## RESEARCH ARTICLE

# Waste separation behaviours at source among UiTM student: An application of Theory of Planned Behaviour

**Nur Azmiera Afiqah Samsudin[1], Muhammad Afiq Zaki[1], Farah Ayuni Shafie[1], Nadiah Wan Rashdi[2,3], Siti Rohana Mohd Yatim[1]\***

*[1]Centre for Environmental Health and Safety Studies, Faculty of Health Sciences, Universiti Teknologi MARA Cawangan Selangor Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia; Affliation ; [2]Faculty of Fisheries and Food Sciences, UMT,21300 Kuala Terengganu, Terengganu; [3]Institute of Tropical Biodiversity and Sustainable Development, UMT,21300 Kuala Terengganu, Terengganu*

**\*Corresponding Author**

Siti Rohana Mohd Yatim
Email:
sitirohana@uitm.edu.my

**Abstract:**

A study on waste separation at source behaviour was conducted among students to determine the factors that most influence their intention to conduct source separation behaviour. In this cross-sectional study, 197 undergraduate students from Faculty of Health Sciences, UiTM were involved. An online questionnaire was administered for assessing socio-demographic and Theory of Planned Behaviour (TPB) constructs which composed of attitude, subjective norms, perceived behavioural control (PBC), separation intention, and waste separation behaviour. The findings demonstrate that subjective norms are the factor that most influence the intention to perform waste separation behaviour, whereas PBC is the critical factor that directly influences the waste separation behaviour. The necessary infrastructure should be rationally and adequately provided, and in order to improve the norms, a comprehensive education and promotion campaign should be implemented and widely disseminated to increase people's understanding of the need of waste segregation.

**Keywords:** Theory of Planned Behaviour (TPB), university's student, waste separation behaviour.

## 1. INTRODUCTION

Municipal solid waste (MSW) management has been and will continue to be one of the significant issues faced by countries worldwide, especially in developing countries including Malaysia. Ballooning population, rapid urbanization and industrialization in urban areas are the major factors that contribute to the rise of MSW amount (Yousefloo, A., & Babazadeh, R., 2020; Artiola et al. 2019). Waste generation rate are proportional to the social standards as the more wealthy and advanced the individuals or societies, the more waste are produced. However, the rise of MSW quantity does not cause any changes in the method of disposal as Malaysia still depends on landfilling, which is the least preferred option in the hierarchy of solid waste management.

Separation at Source Initiative (SSI) under the Solid Waste and Public Cleansing Management Act 2007 (Act 672) has been launched and became effective in September 2005. It requires Malaysians to participate by practicing waste separation at home as it is under the responsible consumption and production goals category. Corresponding to the government's effort, Solid Waste Management and Public Cleanliness (SWCorp) Malaysia also has executed SWCorp Strategic Plan 2014–2020, which emphasises on mind set, behaviour and culture, collaboration and synergy, policy and regulations, organizational capacity, technology system and facilities, law enforcement, and delivery system and at the same time to achieve the objectives stated in National Solid Waste Management Policy (Moh et al.,2017).

Although the Malaysian government is committed to improving this significant issue, based on current statistics of solid waste generation, it indicates that the awareness among the public is still low and according to Yoke et al.(2019), in the year 2017, only 17.5% of Malaysians reduce their waste through waste segregation although the SSI has been introduced. Moh et al. (2017), also stipulated that public participation and commitments in practicing waste separation at source is still lacking among Malaysians due to the deficiency of civic responsibility coupled with their perception towards local authorities as the only responsible party in maintaining the MSW problem.

Current practice in disposing solid waste further aggravates the situation as the method can be considered as the least effective compared to other methods. Even though it is commonly implemented in Malaysia, there is a great number of immoderate landfills without appropriate bottom liners, leachate collection, or treatment system. Based on the data published by SWCorp (2019), there are a total of 311 landfills where 146 are operated landfills while the rest, 165 are non-operated landfills. However, out of 146 operated landfills, only 18 were categorized as sanitary landfills. As landfilling

is the least preferred option in the hierarchy of solid waste management, various downside to human and environment can be found by applying this system. From previous studies, it was proved that the by-products of landfill treatment which are leachate and landfill gas posed negative impact to the environment and human health (Hussein et al., 2021; Shabdin et al., 2019).

To address this problem, every party including the citizens themselves need to play their role in ensuring that MSW can be reduced. One of the best ways to overcome this issue is by recycling, where the separation of waste at the source is necessary as a prerequisite (Zhang et al., 2015). Basically, waste separation is a practice, which requires considerable efforts in individuals to sort, assemble and store their waste (Ayob & Sheau-Ting, 2016). National and local government have to be the front-liner to make this movement achievable by encouraging high level public participation since it requires changes of norm or behaviour for every person to segregate their waste at source. However, most of the efforts taken by the government are focussed more on households rather than to the younger generations such as students.

The approach taken in the effort to enhance solid waste separation should be focused on the young generations. One of the reasons are university usually has a clear and appropriate solid waste management system. The management system of solid waste in the university commonly includes the management of the university and the students' communities, therefore, it is easier to determine stakeholders' responsibilities and strengthen publicity on university campuses rather than in residential areas. Next, it is due to a similar generation of types of waste in a certain concentrated key location. These factors cause source separation system in campuses to becomes uncomplicated and comparably easier to operate. They also can act as source separation forerunners as they are young and highly educated, which can be considered as an advantage as it results in a better understanding of proper waste segregation and the adoption of new processes to achieve environmental sustainability (Zhang et al., 2017).

Several factors have to be taken into consideration as the decision of waste separation is assumed as a tedious task. Therefore, theory-based studies are needed for a better comprehension regarding the mechanism that is responsible for separation behaviours (Zhang et al., 2015). Adhering to the requirement, theory of planned behaviour or TPB as in Figure 1, provides a theoretical framework to aid identifying the factors that influence the decision of waste separation in individuals as the theory has been broadly used to determine waste behaviours (Hasan et al., 2015; Xu et al., 2017; Zhang et al., 2017). According to the theory, individual behaviour is guided by three considerations which are the belief about the likely outcomes of the behaviour (attitude), the belief of normative expectations of others and the motivation to comply to the expectation (subjective norm) and the belief of the presence of the factors that facilitate or impede the behaviour performance and the perceived power of these factors (perceived behavioural control (PBC) (Razali et al.,

2020). The combination of these factors in general may lead to the formation of behavioural intentions. Xu et al. (2019) justify that PBC is the determinant that can directly anticipate the behaviour. As to improve the predictive validity of the TPB, some studies have recommended adding another variable such as environmental knowledge and situational factors (Ayob et al., 2016; Hasan et al., 2015; Ma et al., 2018). However, most of the previous studied conducted were forcussing on waste separation among household (Ma et al., 2018; Nguyen et al., 2015; Taherzadeh et al., 2019). Very limited number of studies have been conducted among young generations in Malaysia. Therefore, the aim of this study was to determine and evaluate the influential factors that have most influence on source separation behaviour among university students as the young generation group at UiTM Puncak Alam, Selangor by application of Theory of Planned Behaviour (TPB).
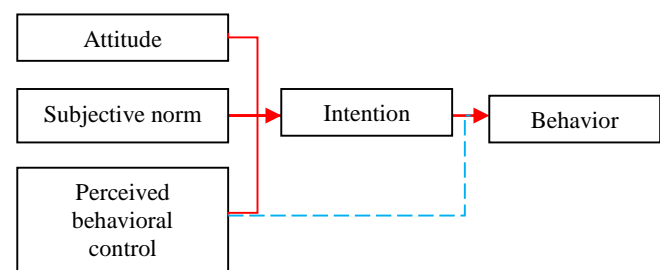


Figure 1. The model of the Theory of Planned Behaviour (TPB)

## 2. MATERIALS AND METHODS

This study is a quantitative study and the design of the study is a cross-sectional study. Based on Cherry et al. (2019), cross- sectional studies are commonly used in developmental psychology such as individual's beliefs, attitude and behaviour. Therefore, this type of research design was selected to describe the prevalence of waste separation behaviour among university students specifically in UiTM Puncak Alam, Selangor.

The data was collected within three months, particularly from October until December 2020 and convenience sampling was employed where the students were conveniently available to participate in the study. Generally, non-probability sampling does not rely on a random selection as in probability sampling, so, the participants can be biased as they do not belong to the population required in the study (Vehovar et al., 2016). To counter this issue, more samples are taken, and inclusion and exclusion criteria of the samples have been set before the data was collected. Undergraduate and full-time students from Faculty of Health Sciences in UiTM Puncak Alam were the sample population in this study. The number of samples involved for this study was 201 samples as its population size is 418. Unfortunately, author received only 197 responses from the respondent.

An online questionnaire was utilized as the survey instrument to obtain the information from respondents in order to answer

the research question in this study. The questionnaire adopted questions mainly from Karim Ghani et al. (2013) and Razali et al.(2020).  It was administered through an online survey form, namely Google Form. It was posted in social media that have relation with the study population in order to avoid respondents which do not fall under the category of the study population.

The questionnaire consists of six sections namely the demographic information, specific attitude, subjective norms, PBC, behavioural intention and waste separation behaviour and it is a series of close ended questions. The questions were provided with summated rating scale, which was one of the attitudinal scales designed to measure the behaviour of respondents towards waste separation. Respondents can categorize their agreements using a five-point scale, where one indicates "strongly disagree and five signifies "strongly agree". Some of the questions was adapted from the previous study that was related to waste separation and TPB.

## 2.1 Pilot Study

Online questionnaire was distributed to a total of 30 students who were not included in the actual experiment as a pre-test. This pre-test can be referred as piloting a questionnaire process as it aims to test various aspects of the survey including the questionnaire. It also helps in increasing the internal validity of the questionnaire and essential to determine the indicators and the questionnaire suitability as a whole by evaluating using internal consistency or reliability approach, namely Cronbach's alpha in IBM Statistical Program for Social Sciences (SPSS) Statistics (Version 21). The result from the analysis conducted showed that the questionnaire was reliable as the result was 0.928. According to Ursachi et al. (2015), reliability coefficient values ($\alpha$) of 0.8 or greater indicates very good level of reliability.

## 2.2  Statistical Analysis

Analysis of data was performed by using SPSS (Version 21). Cronbach's alpha test was firstly applied to identify the reliability of the online questionnaire provided to the respondents as to ensure every question under a variable is measured under similar underlying attributes. Descriptive statistics specifically the frequencies were used to describe the respondents' socio-demographics data and the mean score for influential variables. To determine the relationship and the strength of relationship between the determinants or predictor and the students' behavioural intention, bivariate analysis, particularly Spearman's correlation was applied as it was not normally distributed.

Even though the data was skewed based on Y-axis, the multiple regression analysis was feasible and was carried out. The non-normality data of unconditional variables such as questionnaires-based subject in this study does not cause any disqualification based on the central limit theorem, as the linearity of y-x were observed between the predictors and perceived behavioural control (PBC) (Gillespie, C.S, 2014).

Therefore, the multiple regression analysis was substantially beneficial in highlighting the most influencing predictors of waste separation at source behaviour among students

## 3.  RESULTS AND DISCUSSION

### 3.1 Questionnaire data and demographic features

The demographic data extracted from the field of questionnaire was tabulated in Table 1. A total of 197 respondents that answered the administered online questionnaires are full-time students from Faculty of Health Sciences. Full-time students can be referred as students that spend more time in class during a semester compared to part-time students. It is one of the inclusion criteria in the selection of sample in this study. Most of the respondents were in the age group of 21-23 years (45.2%), followed by students aged 18-20 years (36.0%), 24-26 years (13.2%) and the least were students aged above 27 (5.6%). 83.2% of respondents are female and only 16.8% are male since the actual total number of male students in the population was less than female students.

Table 1. Respondent's demographic characteristics.

| Demographic attribute | Frequency, *n* | Percentage, *%* |
|---|---|---|
| *Age* | | |
| 18-20 | 71 | 36.0 |
| 21-23 | 89 | 45.2 |
| 24-26 | 26 | 13.2 |
| Above 27 | 11 | 5.6 |
| *Gender* | | |
| Male | 33 | 16.8 |
| Female | 164 | 83.2 |

### 3.2  Mean difference of factors influencing waste separation behaviour

There are three antecedents that influence one in performing a specific behaviour which include attitude, subjective norms, and PBC. These three factors will lead to the intention that is considered as motivational factors associated to a particular behaviour.

Waste separation behaviour was assessed among students through the application of TPB. According to Table 2, all variables under TPB were evaluated and majority of the respondents showed a positive response to the attitude variable as it was much higher that is 4.72 compared to the other variables. Generally, attitude is described as an individual evaluation being either positive or negative in performing a particular behaviour. Based on the questions asked, it indicated that majority of the respondents were interested in separating solid waste at source and they feel responsible to reduce the amount of waste generated. They

also opined that waste separation at source is useful, good for environment, sensible as well as rewarding. The plausible reasons for the finding was the current environmental-related knowledge which existed among students as it has been taught indirectly since primary education through the implementation of environmental values in the course outline in Malaysia. Overall, it explained that most of the students had positive perceptions and tendencies of exhibiting waste separation behaviour. According to Shen et al. (2019), young generations will become more aware of the importance of waste separation for they do have positive attitude towards the segregation of waste.

Table 2. Means of TPB variables.

| TPB Constructs | N | Mean ± SD |
|---|---|---|
| Attitude | 197 | 4.72 ± 0.53 |
| Subjective Norm | 197 | 2.40 ± 1.49 |
| Perceived Behavioural Control (PBC) | 197 | 2.74 ± 1.27 |
| Separation Intention | 197 | 2.55 ± 0.85 |
| Separation Behaviour | 197 | 2.22 ± 1.50 |

### 3.3 Correlations of TPB variables towards waste separation behaviour

Correlation among predictors; attitude, subjective norms, and PBC with the waste separation intention were identified. From the analysis, it indicated that there was a significant positive relationship among all the variable towards waste separation behaviour as the p-value is less than 0.005.
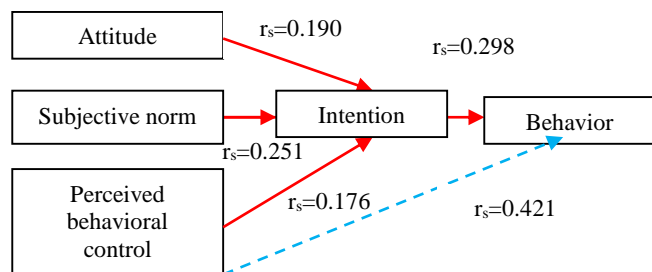


Figure 2. Correlation analysis in application of TPB framework in determination of waste separation behaviour.

Based on Figure 2, respondents' subjective norms were highly influential to the waste separation intention compared to the other two. Although its result was proven to be positively significant as it indicated higher coefficient value among the predictors, yet the relationship strength between this predictor and the intention were categorised as a weak correlation, followed by attitude, and PBC that fall under the very weak correlation category.

The result of subjective norm shows that majority of the students face social pressure among their family, friends,

fellow college residences, and colleagues. As the students stay in the college, friends, college residences and colleagues seem to influence more rather than their parents. This can be proven by the statement given by Zhang et al. (2015) which describes that these findings can be explained by the fact that most of the students spend more of their time with their friends than their parents. Therefore, it indicates that the development of social norms in the campus most likely to be effective in cultivating waste separation behaviour thus the more likeliness of the students to separate their waste as a daily habit. Shen et al. (2019) also points out that young people including students should ascertain that waste separation sorting is a social behaviour which everyone should actively participate. The MSW separation should be included in basic education so that it can be one of the teaching materials, even classes that may become a practice among students. When waste separation activity successfully becomes a habit, it is not impossible that these students will intentionally and forcefully promote waste sorting amongst their circle in the future. With this manner, it is possible that social civilization can continually be encouraged to create a cycle.

With regard to attitude, it also denotes significant positive effect on student's waste separation intention. This finding shows that even though the students recognize the benefits of waste separation and feel responsible in reducing the waste generated, their expression of intention do not show significant improvement as the correlation between attitude and intention showed very weak correlation. These results are similar to previous study conducted by Zhang et al. (2015) that reported the relations between attitude and intention among college students are partly accepted.

This implicit an individual who has a positive attitude towards waste segregation unnecessary lead to intention to perform waste separation behaviour. Nevertheless, by facilitating students to comprehend about the damage that occurs due to high generation of waste and enhancing their actual attempt to protect the environment would be worthwhile for improving their behaviour. Hence, the government, especially the local authority, should create awareness on the current situation of the environment caused by the municipal solid waste to the young generation such as students. Therefore, it can be an eye opener for them to change their behaviour. Also, by launching more field campaigns related to waste sorting, it will help students to have a better understanding on the performance of their actual efforts.

Another predictor of waste separation intention in performing segregation of waste is PBC. PBC is proven to have significant and positive effects although the strength of correlation between PBC and intention indicates very weak correlation compare to the other predictor. From the analysis conducted, it shows that more than half of the respondents (63.5%) clarify their agreement to do waste separation if there are incentives given to them, yet they agree waste sorting activity does not take much of their time. This clearly pointed out that the level of willingness among the students involved in waste separation at source activity is low even though they know the way to separate and the place to put them and type

of solid waste that can be recycled. This findings also can be related to the findings of Ridzuan et al. (2017) in their study regarding recycling behaviour among the residents' of a housing project in Kuala Lumpur where most of the residents do not practise recycling even there is an availability of recycling bins within their residential areas but are more prone to go to recycling facility where they can earn money.

This findings also quite similar to the research conducted by Shen et al. (2019), but they found that PBC as the second sgreatest among other predictive factors. However, both studies are contrary to Ma et al. (2018), who research on intentions and behaviour of public towards source separation in one of under-developed areas in China. According to Shen et al. (2019), the reasons of the difference may due to the education status itself, which is university students can be categorized as well-educated, have strong belief in own ability to accomplish and willingness to separate their waste rather than senior individuals.

Based on TPB, PBC and behavioural intention are two major factors that can predict behavioural achievements. As for this study, PBC is the strongest factors compare to waste separation intention in predicting waste separation at source behaviour among students.  PBC can be considered as a special determinant as it is able to directly influence the behaviour itself. However, the result of this study signify that PBC influence more on behaviour rather than intention, which contrast with the study conducted by Ari & Yilmaz (2016) where both, intention and behaviour are greatest affected. Consequently, Zhang et al. (2017) conclude that the more opportunities and possibilities a person perceives in carrying out a particular behaviour and the less challenges predicted, the greater the assumed behavioural regulation, making the behaviour more likely to occur.

Meanwhile, the correlation between separation intention and waste separation behaviour also convey significant and positive impact to the behaviour but the strength is weak compared to PBC that results moderate correlation with behaviour. This specify intentions in separating waste among students are not much influenced as the PBC. Since the PBC has greatest influence to the students, the obstacles that prevent students from implementing waste separation need to be identified and come out with a solution as soon as possible. As an example, facilities needed for waste separation activity such as specific bins like recycling bins should be adequately provided in the areas where mostly waste generated such as café and college, where students reside.

As a general rule, the more favourable of the attitude and subjective norm and the greater the PBC, the stronger the individual's intention to perform that particular behaviour or in short, intentions drive the behaviour of the individual, while attitude, subjective norm, and PBC are the three determinants that influence the intentions.

### 3.4 Factors that most influence waste separation intention

Subjective norms are proven to be the predictor that most influence the intention among students to commit in waste separation activity as their habit in daily live.  It was done by comparing each of the predictor or the determinant relative contribution in explaining the variance towards the intention that can be found out through the beta weight (ß) from multiple regression analysis conducted as shown in Table 3. Subjective norm with beta weight 0.200 is much higher compared to other two predictors, attitude, and PBC.

Since the subjective norm is the factor that most influences the students, the management of university and the government should concentrate promoting activities of waste segregation among the students, so that it can be a norm among them to segregate their waste. However, the impediment that restrains the students from carrying out waste sorting should be resolved earliest as PBC is the greatest factor that affects separation behaviour rather than intention. Once there is nothing that can hinder the students to perform waste separation, coupled with the high-level norms in waste sorting among the students, the waste separation behaviour can be enhanced and influence the future generation. With that, the environmental quality can be improved. As mentioned by Bashirun et al. (2016), the current students are the determinant of environment quality as they are the future generation that will be a leader in conducting green activities such as separation of waste.

Table 3. Multiple regression results between determinants**.**

| Factors | Beta, ß |
|---|---|
| Attitude | 0.130 |
| Subjective norms | 0.200 |
| Perceived behavioural control (PBC) | 0.125 |

### 4. CONCLUSION

Understanding the factors that motivate and influence the intention to perform segregation of waste among students is crucial in order to ensure young generation like students actively participate in this kind of activity. Segregation of waste can be considered as an urgent action that should be implemented by everyone as the amount of waste generated shows alarming situations that can cause various drawbacks to the environment and human health. Effective and efficient solid waste management is considered as compulsory at this level of situation, but still there is the presence of obstacles that may impede the action. Therefore, by determining the factors that influence the waste separation behaviour among the students by the application of TPB, it can help the authority such as the government and the management of university to identify the deficiency of their current efforts in enhancing the behaviour if segregating the waste and giving ideas for alternative approach to cultivate the awareness

among the public especially young generations like students. This study has revealed that subjective norm (ß= 0.200) is the factor that most influence the intention to perform particular behaviour while PBC is the most critical factor that directly affects the source separation behaviour among students. Thus, the corresponding infrastructure that is required should be rational and adequately provided, while to enhancing the norms, comprehensive education and promotion program should be effectuate and proliferate as to strengthen their awareness towards the importance of waste segregation.

## REFERENCES

Ari, E., & Yilmaz, V (2016). A proposed structural model for housewives' recycling behavior: A case study from Turkey. *Ecological Economics*, 129, 132–142.

Artiola, J. F. (2019). Industrial waste and municipal solid waste treatment and disposal. In *Environmental and Pollution Science* (pp. 377-391). Academic Press.

Ayob, S. F., & Sheau-Ting, L (2016). Key determinants of waste separation intention among students on campus. In MATEC Web of Conferences (Vol. 66, p. 00066). EDP Sciences.

Bashirun, S. N., Badrolhisam, N. I., Johari, F. S., Zolkapli, N. M., Samudin, N. M. R., & Jamian, F(2016). Students'green Perception and Behavior. *Malaysian Journal of Sustainable Environment,* 1(1), 40-51.

Cherry, K. How Does the Cross-Sectional Research Method Work? Retrieved on October, 11, 2020

Gillespie, C. S. (2014). Fitting heavy tailed distributions: the poweRlaw package. arXiv preprint arXiv:1407.3492.

Hasan, S. N. M. S., Harun, R., & Hock, L. K (2015). Application of Theory of Planned Behavior in Measuring the Behavior to Reduce Plastic Consumption Among Students at Universiti Putra Malaysia, Malaysia. *Procedia Environmental Sciences*, 30, 195–200.

Hussein, M., Yoneda, K., Mohd-Zaki, Z., Amir, A., & Othman, N (2021). Heavy metals in leachate, impacted soils and natural soils of different landfills in Malaysia: An alarming threat. *Chemosphere*, 267, 128874.

Karim Ghani, W. A. W. A., Rusli, I. F., Biak, D. R. A., & Idris, Am (2013). An application of the theory of planned behaviour to study the influencing factors of participation in source separation of food waste. *Waste Management*, 33(5), 1276–1281.

Krejcie, R. V., & Morgan, D. W (1970). Determining sample size for research activities. *Educational and Psychological measurement,* 30(3), 607-610.

Ma, J., Hipel, K. W., Hanson, M. L., Cai, X., & Liu, Y (2018). An analysis of influencing factors on municipal solid waste source-separated collection behavior in Guilin, China by Using the Theory of Planned Behavior. *Sustainable Cities and Society*, 37, 336–343.

Taherzadeh, M., Bolton, K., Wong, J., & Pandey, A. (Eds.). (2019). *Sustainable resource recovery and zero waste approaches*. Elsevier.

Moh, Y. C., & Abd Manaf, L (2017). Solid waste management transformation and future challenges of source separation and recycling practice in Malaysia. *Resources, Conservation and Recycling*, 116, 1–14.

Nguyen, T. T. P., Zhu, D., & Le, N. P (2015). Factors influencing waste separation intention of residential households in a developing country: Evidence from Hanoi, Vietnam. *Habitat International*, 48, 169–176.

Razali, F., Daud, D., Weng-Wai, C., & Anthony Jiram, W. R (2020). Waste separation at source behaviour among Malaysian households: The Theory of Planned Behaviour with moral norm. *Journal of Cleaner Production,* 271, 122025.

Ridzuan, M. R., Abd Rahman, N. A. S., Hussin, N. S., & Awang, N (2017). Recycling Endeavours Among the PPR Residents In Kuala Lumpur: A Qualitative Approach. *Malaysian Journal of Sustainable Environment*, 3(2), 117-138.

Shabdin, N. H., Tamunaidu, P., Rambat, S., & Mansor, M. R (2019). Greenhouse gas emissions trend in old landfill, Malaysia. *Chemical Engineering Transactions*, 72, 211–216.

Shen, L., Si, H., Yu, L., & Si, H (2019). Factors influencing young people's intention toward municipal solid waste sorting. *International journal of environmental research and public health*,16(10), 1708.

Ursachi, G., Horodnic, I. A., & Zait, A (2015). How Reliable are Measurement Scales? External Factors with Indirect Influence on Reliability Estimators. *Procedia Economics and Finance*, 20(15), 679–686.

Vehovar, V., Toepoel, V., & Steinmetz, S. (2016). Non-probability sampling. *The Sage handbook of survey methods*, 329-345.

Xu, L., Ling, M., Lu, Y., & Shen, M (2017). External influences on forming residents' waste separation behaviour: Evidence from households in Hangzhou, China. *Habitat International*, 63, 21–33.

Yoke, C. C., Mun, Y. W., Munusamy, K., Peng, L. M., Nair, M., & Yean, U. L (2019). Government Initiatives and Public Awareness on Sustainable Environment. *Journal of Tourism, Hospitality and Environment Management*,2019, 4(14), 40–50.

Yousefloo, A., & Babazadeh, R (2020). Designing an integrated municipal solid waste management network: A case study. *Journal of Cleaner Production*, 244, 118824.

Zhang, D., Huang, G., Yin, X., & Gong, Q. (2015). Residents' waste separation behaviors at the source: Using SEM with the theory of planned behavior in Guangzhou, China. *International journal of environmental research and public health*, *12*(8), 9475-9491.

Zhang, H., Liu, J., Wen, Z. G., & Chen, Y. X. (2017). College students' municipal solid waste source separation behavior and its influential factors: A case study in Beijing, China. *Journal of cleaner production*, *164*, 444-454.