THE EFFECTS OF ADJACENCY OF TRASH BIN AND RECYCLING BINS IN MOTIVATING WASTE SEPARATION BEHAVIOUR

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I dedicate this thesis to
My beloved mom and dad,
Supportive supervisor,
My family and friends,
Without whose support and inspiration
I would never have the courage to follow my dreams.

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"In the Name of Allah, Most Gracious, Most Merciful"

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ABSTRACT

The increasing amount of solid waste generation is a common issue facing by the countries worldwide. To overcome this problem, many countries implement recycling as the alternative to reduce the amount of solid waste generated. In order to achieve the target set of to achieve 22% of recycling rate in the year 2020, Malaysia government has implemented mandatory waste separation among the Malaysian household. Previous studies have showed that in order to motivate people to practice waste separation, the recycling bin should be placed in shorter distance. The objective of this study is to examine the effects of adjacency of trash bin and recycling bins in motivating waste separation behavior. The scope of this study is shopping mall in Johor Bahru, Johor. Empirical data were collected through experiment settings. Observation sessions have been conducted for a period of fourteen days. The subjects involved in the experiment were selected using convenience sampling technique. Descriptive analysis and Chi-Square test analysis were employed to analyze the data gathered. A total of 715 subjects were involved in the experiment settings. The results of Chi-Square test analysis showed that there are significant differences in waste separation practice when the trash bin is adjacent to the recycling bin. This study has confirmed that the subjects were motivated to practice waste separation when the recycling bin and trash bin were placed adjacently. This study may serve as a guidance to the governance in motivating people to practice waste separation in order to achieve 22% of recycling rate in the year 2020.

ABSTRAK

Peningkatan jumlah penjanaan sisa pepejal merupakan suatu isu yang sering dihadapi oleh kebanyakan negara di seluruh dunia. Bagi mengatasi masalah ini, kebanyakan negara telah melaksanakan program kitar semula sebagai satu alternatif untuk mengurangkan penghasilan jumlah sisa pepejal. Di dalam usaha untuk mencapai sasaran 22% kadar kitar semula pada tahun 2020, kerajaan Malaysia telah melaksanakan sistem pengasingan sisa pepejal di peringkat isi rimah. Kajian terdahulu telah menunjukkan bahawa untuk menggalakkan orang ramai untuk mengamalkan aktivit pengasingan sisa, tong kitar semula perlu diletakkan pada jarak yang pendek. Objektif kajian ini adalah untuk mengkaji kesan apabila tong kitar semula dan tong sampah di letakan secara bersebelahan dalam memotivasikan tingkah laku pengasingan sisa. Skop kajian ini adalah di pusat membeli-belah di Johor Bahru, Johor. Data empirical telah dikumpul melalui kajian eksperimen. Sesi pemerhatian telah dijalankan selama empat belas hari. Subjek yang terlibat di dalam kajian ini telah dipilih dengan menggunakan teknik pensempelan rawak mudah. Analisis diskriptif dan ujian analisis Chi-Square telah digunakan untuk menganalisis data yang telah dikumpulkan. Seramai 715 orang subjek telah terlibat di dalam eksperimen ini. Keputusan ujian analisis Chi-Square menunjukkan bahawa terdapat perbezaan yang signifikan di dalam amalan pengasingan sisa apabila tong sampah dan tong kitar semula diletakkan secara bersebelahan. Kajian ini telah mengesahkan bahawa subjek lebih terdorong untuk mengamalkan pengasingan sisa apabila tong kitar semula dan tong sampah diletakkan secara selari. Kajian ini akan menjadi petunjuk tadbir urus di dalam memotivasikan orang ramai untuk mengamalkan pengasingan sisa bagi mencapai 22% kadar kitar semula pada tahun 2020.

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MSW	-	Municipal Solid Waste
UTM	-	Universiti Teknologi Malaysia
SWCorp	-	Solid Waste Management and Public Cleansing Corporation
MRF	-	Material Recovery Facilities
IM	-	Jabatan Perumahan Bandar dan Desa

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CHAPTER 1

INTRODUCTION

1. 1 Introduction

The rapid development of urbanization in Malaysia causes increasing amount of waste produced every day. These problems require local authorities to give a commitment in the management of solid waste disposal systems to ensure that the problems of waste disposal is controlled. Society should also play a role in addressing this issue. Recycling program is an effective way to deal with an increasing number of waste disposals to continue to rise. There are many recycling programs have been conducted in various countries especially in developing countries due to decreasing of natural resources. In order to achieve sustainable waste management in Malaysia, the government of Malaysia has implemented mandatory waste separation among Malaysian (Moh and Manaf, 2014). Based on previous studies, researchers had found that to increase the rate of recycling, the recycling bins should be located not far away from trash bins. Some people did not think whether their waste is recyclable or not and just go to the nearest bin as it is easier. Most of people have the tendency to choose for nearest location just like they choose to go to the supermarket or hospital near to their location (Velazquez *et al.* 2006). Hence, the objective of this study is to examine the role of adjacency between trash bin and recycling bins in motivating waste separation behaviour.

1.2 Problem Statement

Waste disposal problem is an issue that is often rises among the developed and developing countries. The issues related to solid waste management are attracting the nation's concern in Malaysia. Increasing rate of solid waste generation and too much depending on landfilling in Malaysia causes the issues of space limitations, health and environmental issues. Halvorsen (2012) mentioned that to reduce the increasing rate of solid waste generation and waste separation problem, one should increase the recycling behaviour among household. Another way to overcome the problems of resource depletion, the '3Rs (Reduce, Reuse, Recycle) have been adopted in many countries. However, public attitude in practicing waste separation and recycling as a habit remains as the most critical challenges.

In United Kingdom, 30 percent of Municipal Solid Waste (MSW) was recycled in the year 2014 (Zhang *et al.* 2016). However, MSW in China is sorted and recycled about less than 2 percent (Zhang *et al.* 2016 and Cheng and Urpelainen, 2015). Other Asian countries which also show high recycling rates were Korea 66% (SWCorp, 2010); Singapore 61% (SWCorp, 2013); and Taiwan 60% (SWCorp, 2011). The recycling rate in Thailand is 21% of total waste generation and 71% of recyclables materials where majority of recycling business carried out by private sector (IGES, 2014).

According to World Bank Report, the worldwide average of solid waste should produce is 1.2 kg but Malaysian had produced more than the average which is 1. 64 kg a day (Khor, 2014). Malaysians recycled waste as low as only 5 percent and producing 30,000 tons per day ("Waste Management in Malaysia", 2015). By the year 2020, Malaysia target to achieve 22% of nation's recycling rate (Agamuthu *et al.*, 2009), In order to achieve a recycling rate of 22%, one of the key strategies of solid waste management is to encourage the nation to practice waste separation actively and thus, increase the recycling rates as whole.

Malaysia's prioritised environmental issues are solid waste management when Malaysia depends on landfilling as the main disposal method to manage continuous increase of solid waste (Moh and Abd Manaf, 2017). The ultimate waste

disposal method that can deal with many types of materials is landfill (Badgie *et al.* 2012). The number of population in many countries are increasing every day, it is possible that the amount of land owned diminishing and inadequate. Limited land issues led to the construction of a new landfill is challenging, another way to do this is to create a disposal area in the vicinity of residential areas that cause discomfort to the public. Landfill method mostly use by developing countries and urban cities such as India, China, Vietnam, Thailand and Indonesia due to cost-effective and simple method (Moh and Manaf, 2014). A study was carried out in Nigeria where one of the processes of solid waste management adopted is landfill, this process has been overstressed and the resultant effect is that landfills in many cities in Nigeria are currently facing a critical condition in managing the domestic solid waste (Adefemi and Awokunmi, 2009)

In Malaysia, commercial buildings generated higher volume of solid waste comparing to other sector. Table 1.1 shows the average waste generation by three main sectors: industrial, commercial and institution in Malaysia in the year 2012. Approximately 80% of the total waste generated in urban and rural area contributed by Commercial and Institutions sector, which is 9.224 MT/Day.

Table 1.1 : Average Municipal Waste Generation by Industrial, Commercial and Institution in Malaysia

	Urban		Rural		Total	
Population	20,124,970		8,209,165		28,334,135	
Waste Generation	Waste (MT/ day)	Per Capita (kg/capita/ day)	Waste (MT/ day)	Per Capita (kg/capita/ day)	Waste (MT/ day)	Per Capita (kg/capita/ day)
Industrial	1,689	0.08	590	0.07	2,279	0.08
Commercial and Institutions	7,152	0.36	,072	0.25	9,224	0.33
Overall	8,841	0.44	2,662	0.32	11,503	0.41

Source : Bandar, 2014

According to Sheau-Ting *et al.* (2016), solid waste need to be managed properly and failing to do so will attract other to issues such as expensive operation costs, environmental pollution, land scarcity, etc. In realizing the land scarcity issues and urgency need to recycling practice by the nation, Malaysia Government Authorities had implemented an act as a mandatory of waste separation at household level which is under Act 672 where the household have to separate waste into three waste recyclables categories; plastic, paper and "others'. "Others" waste refers to other recyclables materials such as glass/ceramic, metal/steel/aluminium cans, electronic waste/small electronic appliances, leather/rubber/shoes/fabric and hazardous waste (Ministry of Urban Wellbeing, Housing and Local Government, 2015). On 1 September 2015, a programme named "Separation of Solid Waste at Source" had been launched by the Malaysian Government. The programme is to increase the rate of recycling to achieve the target of 22% by the year of 2020 and also to decrease the amount of the solid waste sent to dumpsite by up to 40%. Starting from June 1st 2016, the implementation of mandatory solid waste separation source was legally implemented at various states covered Federal Territory of Kuala Lumpur, Putrajaya, Pahang, Johor, Melaka, Negeri Sembilan, Perlis and Kedah. The

enforcement of Solid Waste Management and Public Cleansing Act 2007 (Act 672) begun to implement from 1 January 2016 after the people are ready and aware on the importance of solid waste separation.

There are many ways to dispose waste. One of the methods that can be used to disposed waste is recycling and based on Mrema and Côté (2008), recycling is one of the most effective methods used to reduce waste. Recycling is an important activity in most countries. Recycling diverts materials which have recycle value to produce new products and it can indirectly reduce quantities of waste (Matter *et al.* 2013). Examples of waste are an organic waste (food, garden waste), inorganic waste (plastic, paper and glass) and etc (Matter *et al.* 2013). Plastic, glass and paper are the example of recyclable waste which has value to be recycled. Based on Matter *et al.* (2013) waste segregation means separate the waste between recyclable waste and other waste to have higher recycle value and to reduce volume of waste.

According to SWCorp (2014) the recycling rate in Malaysia is still at low level compare with some other developing countries. Malaysia recycling rate remain low due to lack of responses and participation from the public. Factors such as local authorities incapable to maintain the program of recycling, less recyclable materials, poor collection services from the authorities, public not aware about recycling program and lack of policy and master plan focusing on recycling (Moh and Manaf, 2014). Convenience and accessibility to recycling facilities has been studied as a factor in increasing recycling participation.

The accessibility of recycling bins that influence recycling behaviour has been respectively tested and studied in some empirical studies. A study on attributes in waste separation behaviour was conducted where accessibility to the recycling bins was identified as one of the attributes in encouraging community to practice waste separation (Sheau-Ting *et al.* 2016). The study was conducted among 564 students and staffs in Universiti Teknologi Malaysia (UTM). The results from the questionnaire shows that most of the community agrees that the most favourable attributes to encourage their waste separation behaviour is accessibility to the recycling bins and the optimal distance is between 100 and 500 metres. The results

highlighted that the recycling bins should be placed not more than 500 metres of walking distance.

Malakahmad *et al.* (2010) conducted a study at University Technology Petronas (UTP) to explain the participant's attitude and mind set as well as the facilities shortages for recycling activities on the campus. A total of 107 questionnaires were distributed among students and staffs in the campus. Results of the survey showed that 80% of the community willing to join the recycling program nonetheless 83% of them could not find recycling bins in short distance. Unavailability of suitable and enough recycling bins have discouraged the participants to more participate in the activities and when they interested in the activities but they could not find the recycling bin, they will throw the waste in the trash bin. The study suggests that suitable number of recycling bins should be placed in suitable location to encourage people to recycle and at the same time increase waste separation behaviour.

Brothers *et al*. (1994) investigated about proximity of recycling bins have related with the amount of paper recycled in Princeton Child Development Institute. The building of the institute was divided into three environments which are administration, instructional area and offices included with 20 workspaces and 75.6 litre of yellow Huskee container which used for central location recycling was placed at the centre of the building and at the place proximity to participants. When the recycling bin is located at the centre of the building, the result of the study was only 28%. However, when the recycling bin was located close proximity to the participants, about 94% of paper was recycled. It shows that the participants were encouraged to recycle the paper when the recycling bin is near to the participants. Follow-up assessment for 7 months of this study showed increasing rate of paper recycled which was 84% to 98%. Such findings reflect that the nearer accessibility to the bins will increase the recycling rate.

In the study written by (Kumarsrr, 2012) and Nithya *et al*. (2012), Geographical Information System (GIS) was used to investigate preferable walking distance to drop municipal solid waste to the collection bin in one of the urban ward in Sidhapudur, Coimbatore, India. 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. Possibility for the staff to throw the waste into collection bin if they want to do so is low if the collection bin placed far away. In general, the distance of access to collection bin can be determined based on the needs of the community. Thus, appropriate distance to access to the collection bins is able to foster positive behaviour among the community.

The results from the previous study above helped the municipal authorities to decide to rearrange the place of bins according to the results of the study, which follow the requirement of the community. The willingness rate for people to practice waste separation is increase if they could reach the recycling bin within walking distance (Babaei *et al.* 2015). Babaei *et al.* (2015) conducted a research about knowledge, attitudes and practices towards solid waste reduction, source separation and recycling among Abadan residents. A total of 2400 of householders were participated base on the characteristics of gender, age, education status and occupation for a questionnaire survey. The result showed that one of the reasons why householders lack of participation in recycling and waste separation programs were because the accessibility to the recycling bins is not easy. Based on the results, when the recycling bins placed within walking distance from the householder's house, they are willing to practice waste separation or recycling.

Previous studies have confirmed the convenience and accessibility to the recycling bins will increase the recycling practice. In other words, the adjacency of the recycling bins to the trash bin will likely increase the waste separation practice. To further confirm the existing scenario of the adjacency of trash bin and recycling bins in the study context, a preliminary observation has been conducted in shopping malls around the city of Johor Bahru. The aim of preliminary observation is to observe the trend of the location of recycling bins that are usually provided in the local context. A preliminary observation was held in six shopping malls in Johor Bahru are: (1) Aeon Jusco Bukit Indah, (2) Aeon Jusco Taman Universiti, (3) Tesco Mutiara Rini, (4) Umall Taman Universiti, (5) Sutera Mall Johor Bahru, and (6) Tesco Bukit Indah. Based on the observation, it was found that most of the recycling bins provided were placed near to the trash bins but not adjacent (side-to-side). The management of shopping centres placed the trash bins at the distance of

approximately about 10-50 meters from the recycling bins. Observations found that there are individuals who use the recycling bins to dispose non-recyclables waste. The results of the preliminary observation showed, there are contaminations and mixture of the recyclables waste in recycling bin, despite the recycling bin had been labelled clearly accordingly to the colour of the bins. Some photos of preliminary observation see Appendix A.

From the previous study which relate distance of recycling bin with people behaviour on recycling activities can prove that in order to encourage people to recycle waste, the authority should consider the suitable distance of the recycling bin to be place. Majority of the previous studies are focused to investigate the role and optimal distance of the recycling bins availability. However, there are limited previous studies held to investigate whether the distance between the recycling bins and trash bin plays role in motivating an ordinary individual to practice waste separation behaviour in the context of shopping mall. Only two similar studies were found related to this study context. A study was conducted by Truelove *et al.* (2016) Truelove where trash bin and recycling bins have been placed adjacent about 30 feet from the lab. Other than placing the trash bin beside the recycling bin, the researcher also placed second trash bin outside the lab. A sign was placed at the above of the recycling bin to show the encouragement of the university towards recycling while the second trash bin was staged with other recyclable items to encourage participants to throw the bottle in the trash bin. The review was to determine which bins will be selected by the participants to dispose the waste paper and bottles that have been used. The participants were never told to throw the bottle in which bins. At the end of the study, researcher found that in total of 24 participants, 17 was throw in the trash bin while 7 was recycled the water bottle. This study showed that majority of participants practice waste separation when the recycling bin and trash bin were placed side-to-side.

Another study by Aras and Anarat (2016) where the study had been done in the context of university campus. The observation had been carried out at a health sciences university in Istanbul for four different days. The placements of the bins are differently on each day. On day one of the experiment, the trash bins were placed in front of the recycling bins at the corridor of the walkway of the building.

The placements of the trash bins were reversed on the second day. On day three and day four, the placement of the trash bin and recycling bins were placed side-to-side. On day three, the trash bin was placed in between of the recycling bins and it reversed on day four where the recycling bin were placed in between the trash bin adjacency. Result of the study found that the closest bins were preferred more by the participants and it is compatible as the previous findings. It also can conclude that the process of recycling is based on the tendency of people to use the nearest bin.

The procedure of experiment from the previous study conducted by Aras and Anarat (2016) and Truelove *et al.* (2016) are similar to present study. However, Aras and Anarat (2016) and Truelove *et al.* (2016)study was based on the university campus context while the existing study is based on the commercial context. This study is the first attempt to investigate the role of adjacency between trash bin and recycling bins in motivating waste separation practice.

1.3 Research Question

The research question of this study as below:

1. What is the role of adjacency of trash bin and recycling bin in motivating waste separation behaviour?

1.4 Objective of Study

The objective of the study as below:

1. To examine the effects of adjacency of trash bin and recycling bins in motivating waste separation behaviour.

1.5 Scope of Study

The scope of this study is shopping mall in Johor Bahru, Johor Malaysia. The subjects are the individuals including shoppers and employees in the Shopping Mall.

1.6 Significance of Study

The findings of the study will serve a reference guide for future research as there is limited study in examining the effects of adjacency of trash bin and recycling bins. This study also will expect to be served as one of the references to the government in formulating waste management strategy to increase Malaysian's recycling behaviour hence realizing the country's commitment in achieving a 22% of recycling rate in 2020.

1.7 Research Methodology

This research consists of five stages which are literature review, experiment designation, conduct the experiment, data analysis and conclusion and recommendation. Figure 1.1 shows the flow chart of research methodology. The details of research methodology are as follows:

1.7.1 Phase One : Literature Review

The literature review will be based on published literature formed of journals, articles and websites relating to recycling and waste separation behaviour.

1.7.2 Phase Two : Design of Experiment

This stage is to setting the experimental design that will be conducted to gather desired empirical data. Selection of an appropriate experimental method is based upon previous works. This experiment consists of two setting namely Experiment Setting and Control Setting. Experiment will be conducted 7 days in Control Setting and 7 days in Experiment Setting. Researcher will conduct an observation session to observe whether the users practice waste separation in different settings.

1.7.3 Phase Three : Data Recording

Observation methods will be used for the purposes of this study. A checklist will be used to record the necessary information including race, gender, age and whether the user practice waste separation or not. The observation for the purpose of identifying people's behaviour in waste separation practice will be conducted throughout 2 week times.

1.7.4 Phase Four : Data Analysis

The data gathered from the experiment will be compiled and analyse to answer the research objective. Descriptive analysis and Chi-Square test will be used and assisted by Statistical Package of Social Science (SPSS) Version 23.0 Software to perform the analysis.

1.7.5 Phase Five : Conclusion and Recommendation

This stage is the last stage in the study in which the researcher make conclusion based on the findings of the experiment. Limitations and some suggestions for future research will be presented.

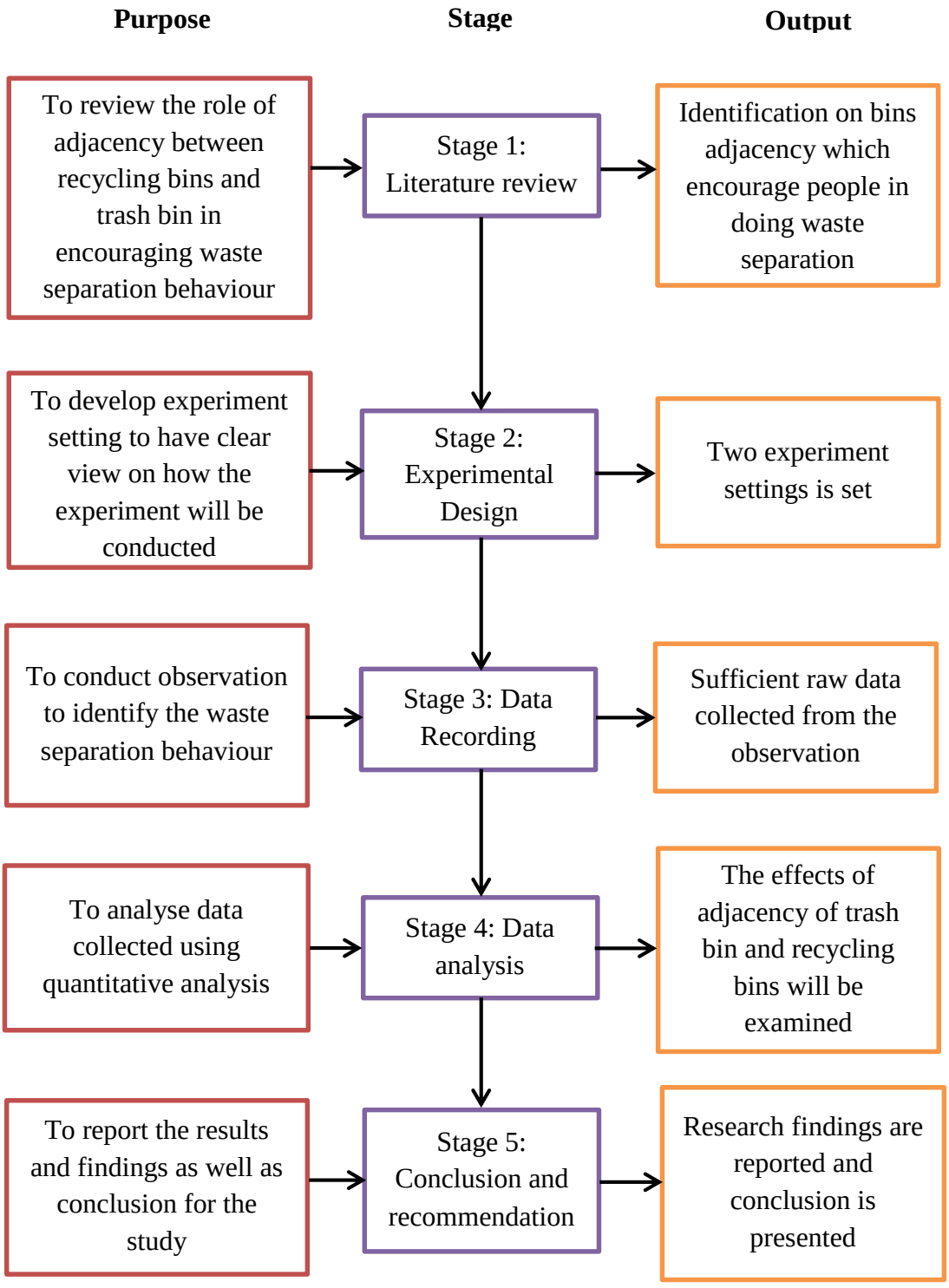

Figure 1.1 : Research Methodology Flow Chart

1.8 Chapter Outline

The study has five chapters. Chapter 1 describes the research background, problem statement, research question, objectives, scope of study, significance of study and brief research methodology.

Chapter 2 presents the literatures that describe the concept of recycling, waste separation, previous studies on waste separation, and the adjacency of trash bin and recycling bins.

Chapter 3 is describing the methodology of the research. The research methodology is critical in determining the validity and methods most suitable for practical study. Overall effective study determined starting from the methodology of the study. The research design, data collection and the methods used to analyse the data.

Chapter 4 presents the results and findings of the Chi-Square test analyses for the objective which to examine the effects of adjacency of trash bin and recycling bins in motivating waste separation behaviour. In brief, this chapter includes the subject's background, the results and findings from the experiment and the discussion of the results.

Finally, Chapter 5 concludes the main findings of this study and provides recommendations for future research.

1.9 Summary

In conclusion, the problem statement and gaps of research have been identified in this chapter. Research objective is formulated and scope of study is defined. A brief research methodology diagram and the chapter outline are presented.

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