

## ENVIRONMENTAL AWARENESS AND EDUCATION: A KEY APPROACH TO SOLID WASTE MANAGEMENT (SWM) - A CASE STUDY OF KLANG VALLEY

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**ABSTRACT:** Solid waste management has been a worldwide issue which most countries are finding the best ways to deal with it. Improper waste management poses a threat to the health of individuals and the environment. The general problem is the perception of the local communities towards solid waste management. It is important to analyze the current level of awareness towards solid waste management to be serve as reference for policy making or education purposes. Thus, this research seeks to analyze the level of awareness towards solid waste management in Klang Valley, which is defined into three aspects knowledge, attitude, and behavior. This research is described as a descriptive survey that is done on Klang Valley communities. The statistical analysis used in this research are descriptive, frequency and Principal Component Analysis using Statistical Packages for Social Science (SPSS) Software for statistical analysis. Generally, regarding solid waste management in Klang Valley, the respondents are highly knowledgeable except for e- waste, however the calculated mean for the attitude is 1.85 and 2.66 for behavior which indicates that their level of attitude and behavior towards solid waste management is low and moderate. Principal component analysis shows that there are three and four principal components for attitude and behavior sections respectively which greatly impact on the respondent's attitude and behavior towards solid waste management. To conclude, promotional and encouragement on proper solid waste management has to be conduct frequently by the public or authorities.

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**KEYWORDS:** Solid waste management awareness; Knowledge; Environmental knowledge, attitude and behaviour; Principal Component Analysis

### 1. INTRODUCTION

Waste management is a serious issue that has been the concern of every country globally, including Malaysia. Improper waste management can cause environmental degradation [3]. Every year, the amount of waste generated kept increasing. For example, in Malaysia, 3,108.9 thousand tonnes of solid waste were produced in 2019 compared to 3,098.7 thousand tonnes in 2018 [4]. Rapid urbanization, industrialization, and increasing population directly affect the amount of waste generation. Also, various types and compositions of waste are generated which depend on various factors such as economic level, seasonal variations, weather and the culture of the community [7]. The more advanced the economic level, the more complex the waste is generated [13]. An average Malaysian produced 1.64kg of solid waste a day which is above average compared to the

worldwide generation of 1.2kg per person [7]. Therefore, the rate of waste generation in Malaysia is higher than other developing countries. The higher the rate of waste generation, the higher the cost to manage them. In Malaysia, the cost for solid waste management from collection until disposal is estimated at RM 148 per tonne per day for the landfilling method, while for the incineration method, it is estimated at RM 365 per tonne [15].

It is common to consider waste as an unwanted thing and has no value. Waste management is also seen to be the government's sole responsibility, forgetting that proper waste management is a public obligation and benefit [5]. Malaysia has taken this issue of solid waste management seriously over the years. However, there is still insufficient storage, illegal dumping, toxic and hazardous material disposal, inefficient disposal site space, and a low recycling rate. For example, in Klang Valley, there are many issues related to solid waste management such as there exist illegal dumping sites in Teluk Gong, Meru and Sementa [17]. Moreover, Sungai Klang is the most polluted and dirtiest river in Malaysia, where many wastes are disposed of. This issue of solid waste management should be taken care of before it becomes more severe than now.

The general problem is the perception of the local community towards solid waste disposal in Malaysia. Their perception has made solid waste management difficult to be managed and causes a serious challenge to waste management companies and local authorities. For a change to take place, people must realize and change their perception and attitude towards solid waste management. Change in habits, behavior and public participation is also an important aspect in waste management besides technical and economic aspects. It is the responsibility of every individual and institution to ensure a clean environment. Hence, the need for environmental education and awareness becomes paramount as an essential measure to curtail the situation to a greater extent and to achieve sustainability in solid waste management.

Nowadays, the government or non-government organization has made much effort to raise awareness towards environment and solid waste management. So, it is an important task to analyze the awareness of the community since it can present significant results that can serve as a reference for making necessary decisions about policy or education. Therefore, this research is to look into environmental awareness in the aspects of knowledge, attitude and behavior towards solid waste management in Klang Valley.

## **2. MATERIAL AND METHOD**

### **2.1 Study location**

The study location is Klang Valley. Klang Valley is a highly urbanized area at the center of the Malaysian Peninsular which comprises Kuala Lumpur, Putrajaya, and its surroundings. [2]. The population in Klang Valley is estimated to be 7.564 million as of 2018 [20].

### **2.2 Sample**

The sample population is randomly selected in Klang. Collecting data from the entire population may not be feasible. A large sample may increase the odds that the response correctly represents the entire population. Therefore, this research involved 102 people who responded to the survey. The sample size is acceptable as the minimum is 100 [12].

### 2.3 Research Questionnaires

The research was carried out using questionnaires as the data collection instrument. The questionnaires included 37 closed-ended questions and were administered online. It is believed that closed-ended questions probably limit the responses to the topics. The questions were developed using various published literature as references.

The questionnaires consisted of 5 sections which were demographic information, general concern, environmental knowledge, attitude and behavior towards solid waste. For demographic information, there are a total of 5 multiple choice questions, which consist of gender, age group, level of education, race and monthly income. The general concern section includes two multiple-choice questions to gain information on whether the respondents are aware of the current environment issues and to recognize which issues concern them the most. Next, regarding the knowledge section, a total of 10 questions were written. They are all multiple-choice questions that consist of yes or no answers. Then, for attitude and behavior sections, both contain ten questions. All ten questions were in Likert- scale form carrying five options which are strongly agree, agree, no opinion, disagree and strongly disagree for attitude section while the options for behavior section are almost always, often, sometimes, almost never and never. It is also worth noting that some of the questions are negatively worded. The benefits of mixing positively with negatively worded are to reduce acquiescence bias [3].

### 2.4 Validity and reliability of the questionnaires

To ensure the validity of the questionnaires, expert advice was sought from an assistant professor at International Islamic University Malaysia. She ensured that all the questions were following the scope of the study before administering them.

Next, the reliability of the questionnaires was tested using the Cronbach Alpha test. It is important to test the reliability of the questionnaires to make sure that it will produce the same result if measurement is to be taken again. Cronbach Alpha Values below 0.50 indicate low reliability, moderate reliability between 0.50 and 0.70, good reliability between 0.70 and 0.90, and excellent reliability above 0.90 [16]. Table 1 shows the Cronbach Alpha value for knowledge, attitude and behavior sections. Based on Table 1, the questionnaires developed are moderate and highly reliable.

Table 1: Cronbach Alpha values

Scale	No of items	Value
Knowledge	10	0.635
Attitude	10	0.701
Behavior	10	0.751

### 2.5 Data collection and scoring of responses

The data is collected using an online survey which was created using Google Forms. The link to the survey is given to people who live in Klang Valley randomly. The access to the link was closed when the number of respondents reached 100. For knowledge section, scoring depends on the frequency of the yes or no in each question. For the attitude and behavior sections, the mean was calculated, and the level's categorization is determined. Table 2 shows

the category of the level of attitude and behavior. The categorization was made by using the range of the mean by [11]. Lower levels are between 1.00 to 2.33, the medium level is between 2.34 to 3.66 while higher levels are between 3.67 to 5.00

Table 2: Category of the level for attitude and behavior.

<b>Criteria</b>	<b>Range of mean</b>
Low	1.00 to 2.33
Medium	2.34 to 3.66
High	3.67 to 5.00

## 2.6 Data analysis

The data collected was sorted using Microsoft Excel and analyzed using Statistical Packages for Social Science (SPSS) Software for statistical analysis version 26. The statistical analysis used in this research are descriptive, frequency and Principal Component Analysis which are done using SPSS software

## 3. RESULT AND DISCUSSION

### 3.1 Demographic information

This research has gathered demographic information of the respondents in Klang Valley which are presented in Table 3. Analysis of the demographic characteristics of the respondents showed that male respondents comprised 48% of the sample size, whereas 52% are female. The number of male and female respondents were almost the same. Next, the age distribution of the respondents shows that 12.7% of the people were from the age group of 16-20 years, 24.5% were from the age group of 21-25, 37.3% were from the 26-35, 13.7% were from the age group of 36-40 and 11.8% were from the age of 41 and above. Majority of the respondents' ages are between 26 to 35 because the range of age is bigger than other age groups. Furthermore, the finding shows the educational background of the respondents as well. It is reported that 14.7% of the respondents are from SPM, 3.9% are from diploma, 22.5% are still undergraduates, 29.4% are from degree and the remaining 29.4% are from postgraduates. The respondents are more likely to answer the survey if they have a degree or above. The possible reason is that they had done a survey during their study and they understand the significance of the high number of respondents towards the survey. Regarding the race of the respondents, majority of the respondents are Malay which comprised 71.6% of total respondents while Chinese comprised 16.7% and Indian 11.8%. The possible reason for the high number of Malay respondents is due to more Malay receiving the link. Regarding the monthly income of the respondents. 38.2% are from B40 which is the low-income group, 39.2% are from M40, middle-class, while the remaining 22.5% are from T20, which is the high-income group.

Table 3: Demographic information of respondents.

Characteristic		Number of respondents	Percent (%)
Gender	Male	49	48
	female	53	52
	Total	102	100
Age	16-20	13	12.7
	21-25	25	24.5
	26-35	38	37.3
	36-40	14	13.7
	41 and above	12	11.8
	Total	102	100
Level of education	SPM	15	14.7
	Diploma	4	3.9
	Undergraduate	23	22.5
	Degree	30	29.4
	Postgraduate	30	29.4
Total	102	100	
Race	Malay	73	71.6
	Chinese	17	16.7
	Indian	12	11.8
	Total	102	100
Monthly income	B40	39	38.2
	M40	40	39.2
	T20	23	22.5
	Total	102	100

### 3.2 General concern on environmental issues

In this section, on questions regarding awareness towards recent environmental issues in Klang Valley, the majority of the respondents which comprised 79.4% are aware, 12.7% are not sure while the remaining 8% are not aware. Most respondents are well aware of the current environmental issue, their factors and implications as some of the effects of the issues such as water pollution, waste management, climate change and air pollution are obvious. In Klang Valley, issues related to water pollution is pollution in the Klang River, climate change is the heatwave, air pollution is the haze while for solid waste is the generation of the solid waste itself. Figure 1 shows the result of awareness towards recent environmental issues in Klang Valley.

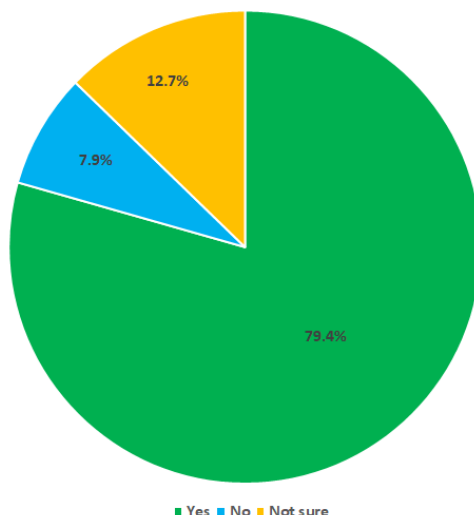


Figure 1: Awareness towards recent environment issue

Figure 2 shows the environmental issues which concern the respondents the most. Based on figure 2, water pollution is the most concerning issue as 62 (60.8%) respondents chose this issue. The second issue is the increase in waste generation with 23.5% (24), the third issue is climate change with 8.8% (9) and the last issue is air pollution with 6.9% (7).

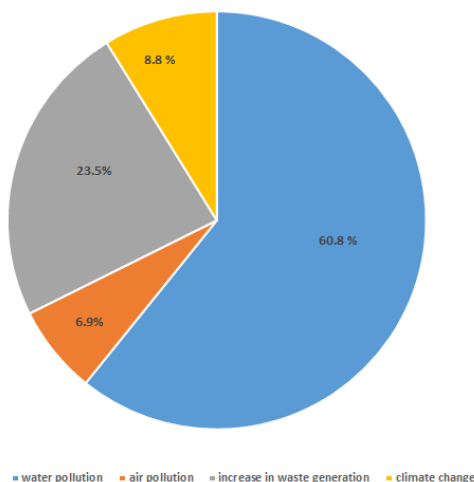


Figure 2: Environmental issues which concern the most

Water pollution is chosen the most as most of the respondents are well aware regarding the factors and consequences of water pollution that occurs in Klang Valley. The biggest example is the Klang River, the most polluted river in Malaysia. The causes of water pollution are industrial discharge, agricultural, municipal sewers, sand mining, landfill, or urban runoff, wet markets and construction. The second issue which concerns the most is the increase of solid waste generation. This study shows that the respondents are aware of the serious outcome of poor solid waste management practices. This may be due to waste generation in Klang Valley being high and the existence of several illegal dumping sites in Klang Valley, such as in Port Klang [10]. Next, climate change is rated as the third most concerning issue, the respondent may not realize the causes and implications of extreme weather. The possible reason is that

Malaysia experienced a tropical rainforest climate throughout the year [15]. Also, the weather Malaysian experienced is consistent hot and humid, so they may not be able to relate with climate change such extreme heat. On the other hand, air pollution is the least concerning issue. For most of the respondents, they may not realize the causes and negative effects of air pollution. One possible explanation is that Malaysia tackle air pollution issues faster and earlier compared to other Asian countries and Malaysia's air quality is quite good [21]. The second issue which concerns the most is the increase in solid waste generation. This is probably due to the existence of illegal dumping site such as in Port Klang.

### 3.3 Awareness towards solid waste management in Klang Valley

The evaluation of environmental awareness toward solid waste management is based on three variables which are knowledge, attitudes and behavior or practice as mentioned in the introduction in this report.

#### 3.3.1 Knowledge toward solid waste management

Figure 3 shows the result of the survey on knowledge towards solid waste management. It shows that all 102 respondents know that waste pollutes the environment, as all of them answer yes on Question 1. On the question of whether waste can be a resource or not, 98 (96.1%) of the respondents indicated Yes, while 4 (3.9%) indicated No. The study revealed that all 102 (100%) respondents answered yes on whether waste can be sorted or not. Next, on whether respondents understand the 3R campaign, 93 (91.2%) indicated Yes, while 9 (8.8%) indicated No.

Among the respondents, 93 (91.2%) knew about the implications of improper waste management, while 9 (8.8%) did not. On the question of whether respondents know about the effect of open burning of generated waste towards the environment, 101 (99.0%) answered yes, while 1 (1%) answered no. Then, on awareness of e-waste, 63 (61.8%) ticked Yes while the remaining 59 (57.8%) ticked No. 59 (57.8%) respondents did not know how to dispose of e-waste while the remaining 43 (42.2%) knew about it. Also, 81 (79.4%) knew about waste segregation while the remaining 21 (20.6%) did not. Finally, 56 (54.9%) respondents believe that waste management in the city is the sole responsibility of the local authority.

Based on the responses, almost all the respondents indicated Yes which are a good response for questions 1 to 6 and 9. It shows that the respondents understand the effect, method, campaign done and several complications of improper waste management. It is not surprising as most of the respondents are aware of the current environmental issues which may be related to questions 1 to 6. Majority of the respondents are aware of e-waste however, more than half of the respondents did not know the correct disposal method of e-waste. In Malaysia, e-waste management is still in the early stages and despite the increase in the usage of electrical appliances, there are still flaws in the management and its disposal mechanism [14]. Then, more than half of respondents believe that solid waste management is not the sole responsibility of local authorities. This contrasts with the findings by Kwarteng (2017), which found that the majority of the respondents believe it is the responsibility of local authorities. The belief that SWM is the sole responsibility of local authorities has made people less concerned about waste management practices [22]. Overall, the majority of the respondents highly knowledgeable about solid waste management except for e-waste.

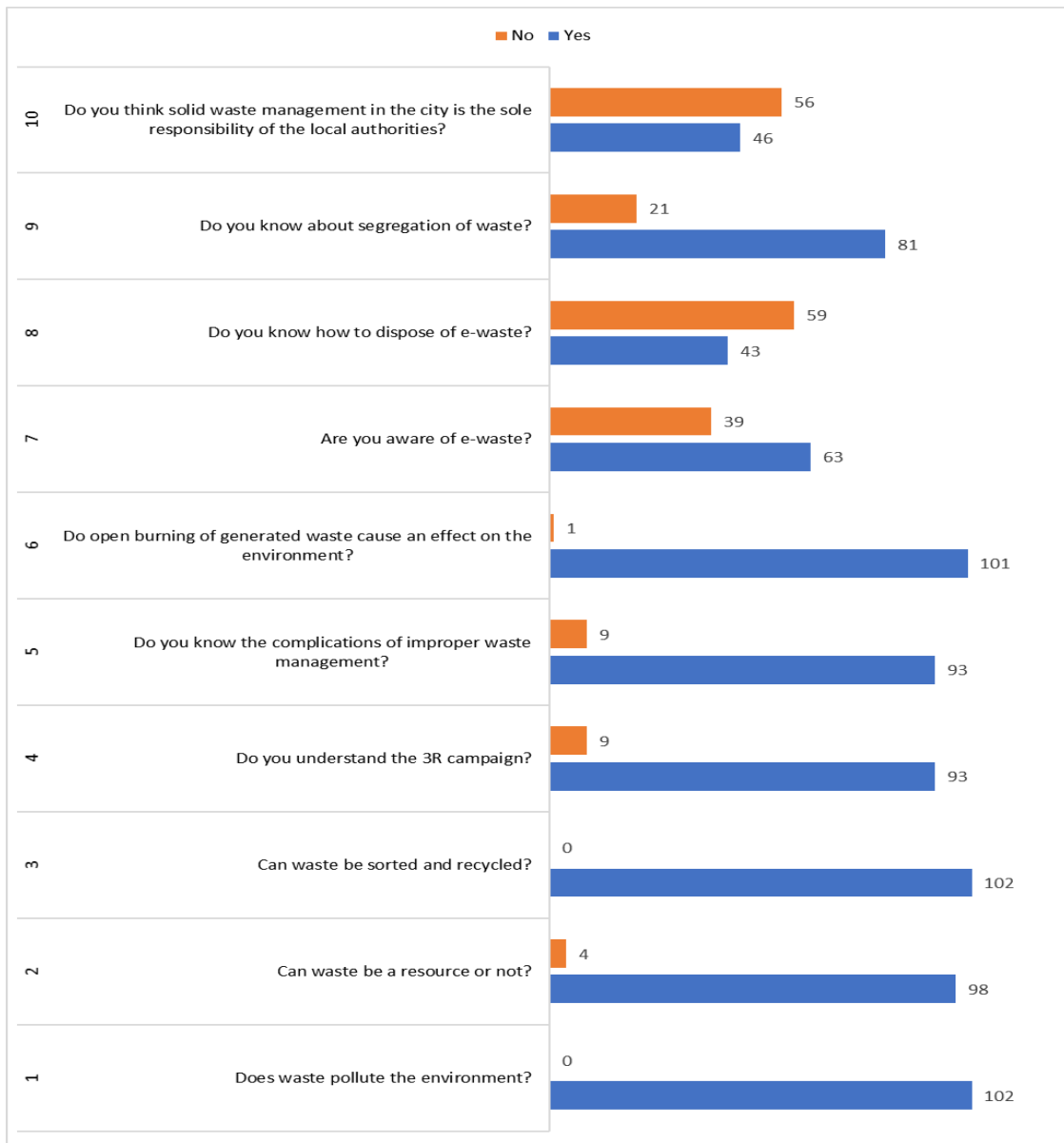


Figure 3: Respondents’ respond on knowledge towards solid waste management.

### 3.3.2 Attitude towards solid waste management

A total of 10 Likert scale questions were included in this section of the survey. The mean of each respondent is calculated to evaluate the level of attitude towards solid waste management. The level of attitude is determined based on the mean shown in table 2. Table 4 shows the respondents’ attitude level’s frequency distribution. Based on Table 4, the calculated mean for the attitude sections is 1.85 and it is in the low level. This indicate that the attitude towards solid waste management in Klang Valley is low. This is contrary to the findings of Laor et.al (2017), which found that the level of attitude towards solid waste management in Thailand is moderate. The probable reason for low level even though most of them are knowledgeable is



that some of the respondents are still clueless about intrinsic value of the waste and perceived waste as an unwanted material.

Table 4: Respondents' attitude level's frequency distribution.

Level							
Low		Medium		High		Mean	Category
N	(%)	N	(%)	N	(%)	1.85	Low
60	58.8	42	41.2	0	0		

### 3.3.3 Behavior towards solid waste management

A total of 10 Likert scale questions were included in this section of the survey. The mean of each respondent is calculated to evaluate the level of attitude towards solid waste management. The level of behavior is determined based on the mean shown in table 2. Table 5 shows the respondents' behavior level's frequency distribution. Based on Table 5, the calculated mean for the behavior sections is 2.66, and it is in the medium level mean value. This indicates that the behavior towards solid waste management in Klang Valley is moderate. The level of behavior is determined based on the mean shown in table 2. This is in line to the findings of Laor et.al (2017), which found that the level of behavior towards solid waste management in Thailand is moderate. The probable reasons for medium level of behavior are that some of the respondents still practice illegal dumping and they are not actively participating in environmental actions or reporting to local authority regarding any violation or problem related to SWM.

Table 5: Respondents' behavior level's frequency distribution.

Level							
Low		Medium		High		Mean	Category
N	(%)	N	(%)	N	(%)	2.66	Medium
29	28.4	69	67.7	4	4.0		

### 3.4 Principal Component Analysis

Principal Component Analysis (PCA) is to reduce the relatively large numbers of variables into smaller variable numbers by grouping them as well as retain most of the information which is related to our research. PCA requires continuous data [6]. For this research, both the attitude and behavior section have continuous data as we are using a 5- point Likert scale. The 5-point Likert scale is considered continuous data as it belongs to the interval scale category [1]. For knowledge sections, PCA will not be applied as the data collected are binary or categorical [9].

### 3.4.1 Eigenvalues and Scree Plot for attitude section

Identification of the principal components depends on the eigenvalue and scree plot. The eigenvalues of the data are given in Table 7. Component with eigenvalue 1 or more is chosen as the principal component. From the Table 7, the first three component are the principal component. The total variability of the first three components is 60% which is acceptable as the minimum is 60% [8]. These three components explain nearly 60% of the variability in the original ten variables. Thus, most of the data can be captured in these underlying dimensions. According to the Scree Plot shown in Figure 4, it is unclear whether keeping two or three components is better as components 2 and 3 are above the elbow. However, if two components are chosen, the total variance explained will drop to 49%, which is less than the minimum, 60%. So, we decided that three principal components best describe our data matrix as they have more impact on the attitude towards the environment.

Table 7: Total variance explain for attitude section.

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.478	34.783	34.783
2	1.429	14.286	49.069
3	1.092	10.921	59.990
4	.872	8.717	68.707
5	.780	7.804	76.511
6	.662	6.625	83.136
7	.564	5.639	88.775
8	.492	4.916	93.690
9	.374	3.739	97.429
10	.257	2.571	100.000

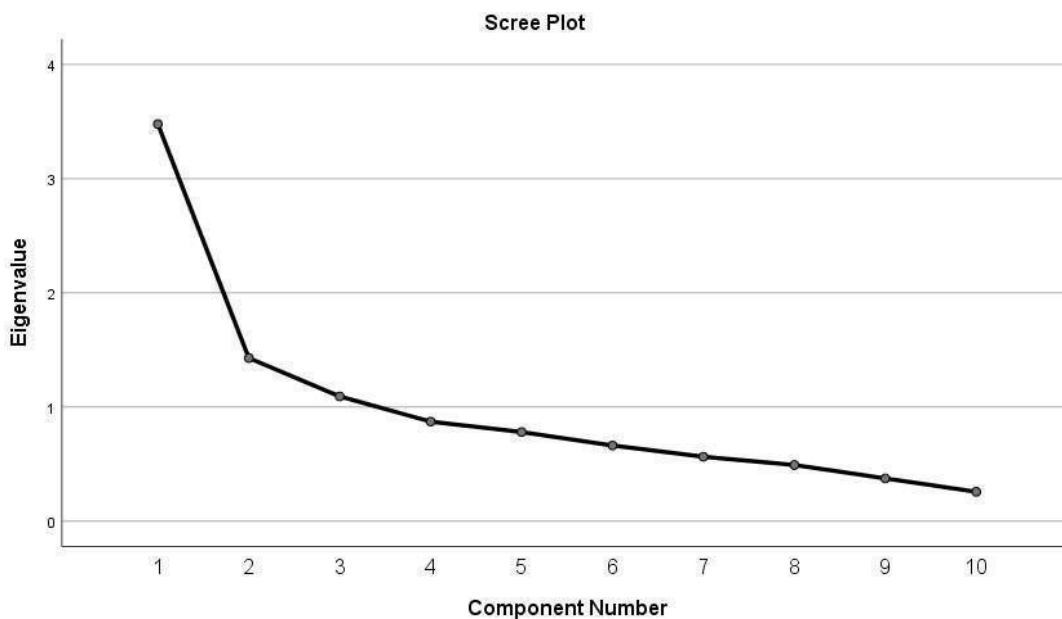


Figure 4: Scree plot of Eigenvalue vs Component Number for determining the number

of PCs in attitude section.

### 3.4.2 Rotated component matrix for attitude section.

Rotated component refers to the loading which component represents. Table 8 shows the Rotated Component Matrix for attitude data. In the attitude section, questions 1 to 5 and question 9 load highly on the principal component (PC1). PC1 can best be described as conscious of implications. This component accounted for 34.9% of the variability of the ten variables. Next, loading highly on the principal component (PC2) is questions 6,7 and 8. This component accounted for 14.2% of the variability of the ten variables. Therefore, this component can be best described as incomprehension towards proper waste management. Some 10% of the variation of the sample is accounted for by PC3. Only question 10 loaded highly on the principal component (PC3). PC3 can best be described as regulations of pollution and industrial growth.

Table 8: Rotated Component Matrix for attitude data

Question	Principal Component		
	1	2	3
1	.737	.416	.156
2	.716	.092	.199
3	.687	-.123	.015
4	.648	.437	-.268
5	.587	.258	.395
6	.009	.749	.072
7	.242	.675	.119
8	.495	.519	-.186
9	.485	-.510	-.118
10	.086	.077	.891

### 3.4.3 Eigenvalues and Scree Plot for behavior section

Identification of the principal components depends on the eigenvalue and scree plot. The eigenvalues of the data are given in Table 9. Component with eigenvalue 1 or more is chosen as the principal component. From 9 table the first four components are the principal component. The total variability of the first four components is 72% which is acceptable as the minimum is 60% [8]. These four components explain nearly 72% of the variability in the original ten variables. Thus, most of the data can be captured in these underlying dimensions. According to the Scree Plot shown in Figure 5, it is unclear whether keeping three or four components is better. However, if three components are chosen, the total variance explained will drop to 61%, which is less than the minimum. Using PCA is to reduce the dimensions while keeping the maximum variable of the original data set. So, we decided that four principal components best describe our data matrix as they have more impact on the behavior towards the environment.

Table 9: Total variance explain for behavior section.

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.769	37.691	37.691
2	1.263	12.631	50.322
3	1.101	11.009	61.331
4	1.074	10.737	72.068
5	.743	7.429	79.497
6	.575	5.750	85.247
7	.467	4.667	89.914
8	.435	4.351	94.265
9	.298	2.978	97.243
10	.276	2.757	100.00

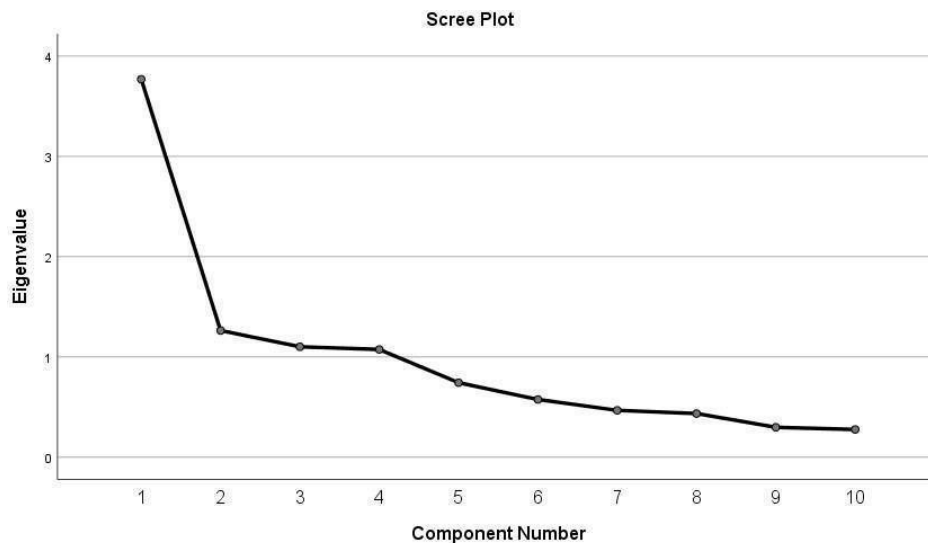


Figure 5: Scree plot of Eigenvalue vs Component Number to determine the number of components for behavior section.

#### 3.4.4 Rotated component matrix for behavior section

Rotated component refers to the loading which component represents. Table 10 shows the Rotated component matrix for behavior data. In this section, questions 1 to 4 loaded highly on the principal component (PC1). This component accounted for 37.7% of the variability of the ten variables. So, PC1 can best be described as attentiveness towards the surroundings. Next, loaded highly on the principal component (PC2) is questions 5 to 7. This component accounted for 12.6% of the variability of the ten variables. Therefore, this component can be best

described as participation in environmental action. Some 11% of the variation of the sample is accounted for by PC3. Questions 8 and 9 loaded highly on the principal component (PC3). Spending on eco-friendly products is best to describe the PC3. Regarding the principal component (PC4), which accounted for 37.7% of the variability of the ten variables, question 10 loaded highly on it. Therefore, PC4 can be best described as illegal dumping.

Table 10: Rotated Component Matrix for behavior data.

Question	Principal Component			
	1	2	3	4
1	.831	.118	.199	.061
2	.721	.264	.011	-.303
3	.655	.009	.278	.086
4	.551	.532	.105	.019
5	.021	.851	.019	-.196
6	.118	.740	.423	.213
7	.450	.619	.075	.081
8	.112	.148	.882	-.016
9	.310	.105	.796	-.175
10	-.002	.004	-.117	.960

#### 4. CONCLUSION

The study sheds some insight into solid waste management awareness based on knowledge, attitude, and behavior. Overall, it has been discovered that solid waste management awareness among the community in Klang Valley is getting better and is still improving. This survey shows that 79% of the respondents are aware of the recent environmental issues in Klang Valley. Even though environmental awareness is not the only aspect that leads to environmental action, the result from this study is crucial to show the awareness towards the current environmental issues in Klang Valley. From this study, it can be concluded that respondents concern the most on water pollution because the respondents have experienced the effect of water pollution personally. This study shows that the respondents are knowledgeable on solid waste management. Almost 100% of the respondents answered yes with the least percentage to respond yes is at 80% except for e-waste. For e-waste, only 61.8% of the respondents are aware, and only 42.2% of the respondents know how to dispose of them. This provides evidence that both government and non-governmental organizations should develop initiative to raise awareness on e-waste and enhance e-waste management in Malaysia. In contrast, this study also revealed that the level of attitude and behavior towards solid waste management is low and moderate even though they have knowledge on solid waste management. This shows that it is apparent that there is a necessity to develop an attitude towards solid waste management. However, it is nearly impossible to rely entirely on government initiatives to change people's attitudes and behaviors regarding solid waste management. The government has actively encouraged environmental action to address with the variety of global environmental problems, Therefore, encouraging environmental attitudes and behavior must begin from home and childhood.

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