

# Attributes in Fostering Waste Segregation Behaviour

Tee Sin-Yee and Low Sheau-Ting

**Abstract**—This study focuses on attributes to foster waste segregation behaviour in organization. Recycle can reduce the amount of waste in sustainable way. Segregate the waste before recycling is important to avoid contamination of waste which could diminish the value of recycling. Segregate the waste before recycling can increase recycle rate as well. A preliminary study conducted in organizational setting indicates that waste segregation behaviour among the community in organisation was found not encouraging. Critical literature search over previous studies conducted in related discipline shows total of four attributes affecting the waste segregation behaviour among the community: accessibility to the recycling bins, waste segregation information, waste segregation incentive, and reminder to the users to segregate waste. The attributes identified from the literature review will provide a guidance in fostering the waste segregation behaviour in the community.

**Index Terms**—Recycle, waste segregation behavior.

## I. INTRODUCTION

Since the climate change and global warming issues are getting serious currently [1], the government of Malaysia is trying hard to improve the environmental protection as stated in Vision 2020 [2]. The 8th Malaysian Plan (2001-2005) emphasized on waste minimization while 9th Malaysian Plan (2006-2010) emphasized on 3R which are reduce, reuse and recycle. Solid waste is defined as undesirable substances which are generated by people after used [3]. It is found that 0.49 billion tons of global municipal solid waste was generated in 1997 [4]. In the year of 2003, average per capita of generation of solid waste is about 0.5 to 0.8 kg for each person everyday in Malaysia [5]. Currently, the waste produced everyday has increased to 23,000 tonnes in Malaysia [6]. However, amount of waste produced is expected to rise to 31,000 tonnes by the year 2020 [2] due to the increasing number of population and development continuously. Besides, reference [2] highlights that some major cities in Malaysia such as Selangor, Kuala Lumpur, Penang and Johor have higher generation of waste compare to less developed cities [2]. The unhealthy disposal of solid waste poses threats to the nation's health and environment [7].

Since there is high generation of waste in Malaysia, waste management is important to ensure waste is disposed in proper way to minimize negative impact to the environment

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[8]. Reference [9] stated "Recycling is one of the most effective methods used to manage and reduce wastes". Recycling is more efficient and more sustainable rather than incineration and landfill [10]. However, there is only 5 % of the waste is recycled in Malaysia [11]. Such findings reflecting that the recycling rate in Malaysia can be further improved. In order to increase the recycling rate, initial step is to segregate the waste for recycling. Reference [12] stated that "the nation has role to reduce the waste by segregating the waste which have recycle value such as plastic, paper and glass". Furthermore, they have to be cautious to prevent recycle waste mixed with another waste. It is due to the contamination of waste such as metal and plastic will decrease the value of recycle. Besides, contamination among the recycle waste such as plastic and paper will also decrease the value of recycle. Segregation of waste before recycling can increase the recycle rate to 84% [13]. Segregation of waste contributes to the recycling program and public health [14]. The community in an organization should responsible to manage their own waste.

According to a study conducted by [12], only as much as 8% of total waste was segregated despite of incentive had been given in Uttara, Bangladesh. Reason of not segregating the waste is because of it is an activity which needs additional effort and time. The respondents in the study by [12] reported that they prefer to put all the garbage in one recycle bin rather than using several recycle bins which for them are utilizing more space. Hence, it shows more efforts are required to encourage the community to practice waste segregation behaviour. Another study was conducted by [15] on waste segregation behaviour among the community in International Islamic University of Malaysia. The study aims to investigate the frequency of student to practice the waste segregation in the organization. The results of study by [15] revealed that only 28% of respondents are practicing the segregation of recycle bins once every 3 months, followed by 23% of respondents practice it once every month, 18% of them practice it every week, 18% of them practice it every 6 month, and 13% not practicing it.

To further confirm the current scenario of the waste segregation behaviour among the occupants in organization, an observation was conducted. A preliminary observation was conducted within the period of one month in UniversitiTeknologi Malaysia (UTM) campus. The results of the observation show that the community not segregate the waste according bins and types of waste. It was found that the wastes in the recycling bins at the majority of the faculties were not properly segregated. The community are not following the instruction to segregate waste according to types of waste. Instead, the community contaminate and mix different types of recyclables waste in one recycle bin. The waste segregation behaviour of the community was found not

encouraging and further improvement is needed.

In order to foster waste segregation behaviour more effectively, one of the aspects should be taking into consideration is to ascertain the attributes affecting the formulation of the desired behaviour. By identify the right attributes in formulating waste segregation behaviour, the management is more likely to foster the waste segregationbehaviour more effectively.

## II. RECYCLING AND SEGREGATION OF RECYCLABLE WASTE

Recycling plays an important role in waste management strategies [14]. Reference [9] stated that “Recycling is a process where waste product transported, broken down, and reformed”. Recycling divert materials which have recycle value to produce new products and it can indirectly reduce quantities of waste [16]. Recycling reduces the emissions of green gases and reduce ecological footprint [9]. Recycling is one of the easiest and most environmentally friendly ways to organization greening process [17]. There are many types of waste such as organic waste (food, garden waste), inorganic waste (plastic, paper and glass) and etc. [16]. Recyclable waste is waste such as plastic, paper and glass which have recycle value [12]. Segregation of recyclable waste means separate the waste which have recycle value from the other waste in order to have higher level of recycle rate and to reduce volume of waste [16]. The practice do not contaminate the waste of plastic and glass or paper together. Thus, segregation before recycling is vital in waste management to reduce environmental degradation and achieve waste minimization targets.

## III. ATTRIBUTES IN FOSTERING WASTE SEGREGATION BEHAVIOUR

Human behavior is complex and we need to understand how human will change their behaviour to segregate the waste and the attribute to assist them in waste segregation behavior [18]. Waste segregation behaviour can be defined as behaviour of separating waste accordance to types of the waste in order to reduce the contamination of wastes which have potential value of recycle [12]. Encouraging wastesegregation behavior is important to create a higher recycle rate and to reduce volume of waste.

In present context, attribute in fostering waste segregation behaviour can be described as the component that likely to encourage and facilitate people to segregate the waste and thus foster their waste segregation behaviour. There are various attributes may contribute to waste segregation behaviour. The attribute that significant in facilitating waste segregation behaviour is vary across context. In general, this study has ascertained four attributes that encourage waste segregation behavior among the community (see Table I). The following sub sections detailed each of the attributes.

### A. WSA<sup>1</sup>: Accessibility to Recycle Bins

Reference [19] stated that well equipped of recycling bins in an area can motivate initial recycling levels. The greater the accessibility oe the recycle bins, the higher the likelihood the community to practice waste segregation behavior. As

according to [14], sufficient number of recycling bins which located in suitable location increase recycle rate and waste segregation behaviour. For example, locate the paper recycling bins near the paper generation point in office will increase the waste segregation [20].

TABLE I: THE ATTRIBUTES FOSTERING WASTE SEGREGATION BEHAVIOUR

No	Attribute
WSA <sup>1</sup>	Accessibility to recycle bins
WSA <sup>2</sup>	Waste Segregation Information
WSA <sup>3</sup>	Waste Segregation Incentive
WSA <sup>4</sup>	Waste Segregation Reminder

Besides the distance to the recycling bins, the sufficient number of recycling bins provided within the area is among the influencing factors encouraging waste segregation behavior. According to [21], the researchers have observed that the provision of recycle bins and shorter distance of recycle bins are highly increased participation of recycling programs. For instance a survey conducted in University Technology Petronas showed that a total of 83% of the community are willing to participate in recycling program, however they could not find the recycle bins; hence the study suggests that sufficienet number of recycling bins should be provided by the management in appropriate location to encourage the community to recycle [14].

In the study of [22], Geographical Information System (GIS) was used to investigate preferable walking distance to drop municipal solid waste to the collection bin. In this model, among 50 metre, 75 metre and 100 metre, 75 metre is the optimal distance to ensure complete collection of municipal solid waste in the ward. In general, the distance of access to recycle bin can be determined based on the needs of the community as well and area size. Thus, appropriate distance to access to the recycle bins is able to foster positive waste segregation behaviour among the community.

### B. WSA<sup>2</sup>: Waste Segregation Information

Waste segregation information attribute is about raising knowledge about recycling and waste segregation such as materials can be recycled and benefits of waste segregation. Various past research has focused on raising pro-environmental behavior and awareness among the local community. Lack of information on how to segregate the waste is among the common barriers for the community to practice waste segregation behavior. For example a study conducted by [23] showed that students are lack of knowledge about recycling among university students.

In general, information of waste segregation attribute consists of the clear instruction on how to segregate waste and feedback on waste segregated. Clear instruction on how is the separation should be made plays a vital role. According to [20], clear instruction on waste segregation is about making clear on how to make segregation by using different recycling bins and how to locate recycle bins which type of waste can be recycled, and which type of waste cannot be recycled. For instance, we should differentiate the waste of plastic, paper and glass properly and segregate it according to types of recycle bins.

In the recycling program, clear instruction on how to segregate the waste should be taught. A survey conducted at Michigan State University found that university members had

limited knowledge regarding what they could recycle and where they could recycle despite of recycling is important for them [24]. Study by [20] has suggested that recycling program should be focus on clear instruction of how to differentiate recycling bins of plastic, paper and glass. Furthermore, the results from [23] suggests that communication efforts for recycling programming should focus more on clear instruction on what, how, and where to recycle. In general, the person is more likely to recycle if obtain clearer instruction on which materials are recyclable, or where are the recycle waste collected [25].

Besides a clear instruction on how to segregate waste, feedback on total of waste segregated is important to foster waste segregation behavior among the community. According to Oxford English Dictionary, feedback is “information of the result of a process that can be used in control of a process, especially by noting the difference between a desired and an actual result” [26]. For example, in the recycling program, organizer uses email messages as a feedback to participants about the information of quantities of cardboard and paper which have segregated [20].

Feedback is proven effective in fostering pro-environmental behavior. For instance in the research conducted by [27], the effectiveness of feedback has been proved through experiment of two groups of respondents. Firstly, for group A, feedback of consumption electricity and education about conservation of electricity were given to them. On the other hand, for group B, there is only education about conservation of electricity was given. After four weeks period, group A who received feedback plus education used 11% less energy than group B who received education only. Thus, it reveals that feedback is effective in energy conservation. The effectiveness of feedback in energy conservation can potentially reflect its applicability in the context of other pro-environmental behavior such as waste segregation behavior in present context. The feedback is plausible to sustain waste segregation behavior.

#### *C. WSA<sup>3</sup>: Waste Segregation Incentive*

Another attribute to foster waste segregation behavior among the community is to provide incentives for waste segregation practice done. According to [28], incentive motivates a people to do better to motivate future and encourage certain behaviour. Incentive is powerful and effective in inducing behaviour change. Incentive is effective in motivating people to practice positive behavior such as waste segregation. The more the incentive is given, the higher the likelihood the desired behavior is to be performed. According to [29], people who are not recycling currently will normally increase their recycle behaviour once receiving reward.

In general, there are two types of incentives which known as monetary incentives and non-monetary incentives. Monetary incentives is reward the waste segregation practice in form of money (Ringgit Malaysia). Non monetary incentives is reward in the form of not money. The effectiveness of monetary incentives in motivating the desired behavior is acknowledged in previous research. For instance, study by [30] has indicated that two-thirds of people prefer financial rewards as a motivational factor to increase recycling behavior. Cash or discounts in monetary form can

encourage people to recycle as they are not sufficiently motivated by social and environmental concerns [20]. Incentive in monetary form also yields a successful result in other context. For instance a study by [31], a field experiment in America showed that post-secondary scholarships with incentives encourage student to concentrate more on the academic work rather than work and leisure activities. Besides monetary incentives, other form of incentives is in the form of non-monetary. According to [28], non-monetary incentives are in tangible or intangible form but does not involve cash payment, such as gifts, appreciation letter, recognition certification, and some social activities, etc.

#### *D. WSA<sup>4</sup>: Waste Segregation Reminder*

Another attribute to foster waste segregation behaviour is to provide reminder to remind the user to segregate the waste. Reference [32] defined reminder as “instruction and gestures to increase the likelihood of people to make correct responses”. Reminder represents the simplest and least expensive information which can be delivered in writing, over the telephone, or through the person [25]. Reminder helps user to remember to maintain sustainable behaviour which they tend to forget [18], [33].

Commonly, there are two types of reminder which including written reminder and verbal reminder. Written reminder can be presented in the form of signage in corridors, signage near the recycle bin, flyer, email, short written explanation about types of waste can be recycled, etc. As suggested by [20] in a study conducted to examine the participation of waste segregation program in university context, flyers distributed to students, sticker on window of vehicles, table or wall were used to encourage the waste segregation practice among the community.

Furthermore, verbal reminder is words, instructions which direct a person to involve in the behaviour [34]. For example, lecturers in university remind and encourage students to recycle and segregate the waste. In addition, Head of department reminds the staffs to recycle and segregate the waste. Study of [35] is about increasing the consumption of fruit serving among school in the National School Lunch Program (NSLP) in America through verbal reminder. Result showed that verbal reminder is effective as it can significantly increase the percentage of children to take and consume fruit serving.

Both types of reminder is effective based on the needs and local context. Past research showed that combination of both types of reminder produce effective desired behavior change. For instance, a study conducted by [36] highlighted that combination of verbal reminder and written reminder increase the participation of recycle rate to 22.1%. However, when the residents receive the written reminder only, there is only 2.4% increase in participation.

## IV. CONCLUSION

In essence, there are four attributes proposed in this study for fostering waste segregation behavior among the community: accessibility to recycle bins, waste segregation information, incentive for waste segregation and reminder for waste segregation. The accessibility to recycle bins is about the distance and accessibility to the recycle bins. The

information of waste segregation provided to the community may include the instruction on how to segregate the waste and the feedback on the total waste segregated to motivate the community to continuously practice waste segregation behavior. Other attribute to foster waste segregation behavior, which is to provide incentives to the people practice waste segregation behavior, may include monetary incentive and non-monetary incentive. Lastly, the forth attribute to foster waste segregation behavior is to provide reminder which in the form of verbal and written, to remind the community to practice waste segregation behavior. Overall, the findings of this study will shed the light to the management in designing program to target waste segregation behaviour within a community. Further study can be conducted to further confirm the application of these attributes across various local context

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