different lifestyle. Residents must take responsibility rather than the local authority because they directly interact with solid waste daily. The government can inculcate knowledge and practices among society members through formal education and implement activities related to solid waste management issues. Household practices need to be developed to have greener behaviour towards managing solid waste. Human practices can be generated from good support, motivation and great persuasive interactions.

The main objective of this study was to identify the relationship between knowledge and practices towards successful solid household waste management especially through solid waste segregation and recycling implementation among residents at Taman Desa Sinaran Dengkel Selangor. Besides that, some obstacles related to solid waste management practice will also be explored.

LITERATURE RIVIEW

A. Go Green and Sustainability

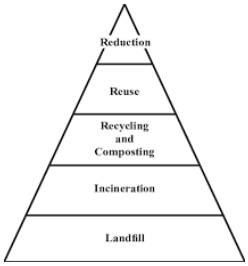
Sustainable Waste Management (SWM) can be interpreted as using variety of resources efficiently to cut down the amount of waste produced, and, where waste is generated, dealing with it in a way that actively contributes to the economic, social, and environmental goals of sustainable development. Sustainability has been defined as the goal of sustainable development, which is "types of economic and social development that protect and enhance the natural environment and social equity" [6].

B. Solid Waste Segregation and Recycling

Initially, waste management hierarchy can be traced back to the 1970s, when environment development started to comment on practices of disposal-based waste management. These movements argued that rubbish should not be a homogenous mass that should be buried. Instead, they propounded that it was made up of different materials that should be treated based on the waste categorisation of either reuse, recycle and composted, burn, or buried (Figure 1).

Fig. 1. Hierarchy of waste management

Objectives for the management of waste is reducing as much as possible of removable dregs and keeping the produced waste using ecological techniques.



Recycling refers to the systematic collection, processing, and reuse of materials, which include the following categories: paper, glass, plastic, wood, aluminium products, and iron[7]. Recycling programmes are more economical by substituting raw materials with used materials, conserve energy, and creates jobs for the local society.

Figure 2 shown that in 2010, 65% of disposed materials in landfills are recyclable materials. Recycling could reach 22% of waste generated in 2020. As a result, Malaysians will be more aware and conscious towards recycling, but only few recycling industries are available [8].

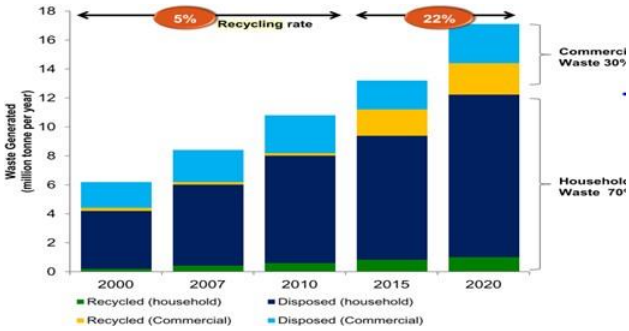


Fig. 2. Household and Commercial Solid Waste Generation

In 2015, household waste (70%) was generated to the tune of about 8.5 million tonnes that had been disposed, but only 0.3 million tonnes were recycled by households. This is crucial as the years pass by as waste is constantly generated, and thus recycling rates should be improved among Malaysians. In 2009, there are 15 recycling centres in Kuala Lumpur, 22 in Selangor, and 56 in Pahang, operated by Alam Flora Sdn. Bhd.

Waste management in Malaysia is still suffers from low rates of success because of the same practices and lack of knowledge in the Malaysian community. Not only the government needs to create alternatives for the community, but the community themselves need to actively manage their own waste and support government campaigns.

The Malaysian authority has been left with one option, which is mandatory recycling with fines for non-compliance. Programmes that handed out recycling bins and hoped for the best have been started and stopped since 2007 but, due to public ignorance and disinterest, have met with utter failure. Despite this fact, the government has rallied once more. This time, it appears to be quite serious about recycling in Malaysia. The Malaysian authority recently created Mandatory Waste Separation Programme, as the legal Act focuses on creating awareness to separate recyclables from garbage, also having an efficient system in collecting and repurpose waste.

Even in well-developed cities, such as Putrajaya, they are having difficulties in waste management. The segregation of waste in Putrajaya is still lower than 22%, which was targeted by the National Solid Waste Management, on account of lack of educational tools in the new era, community practices, and knowledge about waste management, as well as misinformation in position of recycling collection point, time constraint, and limited space [5].

C. Knowledge

Knowledge can lead to a step that is above the level of information and one step below wisdom. Knowledge can reasonably be defined as a worldview or a cognitive framework that creates parameters and ten thousand details of human social and ethical realities, including basic values, beliefs, habits, notions of identity, relationships among human beings (including gender identity and issues) and relationships between humanity and larger realities (political, environmental, and religious). This research focused on the knowledge of waste management in Malaysia. Based on [8], knowledge awareness has already been implemented early in the Malaysian community by introducing public awareness and environmental education. The government has already and will still provide 3R campaigns, better recycling facilities in more civilised and crowded areas to prevent overflow of waste.

TABLE 1. EDUCATION RECYCLING ACTIVITIES (JANUARY-JULY 2013)

Type of Study	Frequency
1. Talk/Speech	13
2. Exhibition	26
3. Meeting	27
4. Actual Recycling Activity	7
Total	73

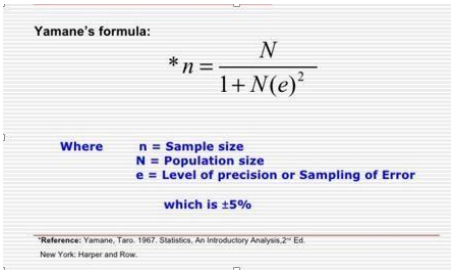
Source: Ministry of Housing & Local Government, Malaysia

Based on Table 1, the government has attempted to improve knowledge among Malaysians through several numbers of activities, such as through presentations, exhibitions, meetings, and recycling activities.

METHODOLOGY

The population for this study consisted of residents at Taman Desa Sinaran, Kg Jenderam Hilir, Dengkil in Selangor. Based on [9], they stated that a sample needs to be collected to represent the whole population. Through the Selangor Website, the latest number of residents in Kg Jenderam Hilir, Dengkil, Selangor is around 1000. Hence, to get the exact sample size, there is a method by [10] which uses the

formula for measuring the minimum sample size. In addition, this formula is best used with 95% confidence level and the value of p = 0.5 (maximum variation). The formula is as follows:



Based on this formula, the sample size that suitable for this study is 100 residents from Taman Desa Sinaran, Kg Jenderam Hilir in Selangor. Besides that, the number of sample size that amounted to 100 was in accordance with the recommendations by [11] that established 100 respondents as the minimum requirement for data analysis using PLS-SEM. Meanwhile, [12] stated that generally a sample size should be within the range of 30 and 500, which is suitable for all types of research. In other words, it called as *The Rule of Thumb.* By using a simple random cluster sampling procedure, the respondents were selected randomly by houses. Most of the respondents are various ages of working individuals.

This study used a questionnaire survey method to collect, analyse, and generalise the data. The main strength to the survey method is that researchers can rapidly collect data from a large sample among different groups. The survey questionnaire developed in this research consisted of three main sections. The first section comprised questions about the company background, and second and third sections consisted of questions about knowledge and practices of waste management implementation. The respondents were asked to rate on a five-point Likert scale on each statement. For the degree of importance, the rate scale ranged from 1 = not important at all, to 5 = very important. Meanwhile for the extent of practice, it was given as 1 = very low, to 5 = very high for each statement item.

FINDING

Data for this survey study was gathered from the residence of Taman Desa Sinaran in Selangor. Demographic information of respondents who had participated in this survey were recorded as follow:

Prior to performing the main data analyses (construct validity, scale reliability and hypotheses testing), several data examination procedures had been conducted following [13] suggestion. The procedures were including identifying; i) missing values, ii) suspicious response patterns, iii) outlier cases, and iv) testing for normality of data distribution. As the results, no missing value, suspicious response, and outlier case were detected. As for data normality test, Mardia's multivariate skewness and kurtosis were observed, following [11] recommendation. The test was performed using a free access online calculator named WebPower which can be accessed at https://webpower.psychstat.org. The used of this online calculator was also evident in several recent studies [14-16]. WebPower application revealed that the dataset used in this study was not normally distributed at z-skewness = 28.033 and z-kurtosis = -2.608. A normally distributed data must be ranging from -3 to +3 for z-skewness and -20 to +20 for z-kurtosis. Thus, this study proceeded with PLS-SEM technique (a non-parametric statistical analysis) to perform the main data analysis procedures. PLS-SEM has the ability to assess path models with a highly skewed data and small sample group [17].

Table 2

RESPONDENTS DEMOGRAPHIC INFORMATION

Information	Freq.	%.	Information	Freq.	%
Gender			**Education Level**		
Male	45	44.6	Primary School	4	4.0
Female	56	55.4	Secondary School	28	27.7
Total	101	100	Diploma	47	44.5
i) Age (years)			Degree	16	15.8
Below 20	13	12.9	Master/PhD	6	5.9
21 to 30	17	16.8	Total	101	100
31 to 40	23	22.8	ii) Home Design		
41 to 50	29	28.7	Bungalow	26	25.7
50 and above	19	18.8	Semi Detach	13	12.9
Total	101	100	Terrace	55	54.5
iii) Race			Condominium	4	4.0
Malay	74	73.3	Others	3	3.0
Chinese	15	14.9	Total	101	100
Indian	12	11.9			
Total	101	100			

Data analysis using PLS-SEM involved two major analytical procedures, namely measurement model and structural model [18]. The purpose of measurement model analysis is to assess construct validity and scale reliability, while structural model analysis was for testing the significance of hypothesised relationships. Software SmartPLS version 3.2.8 [19] was used in this study to fulfil both purposes.

Measurement Model Assessment

Measurement model which also known as the 'outer model' presents the relationship between the indicators and their respective construct. The assessment of measurement model requires researchers to observe the value of composite reliability (ρ_c) to evaluate scale reliability, Average Variance Extracted (AVE) to indicate convergent validity and Hetereotrait-Monotrait (HTMT) ratio to specify discriminant validity. Measurement model of this study was depicted as in Figure 1.

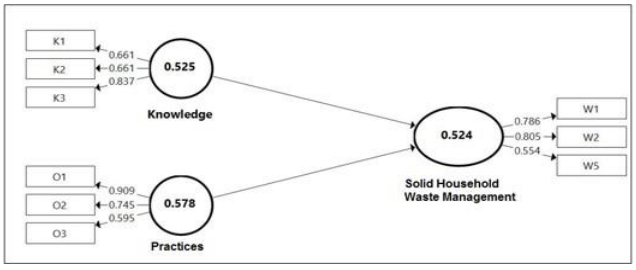


Fig. 3. Measurement Model

Figure 3 demonstrated the values of outer loading (on the arrows) and AVEs (inside constructs). AVE equals to the average of the square of standardized indicators' outer loadings for a particular construct [20]. Two items (W3 and W4) were deleted from the model to enable Solid Household Waste Management construct to achieve acceptable convergent validity (AVE ≥ .50). The full results of measurement model assessment were presented in Table 2 and Table 3.

Table 3

SCALE RELIABILITY AND CONVERGENT VALIDITY RESULTS

Constructs	Items	Loadings	ρ_c	AVE
Solid Household Waste Management	W1	.786	.763	.524
	W2	.805		
	W3	.554		
Knowledge	K1	.661	.766	.525
	K2	.661		
	K3	.837		
Practices	O1	.909	.800	.578
	O2	.745		
	O3	.595		

Table 3 revealed that all constructs had achieved the minimum acceptable convergent validity (AVE ≥ .50), as well as satisfactory level of composite reliability ($\rho_c \geq .70$). Further, discriminant validity was evaluated using HTMT ratio (see Table 5) instead of conventional cross loadings and Fornell and Larcker criterion.

TABLE 4. DISCRIMINANT VALIDITY (HTMT RATIO) RESULT

	1	2	3
1 Solid Household Waste Management			
2 Knowledge	.359		
3 Practices	.281	.293	

HTMT ratio that is greater than .85 [21, 22] indicates a problem of discriminant validity. Table 4 shows that all ratios were below .85. Hence, it was evident that discriminant validity issue between all constructs in the measurement model did not exist.

Structural Model Assessment

Structural model which also known as the 'inner model' presents the relationship between constructs in a SEM model. The assessment of structural model requires researchers to report the value of path coefficients (*β*), significant level (*p*-values) and empirical *t*-values (*t*-statistics) to determine the significance of hypothesised relationships. However, prior to the assessment of significant relationships, [18] urged researchers to check for collinearity issue among predictors in the structural model using variance inflation factor (VIF) statistics. Hence, this study chose to comply with this condition. Lastly, coefficient of determination (R^2) was also reported to specify the model's predictive power Every mentioned value was included in Table 4.

Table 5

STRUCTURAL MODEL (HYPOTHESES TESTING) RESULT

Relationship	VIF	*β*	*t*-stats	*p*-value	R^2	Decisions
Knowledge → Solid Household Waste Management	1.033	.174	2.047	.041	.105	Supported
Practices → Solid Household Waste Management	1.033	.243	3.663	<.001		Not Supported

Note. One-tailed test.

Table 5 revealed that there was no collinearity issue between predictors (Knowledge and Practices) in this structural model with all VIF values were not exceeding 3.3 as suggested by [13] Besides that, only one predictor (Knowledge) had demonstrated significantly positive relationship with Solid Household Waste Management based on one-tailed test at $\beta = .174$, $t = 2.047$ (more than 1.65), and $p = .041$ (less than .05) [23]. This relationship means the more the level of green/recycle knowledge among Taman Desa Sinaran residence, the more they demonstrate behavioral intention to properly manage their waste in their household and neighbourhood. This results also have shown that, Taman Desa Sinaran residence received adequate information from many sources (social media, newspapers, television, website, radio, poster and advertisement) to educate and enhance knowledge among them about solid household waste segregation and recycle. In contrast, practices did not influence the behavioural intention of Taman Desa Sinaran residence to manage their household and neighbourhood waste. Some of the reasons are: improper facilities, unstrategic location factors, lack of space, assume that separation is time consuming, and not being able to afford separate bins for separated waste. Lastly, the results of structural model analysis are concluded with the R^2 value which had achieved minimum acceptable predictive power at $R^2 = 0.105$. According to [24] as well as [25], the minimum level of preditive power should be more than 10% ($R^2 \geq 0.10$).

CONCLUSION AND RECOMMENDATION

Knowledge is the domain factor in the relationship between waste management behaviour among resident of Desa Sinar Harapan, so it is very important that this independent variable is handled professionally and maturely. Relations between knowledge and waste recycled behaviour can be enhanced by having a broader knowledge to create a better perception towards waste management. Besides received adequate interactive information from many sources such as social media, newspapers, television, website, radio, poster, and advertisement to educate and enhance knowledge among them, Green and Sustainable Environment Programs such as organic and food waste recovery, multi-family recycling and 'How to recycle' communication can widen household knowledge and encourage them to segregate and recycle solid household waste.

Factors to improve the relationship between practices and solid household waste segregation and recycled behaviors are from two parties which themselves and local government. Several obstacles such as improper facilities, and unstrategic location factors should be resolve. Besides, local government should promulgate and enforced policies on household waste management to improve waste segregation and recycled behaviour. Punishment such as fine towards littering or improper waste management can increase the rate of practices on recycling in the neighbourhood. Advice and support system must be provided by authorities to handle any problem among residents regarding issues of lack of space, assume that separation is time consuming, and not being able to afford separate bins for separated waste.

The practices in waste management should be enhanced to improve the relationship with waste recycle behaviour. The local authorities should provide recycling facilities to more residential areas. A better approach in attract householders to recycle more often and creating a good waste recycled behaviour among them.

Limitation of Study

There were several limitations encountered in this study. Firstly, an important limitation of this study is that the samples were collected only in one specific area which is Taman Desa Sinaran in Selangor. Malaysian householders are widely spread out, this study did not include the whole Selangor region such as Shah Alam, Rawang and more. Furthermore, various method of recycling also occurred in both urban and suburban areas of Malaysia. The concentration of sample collection in Taman Desa Sinaran may not be adequate in generating exhaustive pictures that reflects the whole perspective of waste recycling behaviour in Malaysia. Waste recycled behaviour differs from other states or from suburban may show different behaviour. As a result, the generalisation of the findings onto a wider population nationwide should be done with caution.

The response bias from the respondent can be expected as consumers with different background may respond to the questions differently. Some respondents having good recycling behaviour, but some are not. To a certain extent, some respondents do not recycle at all. Therefore, evaluation made by the respondents may not be accurate due different levels of understanding on the issues. On the other hand, the honesty of respondents in answering the question during the survey is taken for granted, which could pose a constraint in this study.

SUGGESTION FOR FUTURE RESEARCH

The implication of recycling behaviour should be increase and the variables of household's behaviour present a wide area of study. This research has only investigated a small part of an area of study. Therefore, waste recycling behaviour could be useful to other sector to provide and improve the research area. Firstly, it is recommended that the study should be replicated using a longitudinal study design to test the casual relation between the independent variables in the model. This study has focused on one area which Taman Desa Sinaran,Dengkil, Kg Jenderam Hilir in Selangor. Thus, it is possible that the results taken from other area in Selangor might be yield different results. It is also recommended that future study may consider using current questionnaires modified to suit modern behaviour of householders. Alternatively, a variety of data collection techniques could be used other than the questionnaire. The effect of cultural environment is another area could be explored further. Influential from surrounding also be the factor of various recycling behaviour. There are more factors for future researchers to imply and help to contribute in increase of waste recycling rate among rural areas householders.

CONCLUSION

The result from this study showed that knowledge having significant relationship with waste recycled behaviour. As a summary, having specific knowledge like recycling, reuse and reduce towards waste could improve the outcome of implication of practices and reduce the obstacles in managing waste in rural areas. The relationship between practices and household waste segregation and recycled behaviour can be improve by improve facilities, provide strategic recycling location, provide support group and system, having a regular waste collection schedule and increase awareness to the local people. Finally, through increasing recycling facilities, provied strategic location, throughout the neighbourhood and great support from government to motivate recycling can strengthen the relationship between practices and solid household waste segregation and recycled behaviour.

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