WASTE COMPOSITION AND STUDENTS' ACCEPTANCE OF WASTE SEGREGATION IN WEST LAKE STUDENT HOSTEL AREA, KAMPAR

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A project report submitted in partial fulfillment of the requirement for the award of Bachelor of Engineering (Hons.) Environmental Engineering

Faculty of Engineering and Green Technology

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DECLARATION

I hereby declare that this project report is based on my original work except for citations and quotations which have been duty acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at UTAR or other institutions.

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APPROVAL FOR SUBMISSION

I certify that this project report entitled "**WASTE COMPOSITION AND STUDENTS' ACCEPTANCE OF WASTE SEGREGATION IN WEST LAKE STUDENT HOSTEL AREA, KAMPAR**" was prepared by Lee Jia Yi has met the required standard for submission in partial fulfillment of the requirements for the award of Bachelor of Engineering (Hons.) Environmental Engineering at Universiti Tunku Abdul Rahman.

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ABSTRACT

Municipal solid waste (MSW) problem is a common environmental issue faced by every country in the world, including Malaysia. Due to rapid population growth and urbanization, waste generation in Malaysia has increased dramatically over these few decades, which eventually brings a lot of negative impacts to the environment. Although it is commonly known that waste segregation is an effective way to minimize solid waste problem, there are low awareness and participation of Malaysians in waste segregation, and this phenomenon also occurs among Universiti Tunku Abdul Rahman (UTAR) students. In line with the waste segregation policy under Solid Waste and Public Cleansing Management Act 2007, a waste segregation programme was organized in West Lake student hostel area, Kampar starting from August 2015, with support from Majlis Daerah Kampar (MDK). The programme performance was then studied. Through this study, we could determine the waste generation and composition in the student hostel area and study the students' awareness and acceptance of waste segregation. Furthermore, this study could also serve as a mean to educate the students about waste segregation, and examine the effect of waste segregation program on the waste generation and composition and the waste management behavior of students. Within 8 months, the waste generation in the hostel area had reduced from 0.163 kg/capita/day to 0.124 kg/capita/day, reaching recycling rate of about 25%. In addition, the information obtained from this study will also be important for the future development of local MSW management system.

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LIST OF ABBREVIATIONS

3R	Reduce, Reuse, Recycle
ABS	Acrylonitrile Butadiene Styrene
BOD	Biochemical Oxygen Demand
CFS	Centre of Foundation Studies
CH_4	Methane
COD	Chemical Oxygen Demand
CSS	Community Service Society
DOE	Department of Environment
FAS	Faculty of Art and Social Science
FBF	Faculty of Business and Finance
FEGT	Faculty of Engineering and Green Technology
FICT	Faculty of Information and Communication Technology
FSC	Faculty of Science
GHG	Greenhouse Gases
GST	Goods and Service Tax
HDPE	High Density Polyethylene
ICS	Institute of Chinese Studies
LDPE	Low Density Polyethylene
MBKS	South Kuching City Council
MDK	Majlis Daerah Kampar
MHLG	Ministry of Housing and Local Government
MIGHT	Malaysia Industry-Government Group for High Technology
MSW	Municipal Solid Waste
PC	Polycarbonate
PETE	Polyethylene Terephthalate

PP	Polypropylene
PR	Public Relations
PS	Polystyrene
PVC	Polyvinyl Chloride
SAN	Styrene Acrylonitrile
TSS	Total Suspended Solid
UK	United Kingdom
UKM	Universiti Kebangsaan Malaysia
UTAR	Universiti Tunku Abdul Rahman

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Ever since the declaration of independence of Malaya in 1957 and the formation of Malaysia in 1963, Malaysia has undergone rapid population and economical growth. Malaysia population in urban area has increased more than 50% in the last few decades (Abas & Seow, 2014). Likewise, by 2000, the number of cities in Peninsular Malaysia has increased 400%, as compared with the number of cities in 1957 (Abas & Seow, 2014). The rapidly increasing urbanization and industrialization rate in Malaysia is accompanied by the tremendous generation of solid waste. In 2009, the waste generation per capita per day had already reached 1.3 kg/capita/day (Mohamad & Keng, 2013). If the population growth is assumed to be 3.6% by 2020, the daily waste generation of Malaysia will be 31000 tonnes/day (Alias et al., 2013).

Among all the solid waste generated, 64% of them is municipal solid waste (MSW), and among these MSW, 40% of them are organic waste which mainly consists of food waste, while plastic waste is the first runner up among all types of MSW (Tarmudi et al., 2009). Although there are high percentage of waste which can be recycled as new material, in Malaysia, only 5% of the total MSW collected is diverted from landfill disposal (Tarmudi et al., 2009).

The main disposal method of MSW in Malaysia is landfill disposal (Tarmudi et al., 2009). Although there are 296 landfill sites throughout Malaysia, more than half of them have less than two years of remaining lifespan (Patrick, 2011). In addition, low rate of MSW diversion from landfill does not only create economical problem due to loss of waste material as potential raw material and energy source, it also brings adverse effect to

the environment due to the pollution by leachate leakage and greenhouse gases emission. The latter problem is especially severe in Malaysia because among all of the available landfills, only eight of them are sanitary landfills which provide protection to prevent environmental damage (Patrick, 2011).

Malaysia government has taken several actions to minimize MSW problem. For instance, in 1988, Malaysia government had introduced the Action Plan for a Beautiful and Clean (ABC) Malaysia, together with a series of recycling campaigns organized for consecutive years (Otitoju & Lau, 2014). However, the project failed due to low public participation (Otitoju & Lau, 2014). There were also several other national recycling campaigns being held in the next few decades, such as Reduce, Reuse, Recycle (3R) policy introduced in the 8th Malaysia Plan (2001-2005) and Master Plan on National Waste Minimization (2006-2010), but all these campaigns also received minimal response from the public (Abas & Seow, 2014). Nevertheless, the negative results does not discourage Malaysia government from continuing their effort in increasing the recycle rate of MSW.

On September 2015, the government started to implement a long term waste segregation policy in states including Kuala Lumpur, Putrajaya, Pahang, Johor, Malacca, Negeri Sembilan, Perlis and Kedah under Solid Waste and Public Cleansing Management Act 2007 (Act 672) (The Star Online, 2014). This policy requires citizens to separate their domestic waste into plastic, paper, cardboard, glass, metal, food waste, bulk waste and garden waste before disposal (The Star Online, 2014). Although Perak is not included in the list, this project can provide a good opportunity to students who live in West Lake, Kampar to get used to the waste segregation system early before they eventually need to comply with the new implementation once they go back to their hometown which belongs to the states included.

1.2 Problem Statement

A lot of local studies have been conducted to determine the waste generation and composition at state and national level. Some of the studies also focus on certain city or town area. The results of these studies are discussed in Chapter 2. Nevertheless, there was

no waste study conducted on residential area where majority of the residents are students. Since students generally have different lifestyles from employees and housewives, it is possible that the waste composition will be different compared with the results obtained from previous studies. Therefore, it is interesting to carry out this kind of study at West Lake student hostel area where majority of the residents are studying in Universiti Tunku Abdul Rahman (UTAR) Perak Campus.

In addition, only minority of students in West Lake practice waste segregation themselves. Most of those who practice waste segregation regularly donate their recyclable waste to Tzu Chi, a charity organization which sells recyclable waste to provide financial aid to orphanages, old folks houses, dialysis center and so on. A small number of students also bring their recyclable waste to the recycle bins located in UTAR campus. The remaining faction of them donate or sell their recyclable waste to other organizations.

Unfortunately, there are still large number of students who do not practice waste segregation due to absence of recycling facility in Westlake Home and Harvard area. As shown in Appendix 1, most students in West Lake directly throw their waste into rubbish bins in front of their hostels without separation. Waste of various types can be observed in most of the rubbish bags. Furthermore, since there is no waste separation, some rubbish bins fail to accommodate large amount of waste thrown by the students. There are also a lot of rubbish bins in the area which are either broken or missing, but the students do not immediately report the status of the rubbish bins to the hostel company (Danish House and KT Management), so some rubbish are dumped openly. Therefore, serious cleanliness problem due to scattering waste can be seen around West Lake.

Furthermore, although there has been some waste management campaigns in UTAR campus, they were insufficient to change the perception of UTAR students toward waste segregation. Incorrect usage of dustbins and recycle bins around UTAR campus happens frequently. Since majority of students spend a lot of their times in hostel area especially during their free time, perhaps a change of local solid waste management system through a waste segregation programme at hostel level may bring significant impact to students' waste management behavior in both hostel area and campus area.

1.3 Objectives of Study

This project aims:

1. To study the waste generation and composition in West Lake student hostel area.
2. To study the awareness and acceptance of students in West Lake student hostel area regarding waste segregation.
3. To study the effect of waste segregation programme on students' behavior in waste management and waste disposal pattern in West Lake student hostel area.

CHAPTER 2

LITERATURE REVIEW

2.1 Waste Generation and Composition in Malaysia

Until the end of 1987, there was lack of periodic documentation and systematic analysis by any local authorities to record the waste generation rate in Malaysia (Tarmudi et al., 2009). Starting from 1987, Ministry of Housing and Local Government (MHLG) conducted the first nationwide compilation of waste generation and composition (Tarmudi et al., 2009). In May 1994, Malaysia Industry-Government Group for High Technology (MIGHT) carried out the second study, followed by a series of survey on several selected states on November of the same year (Tarmudi et al., 2009). Aside from government, there were also some related studies conducted by some private sectors on specific locations in Malaysia throughout these few decades. Although none of the previous studies focused on any student hostel areas, the information can be helpful to give us an overall picture about the general waste generation and composition in Malaysia.

According to Malaysia Country Report of Urban and Industrial Solid Waste Management in 2002, Malaysia's MSW generation increased 2% annually on average, and is anticipated to increase to 3% due to rapid population and economic growth during the Ninth Malaysia Plan (2006-2010) (Tarmudi et al., 2009). In 2006, an official study by Malaysia government showed that the total waste generation in Malaysia rose from 5.91 million tonnes in 2001 to 6.97 million tonnes in 2005. In addition, in the same period as above, the average waste generation per capita increased from 0.67 kg/capita/day to 0.8 kg/capita/day (Tarmudi et al., 2009).

In 2009, the waste generation per capita per day was 1.3 kg/capita/day (Mohamad &

Keng, 2013), which was about 1.6 times the waste generation per capita per day back in 2005. The rate of increase of waste generation per capita per day from 2001 to 2005 was 0.0325 kg/year, whereas the rate of increase of waste generation per capita per day from 2005 to 2009 was 0.125 kg/year. The increase of the rate of increase indicates that on average, each individual in Malaysia is generating more and more waste as time passes.

Generally, MSW mainly consists of organic waste, paper, plastic, metal, glass, textile, rubber, wood and other miscellaneous items (Mohamad & Keng, 2013). According to most studies in Malaysia, it is found that organic waste comprises the largest proportion in the overall waste generation for several decades. Furthermore, Malaysia solid waste has high moisture content and a bulk density higher than 200 kg/m^3 due to frequent rainfall in Malaysia as a tropical country (Badgie et al., 2012).

Based on Table 2.1, organic waste, paper and plastic comprised 80% of the overall waste generation in 2003 (Badgie et al., 2012). Meanwhile, according to the report of Ninth Malaysia Plan in 2006, the overall MSW composition in whole Malaysia was reported to consist of 45% food waste, 24% plastic, 7% paper, 6% iron, and lastly 3% for glass and the other types of waste (Tarmudi et al., 2009). Comparison between the report of Ninth Malaysia Plan and the study in 2003 mentioned above reveals that the proportion of food waste, plastic and paper still remain as about 80% of the total waste, indicating that the waste composition has quite a constant pattern at various regions of Malaysia throughout these few years.

Similarly, among all MSW in Malaysia, there were 55% organic waste, 19% plastic and 13% paper, as shown in Figure 2.1 (Mohamad & Keng, 2013). These three types of waste comprised 87% of the total waste at that time. The remaining portion of the waste consists of 4% rubber and textile, 3% metal, 2% glass, 1% wood and 3% miscellaneous items (Mohamad & Keng, 2013). As for East Malaysia, the municipal waste in Sabah by 2010 consists of 47.9% organic waste, 19.9% paper, 3.0% glass, 17.5% plastics, 4.6% metals and 7.1% other wastes (Alias et al., 2013). This shows that East Malaysia has quite similar waste composition with West Malaysia.

Based on the previous study, it can be concluded that the composition of waste in Malaysia remains almost the same for many years. However, most of the studies were conducted on residential areas with residents of various occupations including employees,

students, housewives and etc. Therefore, difference of result might be expected from the waste composition study in West Lake, Kampar where the main occupation of residents in that area is university student.

Table 2.1: Average composition percentage of MSW in Kuala Lumpur, Malaysia (Badgie et al., 2012)

Sources	Residential high income (%)	Residential medium income (%)	Residential low income (%)	Commercial (%)	Institutional (%)
Food/Organic	30.84	38.42	54.04	41.48	22.36
Mixed paper	9.75	7.22	6.37	8.92	11.27
Newsprint	6.05	7.76	3.72	7.13	4.31
High-grade paper	0	1.02	0	0.35	0
Corrugated paper	1.37	1.75	1.53	2.19	1.12
Plastic (rigid)	3.85	3.57	1.9	3.56	3.56
Plastic (film)	21.62	14.75	8.91	12.79	11.82
Plastic (foam)	0.74	1.72	0.85	0.83	4.12
Diapers	6.49	7.58	5.83	3.80	1.69
Textile	1.43	3.55	5.47	1.91	4.65
Rubber/leather	0.48	1.78	1.46	0.80	2.07
Wood	5.83	1.39	0.86	0.96	9.84
Yard waste	6.12	1.12	2.03	5.75	0.87
Glass (clear)	1.58	2.07	1.21	2.90	0.28
Glass (colored)	1.17	2.02	0.09	1.82	0.24
Ferrous	1.93	3.05	2.25	2.47	3.75
Non-ferrous	0.17	0	0.18	0.55	1.55
Aluminium	0.34	0.08	0.39	0.25	0.04
Batteries/hazards	0.22	0.18	0	0.29	0.06
Fine	0	0.71	2.66	0.00	0.39
Other organic	0.02	0	0	1.26	1.00
Other inorganic	0	0.27	0.25	0	8.05
Other	0	0	0	0	6.97
Total	100.00	100.00	100.00	100.00	100.00

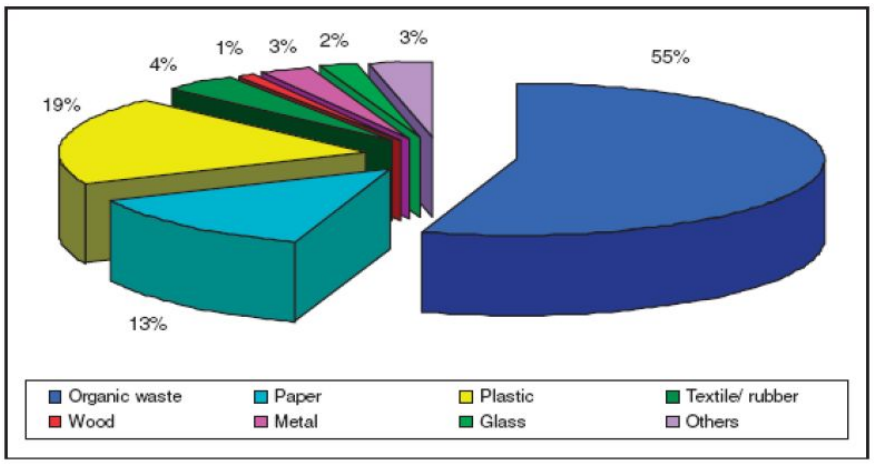


Figure 2.1: Typical MSW composition in Malaysia (Mohamad & Keng, 2013)

2.2 Solid Waste Management in Malaysia

Several acts, strategies and initiatives about solid waste management in Malaysia has been implemented since late 1960 (Abas & Seow, 2014). Since then, as shown in Figure 2.2, Malaysian government has come up with several plans and strategies to improve solid waste management (Abas & Seow, 2014). Unfortunately, the solid waste problem is still not lightened due to poor public participation and poor management of policy (Abas & Seow, 2014).

In 21st century, Solid Waste Management and Public Cleansing Management Act 2007 (Act 672) was approved in 2007 after more than 10 years of debate by Malaysia government to improve the quality of local solid waste management service (Abas & Seow, 2014). Nevertheless, the implementation of this act was delayed due to disagreement of many local authorities with the service quality and operation cost (Abas & Seow, 2014). Until 2011, this act was finally implemented in seven states (Abas & Seow, 2014), and going to be the implementation areas of the new national waste segregation programme starting from September 2015 (The Star Online, 2014). Despite of this, the waste materials targeted for recycling under this act only include paper, plastic, metal and glass (Mohamad & Keng, 2013). No nationwide policy has been set for recycling food waste which comprises about 50% of the solid waste problem in Malaysia (Mohamad & Keng, 2013).

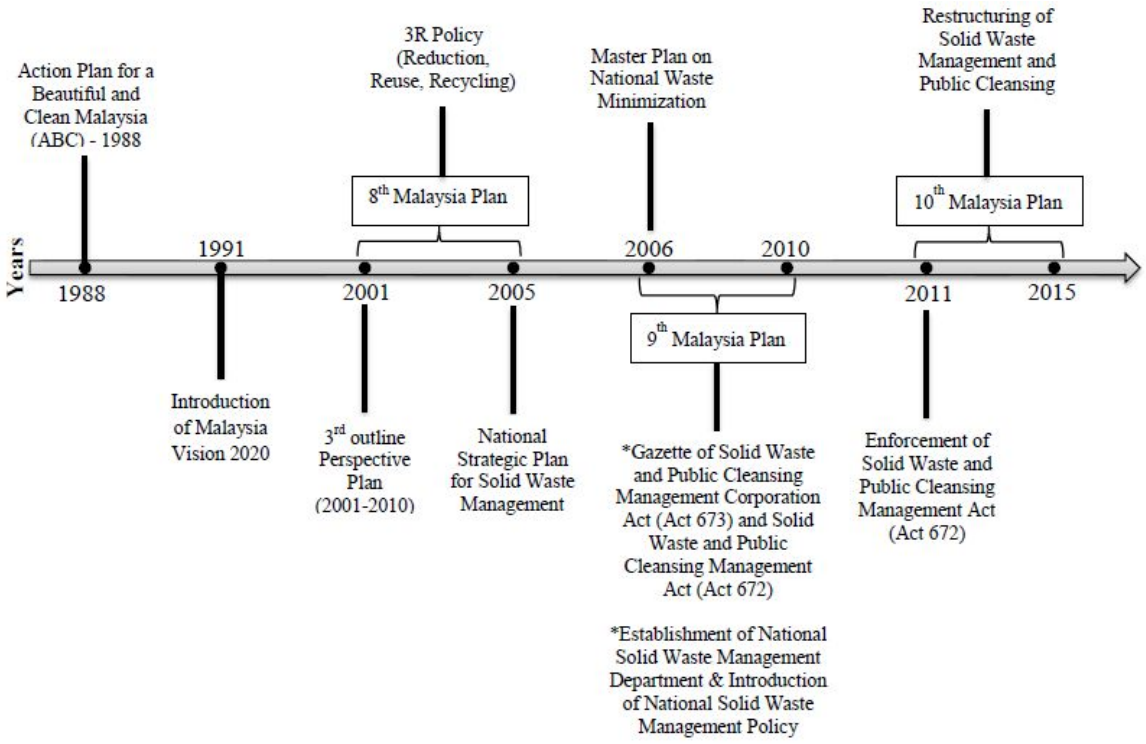


Figure 2.2: Timeline of solid waste management transition in Malaysia (Abas & Seow, 2014)

Currently, the cost used for municipal solid waste management is about 50% of the municipal operating budget, and 70% of the waste management cost is spent on the waste collection (Lau, 2004). The funds for waste management come from municipal taxes, fees charged for service, and subsidies from municipal revenues received from government source (Lau, 2004). Municipal taxes are heavily relied in cities and towns to provide waste management services to their communities the costs of these operations are not covered by the fees charged for collection and transfer service (Lau, 2004). In addition, there is actually no standardized procedure for setting fees and ongoing debates about this issue (Lau, 2004).

In general, the important elements in solid waste composition are storage, collection, transportation, treatment and disposal (Abas & Seow, 2014). In Malaysia, the waste management begins from the storage of waste at waste containers located near residential houses, commercial centers or storage centers (Abas & Seow, 2014). Then, the waste are

collected and transported to be treated (Abas & Seow, 2014). The waste which are unable to be treated will be disposed at landfill (Abas & Seow, 2014). Although this type of waste management system is also very common in many developed and developing countries, the main constraint in Malaysia's waste management system is its inefficiency in reducing the amount of waste (Abas & Seow, 2014).

2.2.1 Waste Storage

Once waste are generated, they are packed by using small or medium plastic bags before being transferred into bigger plastic bags (Abas & Seow, 2014). After that, the waste are stored by the waste generators in the garbage bins/waste containers outside of the houses, premises, offices or factories before the waste are collected by waste collectors (Abas & Seow, 2014). Usually, the properly designed garbage bins are either provided by the local authorities or purchased by the waste generators themselves (Abas & Seow, 2014).

However, there are two major issues in the waste storage. Firstly, most Malaysian households do not practice waste segregation, so various types of waste including food waste, plastic waste and other waste can be found mixing together in the plastic bags (Abas & Seow, 2014). Secondly, in some cases, many bins or containers are not well-maintained and thus resulting the damage of the bins (Abas & Seow, 2014). Some households just leave the garbage bins outside of the streets because they are no longer usable (Abas & Seow, 2014). Therefore, this creates chance to the stray cats and dogs to scatter the waste along the streets (Abas & Seow, 2014). And coincidentally, these issues are also observable in West Lake Students Hostels as shown in Appendix 1.

2.2.2 Waste Collection and Transportation

For many years, the waste collection and transportation are done through cooperation between government and private sectors like Alam Flora Sdn. Bhd. and Southern Waste Sdn. Bhd. to enhance the solid waste management practices (Abas & Seow, 2014). In Malaysia, more than 80% of municipal solid waste are able to be collected (Abas & Seow, 2014). Generally, the waste collection schedule differs based on the area and the situation.

For example, waste collection is carried out everyday except Sunday at commercial area and apartment (Abas & Seow, 2014). At area with land property owners, waste collection is conducted three times weekly (Abas & Seow, 2014). This is similar with West Lake, Kampar, where majority of the hostels are owned by Danish House Sdn. Bhd., as MSW collection is done every Tuesday, Thursday and Saturday. Furthermore, if there is certain seasonal festival in a particular area, frequency of waste collection will also increase due to temporary increase of waste generation (Abas & Seow, 2014). Therefore it is recommended to avoid conducting waste generation study during festive seasons such as Hari Raya Aidilfitri, Deepavali Day, Christmas Day and Chinese New Year.

2.2.3 Waste Treatment and Disposal

After the waste are collected by waste collection vehicles, they will be sent to transfer station for treatment and compaction (Abas & Seow, 2014). There are several transfer stations in Malaysia such as Batu Maung (Penang), Ampang Jajar (Penang) and Jinjang Hill (Kuala Lumpur) (Abas & Seow, 2014). Although waste segregation is performed in several transfer stations, it is practiced as an informal activity (Abas & Seow, 2014). Beside that, in some transfer station like Batu Maung, the solid waste transferred are not compacted before disposal in landfill, thus greatly reducing the remaining space in the landfill (Abas & Seow, 2014).

Landfill has been the main disposal method in Malaysia for many decades. Nevertheless, as the waste generation continues to increase, Malaysia is facing more and more landfill problems including overflowing of landfill and shortage of land (Abas & Seow, 2014). By 2008, the remaining capacity of the existing landfills in many parts of Malaysia is critically low, as shown in Figure 2.3 (Yahaya & Larsen, 2008). Less than 50% of the landfills in Malaysia have remaining lifespan longer than 5 years (Yahaya & Larsen, 2008).

In addition, there are also many technical problems in many Malaysia landfills like absence of facility for venting gas and absence of leachate treatment (Abas & Seow, 2014). By 2011, there are 296 disposal sites throughout Malaysia, but only 8 of them are sanitary landfills which provide proper management of landfill gases and leachate (Patrick, 2011). The remaining landfills, including Sahom Landfill at South Kinta Valley,

are open landfills.

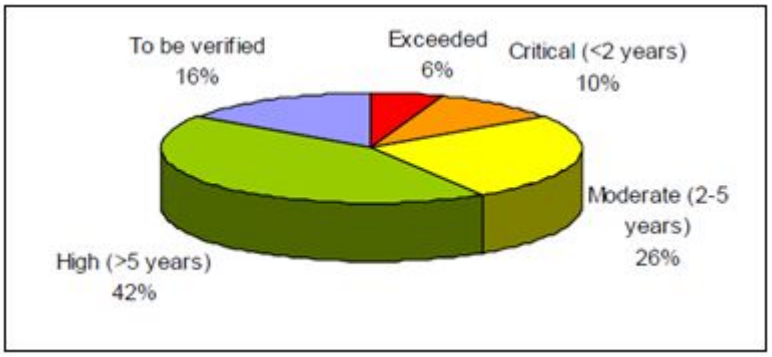


Figure 2.3: Life expectancy of operating landfills in Malaysia (Yahaya & Larsen, 2008)

Another main landfill problem in Malaysia is that the local waste management authorities are more focused on collection, transportation and open dumping (Badgie et al., 2012). In the contrary, in many developed countries, they emphasize the environmental benefits of the waste recovery to reduce the amount of waste accumulated at the landfill (Badgie et al., 2012). In Malaysia, only 5% of the total collected waste are being recycled although a lot of waste in Malaysia has high recycle value (Tarmudi et al., 2009). If the waste recovery for recycling and composting can be increased, perhaps there is a chance to reduce the input of waste into the landfill and thus solving the land shortage problem.

Moreover, Malaysia government is also considering the usage of incinerators (Abas & Seow, 2014). The price for each incinerator is about RM 2.5 million, and its operational cost is also very expensive because it is about RM 600 per day per unit (Abas & Seow, 2014). Despite of the cost, an incinerator can incinerate 5 to 10 tons of solid waste per day (Abas & Seow, 2014). Therefore, it can eliminate 75% to 95% of the total waste, and it can also help to prolong the life span of landfill sites up to 10-20 times (Lau, 2004). However, although the usage of incinerator is approved by Department of Environment (DOE) in Malaysia, there are a lot of protests from civilians and environmental activists (Abas & Seow, 2014). In addition, due to Malaysia's high moisture climate and mixing waste stream (including high content of moist food waste), the efficiency of incinerator will greatly decrease, and more energy is required to

incinerate the waste (Wukasch, 1993). So, incineration is still not an appropriate waste disposal method in Malaysia unless there is change of waste management behavior among Malaysians.

In order to utilize more advanced waste treatment facilities, waste separation from the source for recycling, composting and selective disposal are necessary. Therefore this project will serve as a good opportunity for the students in West Lake to adapt to the new practice.

2.3 Solid Waste Management in Japan Compared with Malaysia

Solid waste problem is a common issue in almost all countries in the world. In most developing and developed countries, the waste generation keeps on increasing because of rapid population growth and urbanization. Nevertheless, some countries have very effective waste management systems that help to minimize the amount of the waste being truly wasted. In this section, the waste management systems in Japan will be discussed and compared with the waste management system in Malaysia. The information can be helpful for this study as well because we can try to adopt the applicable methods of waste management from Japan into West Lake student hostels to improve the local waste management system.

During Japan's rapid economic growth period (1950s - 1970s), the uncontrolled waste disposal from human activities had caused several serious pollution cases such as Minamata disease and Itai-itai disease (Japanese Ministry of the Environment, 2014). To prevent the continuous deterioration of environment, Japanese government started to wage war against waste by revising the old environmental policy, implementing new waste management acts and putting effort in raising the public awareness about the proper waste management (Japanese Ministry of the Environment, 2014). And starting from 1990s, waste reduction was added together with sorted collection and waste recycling in 1991 revision of the waste management act to solve the landfill shortage problem (Japanese Ministry of the Environment, 2014). Within this few decades, Japan has slowly advanced to become one of the Asian countries with the most effective waste management system (Themelis & Mussche, 2013).

The domestic waste in Japan is managed at municipal level (Lane, 2014). Each town in Japan has different rules of waste collection system, including different collection time and different waste classification (Lane, 2014). Despite of the difference, most towns in Japan require separation of domestic waste into more than 40 types (Lane, 2014). For example, even for plastic waste alone, it can be further separated into many sub-categories based on the type of polymer (Lane, 2014). Kerbside recyclable waste collection is generally used in Japan (Lane, 2014), and this collection method has been reported to be able to maximize the recycling rate (Hogg, Mansell, & Network Recycling, 2002).

To make the separation more convenient, labels of material type that are standardized based on the containers and packaging recycling law in Japan can be easily found on the products (Japanese Ministry of the Environment, 2014). After the waste are segregated, the waste has to be inserted into the assigned plastic bags with different colours or labels before they are collected (Lane, 2014). Failure to separate the waste following the rule will cause the waste to be sent back to the waste generators together with a warning sticker (Lane, 2014). On the other hand, failure to put the waste at the assigned location for collection at specified time will leave the waste generator's waste behind without being collected (Lane, 2014).

Consumers, municipalities and business operators all play important roles in the waste management (Japanese Ministry of the Environment, 2014). The waste collected by municipalities from the consumers will be returned to the business operators, so they can manufacture new products by recycling the old materials (Japanese Ministry of the Environment, 2014). Aside from recycling waste, there is also policy in Japan to ensure the manufacturers reduce the waste generation by reducing the thickness and weight of their products, especially for containers and packaging (Japanese Ministry of the Environment, 2014). The similar system also applies to the management of food waste, as food waste is retrieved by the food producers from the consumers to be reused as fertilizers to further produce more food products (Japanese Ministry of the Environment, 2014).

In some districts in Japan, group collection of recyclable waste may be conducted by certain neighborhood associations, district organizations, and volunteer groups (Japanese

Ministry of the Environment, 2014). The group collection system enables residents to separate their recyclable waste at home on specific days and create chance for the residents around the residential area to communicate with each other (Japanese Ministry of the Environment, 2014). The waste will also be sent to recycling operators like the one collected by municipalities (Japanese Ministry of the Environment, 2014). To improve the performance of these private collection, many local governments implement incentive system that provides subsides to private organizations and residents who practice waste segregation (Japanese Ministry of the Environment, 2014).

By 2013, the annual waste generation of Japan is about 65 million tonnes (Themelis & Mussche, 2013). Despite of the large amount of waste generation, only 2% of the waste are landfilled (Themelis & Mussche, 2013). 61% of the waste are incinerated, while the remaining 37% are either recycled or composted (Themelis & Mussche, 2013). The low landfill input and the high recycle rate are the result of effective waste management in Japan (Themelis & Mussche, 2013).

One of the major differences between Malaysia and Japan in waste management is the nature of waste separation at source. In Malaysia, source separation is done by citizens at voluntary basis (Goh, 2011), whereas in Japan, source separation is a part of government policy, and it is enforced to ensure that citizens are following the rules (Japanese Ministry of the Environment, 2014). In term of waste collection method, the waste are not collected separately in Malaysia (Goh, 2011). Recyclable waste are retrievable only if the citizens spontaneously send them to the recycling facilities (Goh, 2011). On the other hand, Japan's waste collection system includes separate collection of different waste even by local government (Japanese Ministry of the Environment, 2014). Incentive system is also available for some regions where private organizations are responsible for the recyclable waste collection (Japanese Ministry of the Environment, 2014).

Due to the difference of waste management method, the amount of final waste disposal also differs. As mentioned in Section 2.2.3, Malaysia's main waste disposal method is landfill due to lack of waste segregation, thus leading to low recycling rate of about only 5% (Tarmudi et al., 2009). Moreover, incinerator is not a feasible method to dispose waste in Malaysia because the efficiency of incinerator can be lowered due to

presence of non-separated waste (Wukasch, 1993). On the other hand, due to the presence of enforced waste separation and separated collection, more than 90% of the waste in Japan can be diverted from landfill disposal, thus solving the landfill shortage problem (Japanese Ministry of the Environment, 2014).

In addition, in term of public perception, from Malaysians' perspective, waste management is the responsibility of the local government or waste collectors (Otitoju & Lau, 2014). More details about this perception is discussed in Section 2.4.3. However, in Japan, aside from government, citizens and even the manufacturers are responsible in waste management, because from Japanese's perception, anyone who generate the waste from domestic activities and commercial activities are responsible to manage them well (Japanese Ministry of the Environment, 2014). Therefore, the waste management becomes much easier because the manufacturers also help in waste reduction through redesigning of product for easier recycling and retrieval of waste as new raw material (Japanese Ministry of the Environment, 2014).

It is difficult to adopt all aspects of the waste management method in Japan into Malaysia completely due to cultural difference, and some systems such as the incentive system and the enforcement of recycling law cannot be executed with proper long term national planning. Nevertheless, one of the aspects that can potentially be adopted is the source separation and separate collection. To enable this new waste management system to be implemented in Malaysia, cooperation between residents and local government is required.

2.4 Public Awareness of Waste Segregation in Malaysia

Aside from the effort of government, public participation is also required in solving the waste problem in Malaysia. Previous studies revealed that most of the waste separation campaigns failed to achieve their objective due to minimal public response (Otitoju & Lau, 2014). This is because everyone in the society is waste generator, so it is more effective to reduce waste from the source through spontaneous waste segregation (Desa et al., 2010). To achieve this, people have to be educated about the importance of waste segregation (Desa et al., 2010). A lot of studies have been conducted to learn the

awareness and acceptance of Malaysians on waste separation. The information obtained from these studies will be very useful in designing the questionnaire for the awareness and acceptance study in West Lake and planning suitable actions to be taken to implement a socially acceptable waste segregation programme in West Lake which may be feasible even for all Malaysians in general .

2.4.1 Awareness of Malaysians about Solid Waste and Public Cleansing Management Act 2007 (Act 672)

As mentioned in Section 1.1, Malaysia government started to implement a new waste segregation policy in several states under Solid Waste and Public Cleansing Management Act 2007 (Act 672). However, according to Bernama (2015), only 10.5% of Malaysians aware about this policy. Some of the respondents of the survey responded that there is insufficient news and information regarding the policy being delivered to the public (Bernama, 2015). Some of the respondents also responded that the government should have aggressively boost the publicity of the policy through various channel just like how they promote Goods and Service Tax (GST) (Bernama, 2015).

While something seems to go wrong with the promotion of the policy, an environmental studies lecturer from Universiti Putra Malaysia, Ab Rahim claimed that the poor awareness of Malaysians on the waste segregation policy is due to poor attitude of Malaysians regarding cleanliness (Bernama, 2015). One of the factors is the local culture which does not emphasize on environmental conservation. Most Malaysians have a mindset that waste management is the sole responsibility of the contributors, without realizing that they who are the biggest waste contributors should be responsible to tackle the waste problem. Other reasons behind the poor attitude of Malaysians in waste management are discussed in Section 2.4.2 and Section 2.4.3.

2.4.2 Inconsistency of Awareness and Behavior of Malaysians on Waste Segregation

Several studies in Malaysia showed that majority of Malaysians have high awareness about waste segregation (Otitoju & Lau, 2014; Desa et al., 2010 & 2012). For instance, from an awareness study in South Kuching City, Sarawak, 86.3% of the residents who were surveyed have heard about the news about waste separation, while only 13.7% of

them have never heard about waste separation (Otitoju & Lau, 2014). Similarly, an awareness study in Universiti Kebangsaan Malaysia (UKM) which targeted first year students revealed that 63.8% of the first year students are aware about solid waste management around UKM (Desa et al., 2010).

Despite of the high awareness among public, inconsistency of awareness and practice have been observed in the similar studies above. For example, in UKM, although more than half of the first year students aware about waste segregation, only 34.1% of students have positive attitude towards solid waste management, and only 42.8% of the students actually practice waste segregation (Desa et al., 2010). Likewise, in South Kuching, only 49.5% of the respondents separate their waste at their home.

This contradiction is supported by a study of Al-Najede in 1990, which showed that awareness and attitude to the environment share no relation with each other (Desa et al., 2010). Furthermore, this research also shows that the transfer from attitude to behavior is also affected by lifestyle (Desa et al., 2010). Many people may not be willing to change their lifestyle if they have to sacrifice certain forms of leisure and comfort to save the environment, despite they may show positive attitude to the environment (Desa et al., 2010).

According to Hvatum and Kelly (2008), this situation is labeled as "You know it, but you don't do it" (Desa et al., 2012). This behavior problem may be caused by attitudinal problems, lack of government enforcement, lack of regular monitoring and lack of people's understanding about their roles and responsibilities in environmental protection (Desa et al., 2012). Furthermore, findings of Hines, Hugerford and Tomera (1986) also showed that a person's knowledge and awareness, public verbal commitment and sense of responsibility greatly influence the consistency between environmental awareness and behavior (Desa et al., 2012).

Besides, the inconsistency mentioned above may also be contributed by a number of constraints, which conclude that it is not sufficient to only raise the awareness of public in order to increase the activity of waste segregation as we also need to consider the other factors that can influence the public participation. Nevertheless, it is not necessary to consider gender, age and education level as these factors do not bring notable change to the awareness level (Otitoju & Lau, 2014).

2.4.3 Constraints towards Waste Segregation Practice and Their Corresponding Motivation Factors

A lot of constraints towards waste segregation practice have been outlined in many related studies. The most common constraints include absence of waste segregation facilities, inconvenience, lack of time, lack of enforcement, low awareness and lack of incentive (Otitoju & Lau, 2014; Richardson, 2005). The motivation factors are generally the opposite of the constraints.

According to a study in Ampang Jaya and Subang Jaya, it was found that Subang Jaya has larger number of households who take part in recycling (68%) than Ampang Jaya (43%) because Subang Jaya has more recycling facilities than Ampang Jaya. (Richardson, 2005). Furthermore, the study in these two areas also revealed that the longer the distance between the residential area and the recycling center, the higher the difficulty for the residents to take part in recycling (Richardson, 2005). Similarly, among the 57.6% of respondents in the South Kuching awareness study who do not practice waste segregation, 29.2% claimed that the absence of waste segregation facility, such as recycle bins, near the residential area discourages them from practicing waste separation (Otitoju & Lau, 2014). The finding above was also agreed by South Kuching City Council (MBKS) because they stated that the biggest reason for the low public participation is the difficulty of access to recycling centers and also the absence of transport of the recyclables to the recycling company at the peninsular Malaysia (Otitoju & Lau, 2014). These situations also occur in West Lake because students who separate waste have to bring their recyclable waste out of the hostel area to Tzu Chi or other organizations that accept recyclable waste. It would be more convenient to the students if certain form of waste collection infrastructure such as recycle bins and food waste collection bins are installed in West Lake. In order to execute this, financial support from both Majlis Daerah Kampar (MDK) and the hostel companies are required.

Besides, financial limitation and low number of workforce will also discourage households to practice waste segregation (Otitoju & Lau, 2014). In other words, many

respondents are not willing to separate waste because they think that MBKS have not done enough to encourage and develop effective and efficient waste segregation system (Otitoju & Lau, 2014). Therefore, the loss of public confidence toward government can also become an inhibitor in public awareness and participation. Likewise, to make sure the waste segregation programme in West Lake can be implemented successfully, students' trust to MDK must be restored through improvement of local waste management. Nevertheless, appropriate planning is required to produce a sustainable waste collection method which is eco-friendly, economically affordable and most importantly social-acceptable since residents play an important role in following the management system.

Those who suggested time used to separate waste as a limiting factor have high opportunity cost of time (Otitoju & Lau, 2014). The inconveniences might also be caused by the long distance between residential area and recycle facilities, non-systematic operations, failure of collection time and odour (Otitoju & Lau, 2014). However, the perception towards time usage and convenience can also differ based on whether the person is waste-separator or non-waste separator (Otitoju & Lau, 2014). Most waste separators perceived that they should take part in waste separation because they are aware of the benefits and impacts to the environment, and they also support the initiative of government to improve the environment's quality (Otitoju & Lau, 2014). On the other hand, non-waste-separators are not willing to accept laws about waste segregation because they believed that it is a matter of personal choice to practice waste separation as solid waste management is supposed to be the government's responsibility without involvement of public (Otitoju & Lau, 2014). Therefore, they will not put waste segregation as priority in their life, and hence they have the perception that waste segregation is time consuming and inconvenient.

The same thing also applies to the incentive issue. A few studies showed that low public participation is also caused by lack of incentives (Akil et al., 2012; Otitoju & Lau, 2014) Some people perceived that it is not profitable to separate waste because of low market price of recyclable materials (Akil et al., 2012). Some people also perceived that tax reduction or other forms of rewards should be provided in order to motivate them to separate waste (Otitoju & Lau, 2014). This concept is supported by Gagne and Skinner

(2003), who suggested that behaviors, opinions and attitudes which are rewarded and reinforced are more likely to be repeated as a habit (Desa et al., 2010). In addition, majority of household still see waste recovery as a benefit to the government (Otitoju & Lau, 2014). Therefore, the public participation will stay low unless the public finally realize that waste segregation also brings benefit to themselves (Otitoju & Lau, 2014).

Furthermore, lack of enforcement by government has been a long time problem in Malaysia according to Goh (2011). Despite there are a lot of waste segregation programmes being organized by the government, there is no strong and long term enforcement to make sure Malaysians follow the laws of waste management (Goh, 2011). Although there is no enforcement of waste segregation in Penang currently, the banning of polystyrene food containers starting from December 2012 had proven the importance of law enforcement in creating green society (Mok, 2012). After 1st December 2012, any hypermarkets, restaurants or stalls which are caught using polystyrene food containers will have their licenses revoked (Mok, 2012). This can effectively cut the supply of polystyrene food containers in Penang and thus reducing a lot of polystyrene waste which is difficult to be recycled and decomposed. Therefore, it may be possible to increase the waste separation rate if enforcement like this is taken.

Another constraint which was mentioned by Desa et al. (2012) is the inadequacy in education. So far, detailed environmental issue is only being exposed to students who are studying subjects related with environment such as Environmental Science, Health Education and Agricultural Science (Desa et al., 2012). One of the biggest flaws in most of the waste management campaigns is that they only emphasize the promotion of waste segregation practice without exploring the whole picture of how solid waste management in Malaysia works (Desa et al., 2012). Desa et al. (2012) believed that it will be easier to persuade people to separate waste if they understand the situation around them which in the process also allow them to realize how waste segregation benefits them.

Aside from campaigns, a more effective motivation factor which is related with education is implementation of formal education at school (Akil et al., 2012). According to Yin (2002), in Sweden, people's attitudes towards waste management are trained at an early age (Akil et al., 2012). Environmental education is provided since pre-school to bring long term effect to people's awareness and attitude towards environmental issues

(Akil et al., 2012). Therefore, instead of following the rules, people in Sweden already practice waste segregation as their daily routine (Akil et al., 2012). Although it will take a long time for Malaysia to implement this kind of education, there are other positive aspects in Japan's waste management system that can be adopted into Malaysia, as mentioned in Section 2.3.

Despite of the constraints discussed above, the effort to promote waste separation has to be continued. Even in Japan, the government took more than 30 years to successfully change the waste management of Japan to the current noble state. And they are still continuing to strive for better performance in the future although their current performance has already exceeded many other developing and developed countries. Besides, it can be indicated that the slow advancement of waste management system in Malaysia is due to the lack of cooperation and trust between citizens and government. If we can find a way to build a link between the government and the citizens, perhaps the waste management system will be improved, and eventually, this can solve a lot of the solid waste problems which are currently occurring in Malaysia.

2.5 Benefits of Waste Segregation

Waste segregation is generally encouraged for most waste management system due to its benefits to environment and economy. Firstly, as mentioned earlier, waste segregation is an effective way to reduce waste. Although waste generation is inevitable due to rapid economic growth, if high percentage of waste can be reused as new material or energy source, that means the actual amount of waste "wasted" will be reduced. In Japan, the long term source separation policy has successfully reduced the final waste disposal amount year by year as most of the waste are either recycled or incinerated as shown in Figure 2.4 (Japanese Ministry of the Environment, 2014).

Secondly, waste segregation can help to improve a country's economy. For example, Japanese government only spend about 3.6% of annual budget for waste-related expenses (Japanese Ministry of the Environment, 2014). Therefore, more money can be spent for other expenses such as educational expenses, community development expenses, health and welfare expenses and etc (Japanese Ministry of the Environment, 2014). The low

waste management cost is the result of the waste reduction thanks to the cooperation from the citizens and the manufacturers (Japanese Ministry of the Environment, 2014). The material cycle system allows the existing materials to flow in a close system, thus saving not only the harvest cost and manufacture cost, but also the waste management cost due to waste reduction (Japanese Ministry of the Environment, 2014).

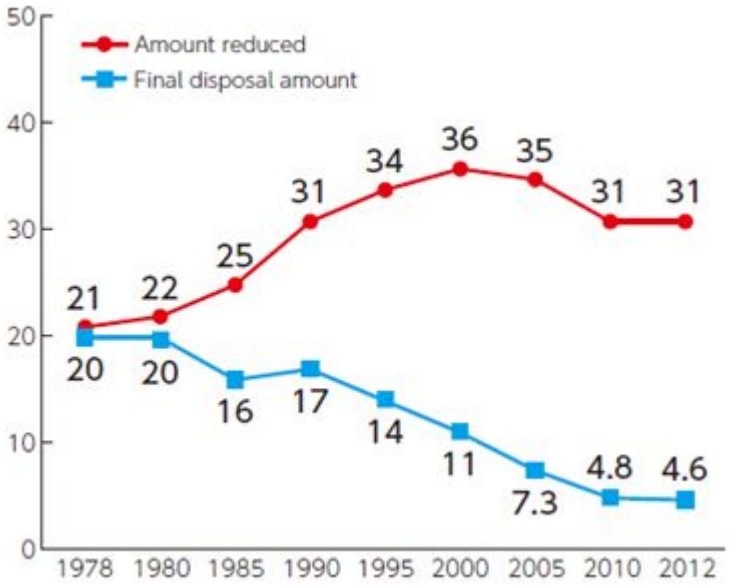


Figure 2.4: Amounts of final disposal and waste reduction (million tons) in Japan (Japanese Ministry of the Environment, 2014)

In addition, landfill is also a huge source of greenhouse gas (GHG) emission, especially the emission of methane (CH_4) gas (Mohamad & Keng, 2013). CH_4 is released when organic waste is decomposed by microorganisms at open landfill sites (Mohamad & Keng, 2013). Aside from this, CH_4 is also released from fugitive emissions from oil and natural gas, agricultural activities, wastewater treatment and other anthropogenic activities (Mohamad & Keng, 2013). Nevertheless, almost half of the total CH_4 emission in Malaysia is contributed by landfills, as shown in Figure 2.5 (Mohamad & Keng, 2013). Since almost half of the municipal solid waste in Malaysia is comprised of food waste, which is the main source of CH_4 emission, CH_4 gas emission can be reduced if food waste is diverted from landfill disposal through waste separation.

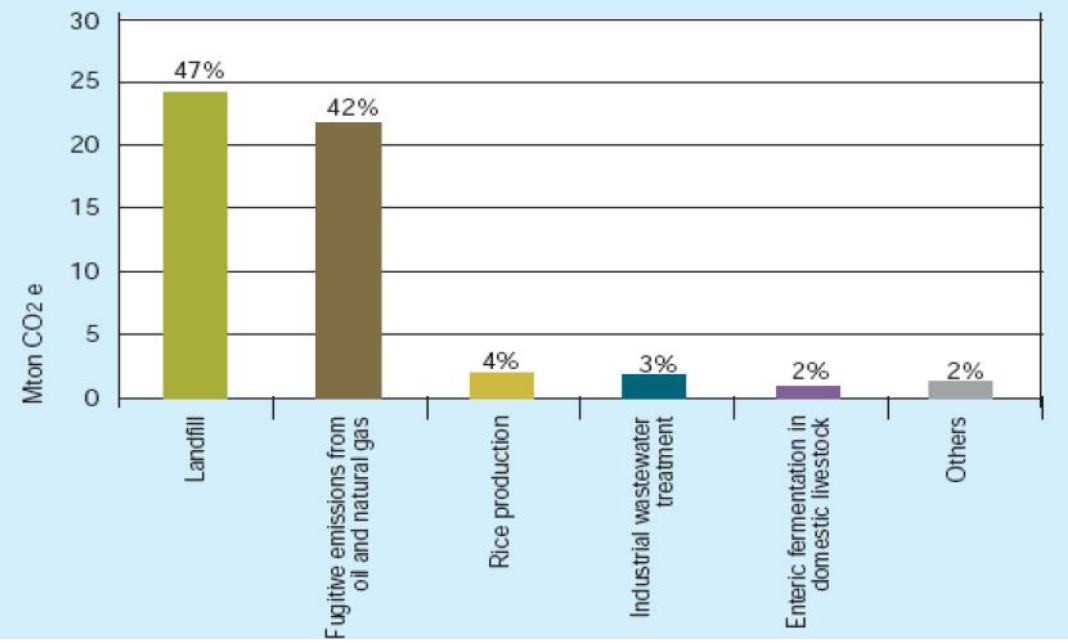


Figure 2.5: Major sources of CH_4 emissions in Malaysia (Mohamad & Keng, 2013)

Furthermore, leachate problem is also one of the common issues faced by all landfill operators in the world. Without proper protection and treatment, leachate will leak out from the landfill and pollute the surface water and groundwater (Goh, 2011). Although leachate problem is inevitable as long as landfills exist, a study in Canada shows that the leachate strength of landfill with separated waste is lower than the leachate strength in landfill with non-separated waste (Jardine, 2001). When waste watch source separation is applied before the waste disposal at East Prince Edward Island landfill, the biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solid (TSS), alkalinity and metal content of the leachate becomes about 90% lower than the leachate in conventional landfills without waste separation, refer to Table 2.2 (Jardine, 2001). This reduction does not only make the leachate treatment process easier, but it also minimizes the potential of groundwater contamination (Jardine, 2001). Therefore, waste separation can help to minimize the negative impact of leachate from landfills before better waste disposal method is introduced into Malaysia.

Table 2.2: Source separation versus mixed waste leachate in terms of chemical parameters (Jardine, 2001)

Parameter	Units	East Prince Avg. Conc.	Mixed Waste
BOD	Mg/L	873	10,500
COD	Mg/L	1793	15,000
Total Solids	Mg/L	171	16,000
Ammonia	Mg/L	78.7	300
Alkalinity (total)	Mg/L	639	3,600
pH	Mg/L	6.8	6.3
Calcium	Mg/L	147	1,000
Magnesium	Mg/L	29.5	700
Sodium	Mg/L	246	700
Chloride	Mg/L	347	980
Sulphate	Mg/L	75	380
Chromium	Mg/L	nd	0.9
Cadmium	Mg/L	.005	.05
Copper	Mg/L	nd	0.5
Lead	Mg/L	nd	0.5
Nickel	Mg/L	nd	1.2
Iron (ext.)	Mg/L	13	430
Zinc	Mg/L	0.1	21
Nitrate (N)	Mg/L	0.2	4

To summarise this section, waste separation indeed brings a lot of positive impacts to the environment, economy and society. So, there is no excuse to not practice waste segregation. Although this study does not include result evaluation through leachate strength and CH_4 emission, the comparison of waste generation, waste composition and waste handling cost before and after the project should be sufficient for verification of waste separation's benefits.

CHAPTER 3

RESEARCH METHODOLOGY

The main procedures conducted in this study are summarized in Figure 3.1.

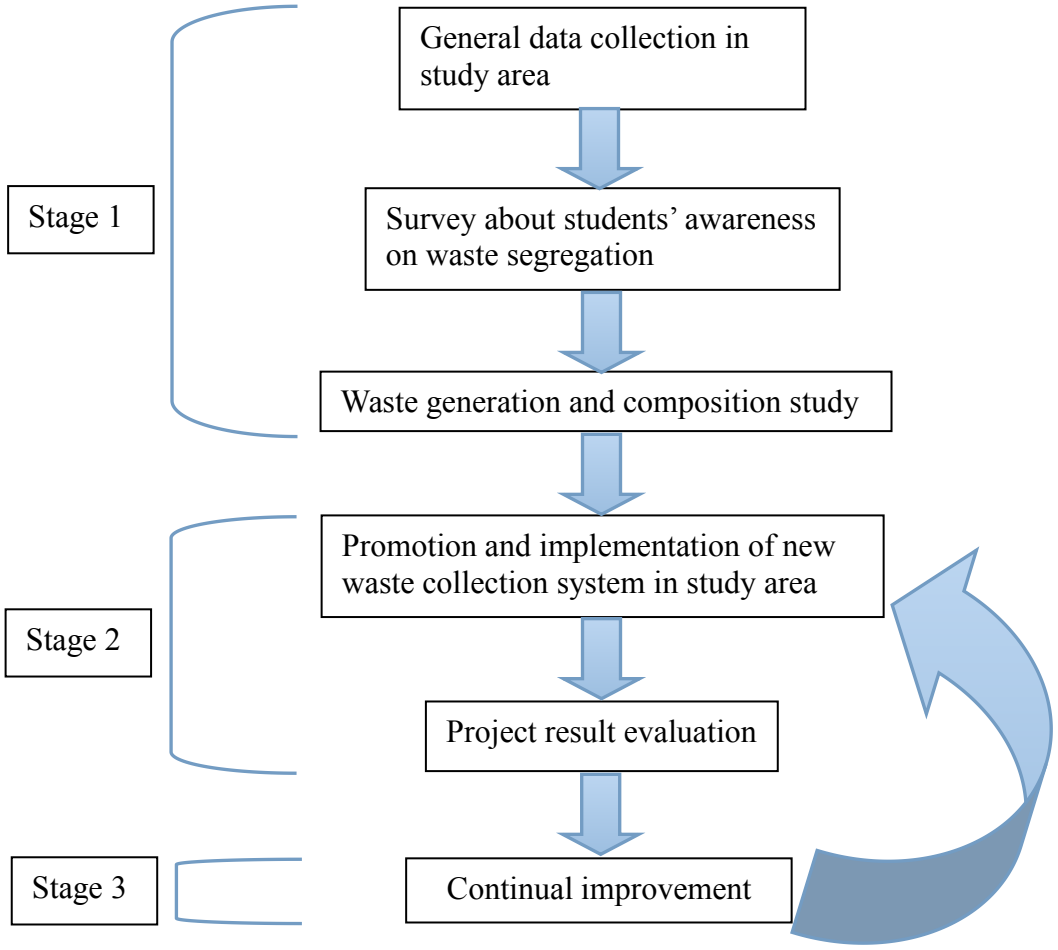


Figure 3.1 Main procedures conducted in this study

3.1 Study Area

The study area is West Lake student hostel area, also known as Bandar Barat, which is located in Kampar, Perak, Malaysia. Since this area is close to UTAR Perak Campus, majority of the residents in this area are UTAR students. The locations of the study area (Westlake Home and Harvard) and UTAR Perak Campus are illustrated in Figure 3.2 and 3.3. There are 1044 houses in the study area (Appendix 2), with 12786 residents in June 2015, 9580 residents in October 2015 (internship period) and 12852 residents in January 2016. 92.3% of the hostels in the study area are owned by Danish House Sdn. Bhd., 5.7% of them are owned by KT Management Sdn. Bhd. And the remaining 2% are owned by other hostel owners. The hostels in Stanford are also owned by Danish House, but it is not included in the study area because a lot of hostels in Stanford area were still not occupied.

MDK is the local authority that is responsible for the MSW collection in the study area every Tuesday, Thursday and Saturday. The collected MSW is disposed into Sahom Landfill (Appendix 3) which receives municipal solid waste from areas around South Kinta Valley including Kampar, Mambang Diawan, Tronoh Mines, Gopeng, Kopisan, Lawan Kuda, Kota Bharu, Jeram, Kuala Diapang, Malim Nawar and Sungai Siput (Goh, 2014). Currently, there is no waste collection system that allows separate collection of waste according to their types in South Kinta Valley, and this situation also occurs in other parts of Malaysia. Despite of this, there is a composting center in Sahom Landfill which gathers food waste from some restaurants and food courts around South Kinta Valley for composting.

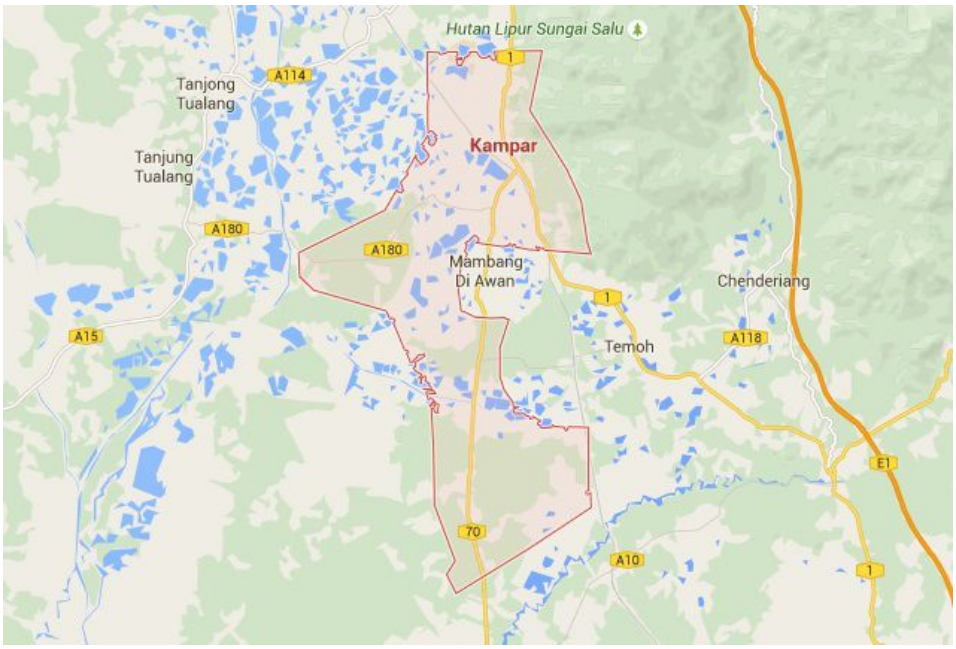


Figure 3.2: Location of Kampar in Perak, Malaysia

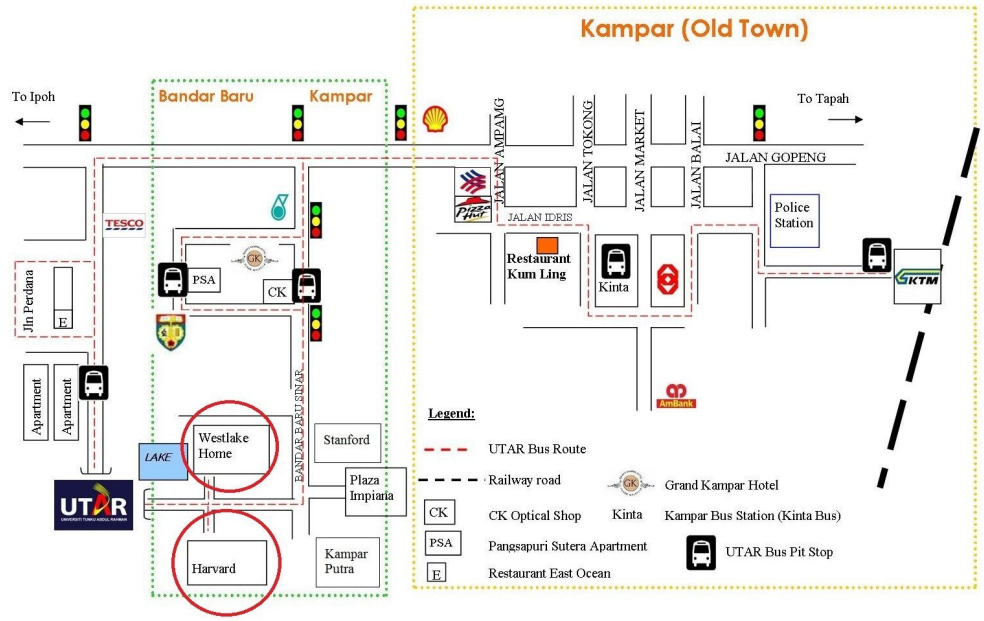


Figure 3.3: Location of West Lake student hostel area in Kampar

3.2 Students' Awareness of Waste Segregation Before Programme Implementation

This student survey was conducted before the implementation of new waste

collection system in West Lake student hostels to obtain understanding about the initial awareness and behavior of students on waste segregation.

To determine the sample size for the surveying work, the population size should be identified. Although the total population in the study area is 12786, it was assumed that the 9000 students who live in Westlake Home area is sufficient to represent all West Lake students including those who live in Harvard area. Therefore, the sample size could be calculated based on those 9000 students. According to Goh (2014), the most commonly used confidence level and confidence interval for surveying work are 95% and 5% respectively, as this combination can provide accurate result while the sample size does not appear to be too large. So, by using the sample size calculator available on the online resource, the sample size was determined as 368, as shown in Figure 3.4.

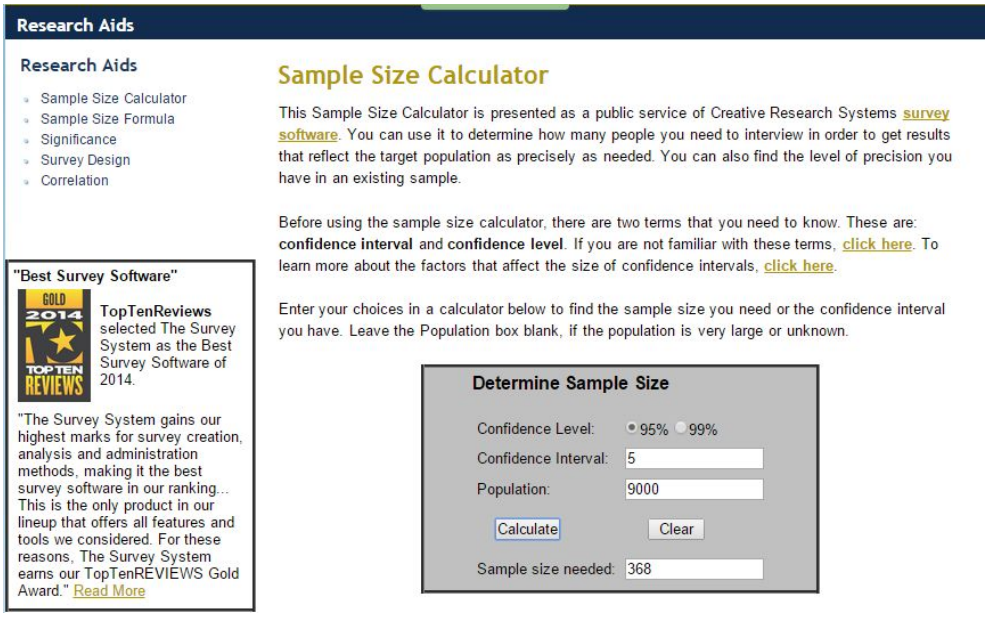


Figure 3.4: Sample size calculator (Creative Research Systems, 2012)

There are 17 questions in the questionnaire (Appendix 4). These questions are divided into 4 parts. The first part is about personal information, which questions about the students' faculty of study, age and gender. The second part is about the awareness and general practice of the students, which allow us to know how aware are the students about waste segregation and what is their daily practice in domestic waste management. The third part is about the awareness of students on the local waste management system. Lastly, the fourth part, which is also the most important part, is about the opinions of

students about some encouraging and discouraging factors of waste segregation practice that are commonly discussed in previous studies stated in Chapter 2. The response for this part is crucial for the set up of new waste collection system in West Lake. After the questionnaire design was completed, questionnaires were distributed to 370 randomly-selected students who live in Westlake Home area through face-to-face approach.

After the student survey was completed, the result of the first student survey was analyzed by using Microsoft Excel. For Part 4 of the student survey, the data was analyzed by using a scoring system as shown in Table 3.1. Then, the score for each opinion was divided by the total score (If all students answer "strongly agree") to express the agreement level in term of percentage. Score higher than 60% (Majority of students answer either "strongly agree" or "agree") indicates positive result, while score lower than 60% (Majority of students answer either "undecided/neutral", "disagree" or "strongly disagree") indicates negative result.

Table 3.1: Scoring system for Part 4 of the first student survey and Part 3 & 4 of the second student survey.

	Score
Strongly agree	5
Agree	4
Undecided	3
Disagree	2
Strongly disagree	1

3.3 Waste Generation and Composition Study Before Programme Implementation

The waste study was conducted with the support from MDK to find out the waste generation and composition in West Lake student hostels before the implementation of new waste collection system. The result of this preliminary study is helpful as it can be compared with the waste composition after the execution of the new waste collection system to evaluate the system's effectiveness.

The first waste generation study was conducted in the last week of July 2015. On the

three days with MSW collection, the total mass of waste collected from Westlake Home and Harvard area with MDK's MSW truck were measured with the floor scale balance at Sahom Landfill. The sum of the total mass for three days was divided by 7 to obtain the amount of waste generated per day (kg/day). Then, the total amount was divided by the total population of the study area to obtain the amount of waste generated per capita per day (kg/capita/day).

To conduct waste composition study, a specially assigned truck was driven into West Lake student hostel area to collect the waste from 50 hostels which were randomly selected with the help of random number generator in Microsoft Excel (Appendix 5). After that, the waste were sent to Sahom Landfill. The waste were separated manually into paper/cardboard, plastic, metal, glass, food/organic and other/non-recyclable waste. Then, the total mass of each type of waste were measured to estimate the proportion of each waste in the waste stream. Based on the calculation method used in previous studies, waste composition is usually expressed in term of % mass.

Despite E-waste is also recyclable, it is still grouped into the other/non-recyclable waste group because it is very uncommon in Kampar (Goh, 2011). Furthermore, since this study is to investigate the effect of waste segregation on diversion of recyclable waste from landfill, the plastic waste in the waste composition refers to the one that are classified as recyclable in Malaysia. For instance, the easy plastics to recycle include Polyethylene Terephthalate (PETE) and High Density Polyethylene (HDPE) (GESB, 2011). Less commonly recycled plastics include Polyvinyl Chloride (PVC), Low Density Polyethylene (LDPE) and Polypropylene (PP) (GESB, 2011). The remaining plastics such as Polystyrene (PS), Polycarbonate (PC), Styrene Acrylonitrile (SAN), Acrylonitrile Butadiene Styrene (ABS), acrylic and nylon are generally classified as non-recyclable in Malaysia due to limitation of technology, low market demand and high cost, although all plastics are recyclable theoretically (GESB, 2011). In addition, medical waste, wood, tissue, textile, rubber and some composite materials such as aluminium-foiled plastic packaging are also treated as non-recyclable waste (Goh, 2011).

3.4 Promotion and Implementation of New Waste Collection System in West Lake Student Hostel Area

The promotional activities began from the beginning of August 2015. Seminars about waste segregation were held on 12 August and 13 August 2015 for students from every faculty, as shown in Appendix 6A and 6B. The seminar was conducted with support from MDK. The content of the seminar includes:

1. The municipal solid waste management and problems in Malaysia
2. The result of student survey about awareness on waste segregation in West Lake student hostels
3. The result of waste generation and composition study in West Lake student hostels
4. Concept of waste segregation
5. Implementation of new waste collection system in West Lake student hostels

Aside from seminars, posters (Appendix 7A), flyers (Appendix 7B), Banners (Appendix 7C) and Facebook page (Appendix 7D) were also used as the medium to promote waste segregation to UTAR students. The posters were either posted on the bulletin boards of each faculty or on the webpage of each faculty. Flyers were displayed in the office of hostel company and distributed to students who visit the office to pay their rental fee. In addition, the digital copy of the flyer can also be seen as a web announcement from Danish House and KT Management. The flyers do not only show the details of the new waste collection system, but they also show the types of waste that are acceptable for recycling and vice versa. Likewise, Facebook page about this programme was created to show the latest update of the programme.

In addition, to further increase the number of students who are aware about this programme, 5 minutes class presentation was conducted class by class within a week to introduce this programme to students who missed the main seminar.

The new waste collection system was executed starting from 16 August 2015 (Appendix 8). This system shares several similarities with the waste collection system in Japan, which include:

1. Students are requested to separate the waste at their hostel before disposal.

2. Students have to put their recyclable waste outside of their hostels every Sunday morning to be collected by MDK. Kerbside recyclable waste collection is used as it can maximize the recycling rate according to a research in United Kingdom (UK) (Hogg, Mansell, & Network Recycling, 2002). E-waste is also collected during the kerbside collection.
3. Students also have to separate food waste from the other waste and put them into the food composting containers or food waste bins provided by MDK. Students can choose to either compost the food waste themselves with food composting containers or put their food waste into the designated food waste bins so that the food waste can be collected by MDK for composting purpose.

To increase the number of students who are aware about the programme, the lorry used for the collection in West Lake will have unique appearance compared with ordinary lorries. Moreover, speaker announcement is made from the collection lorry every time the lorry enters West Lake to collect recyclable waste and food waste.

MSW collection on every Tuesday, Thursday and Saturday will continue as usual. However, it was expected that through the new waste collection system, the MSW collected during those three days would be reduced.

3.5 Result Evaluation

The performance of the new waste collection system was evaluated based on its effectiveness in diverting waste from landfill, its economical value and the students' acceptance of this system.

3.5.1 Waste Generation and Composition Study After Programme Implementation

The second and third waste generation and composition studies were conducted in November 2015 and March 2016 respectively. The method used was similar as described in Section 3.3. The results of these studies were compared with the result of the preliminary waste study to determine whether the programme succeeds to divert waste from landfill or not.

3.5.2 Students' Acceptance of Waste Segregation After Programme Implementation

Second student survey (Appendix 9) was carried out in November 2015 to study the effect of the new waste collection system on the students' lifestyle and their perception on waste segregation. Besides, this survey is a good opportunity to get the opinions from the students to further improve the management of the waste collection system. In addition, the effect of the improvement on the students' behavior in waste management can also be studied through the third waste disposal and composition study and the third student survey. The methods to determine sample size and analyze survey result are similar as described in Section 3.2.

3.5.3 Study of Students' Behavior in Waste Segregation through Site Observation

Aside from student survey, the students' behavior in waste segregation were also studied through site observation (Appendix 10), by observing the on-site response of the students towards the kerbside recyclable waste collection and the usage of recycle bins and food waste bins.

3.6 Improvement of Waste Segregation Programme and Waste Collection System

Based on the result obtained from the second student survey, several major improvement have been applied to the waste segregation programme and waste collection system. The programme improvement was expected to improve the recycling rate in the hostel area. The outcome could be verified with the result of the third waste composition study conducted in March 2016.

3.7 Economical Aspect of Waste Segregation Programme

The data about the price of the recyclable waste was collected during selling of recyclable waste to recycling company in Gopeng, Perak (Appendix 11), and the economical value of the recyclable waste was analyzed. Moreover, other economical issues observed during the implementation of the programme will also be discussed.

CHAPTER 4

RESULT AND DISCUSSION

4.1 General Distribution Data of Questionnaire Respondents

The first and the second student surveys were participated by 370 UTAR students. Among them, 25% were distributed to Centre of Foundation Studies (CFS) students, 20.7% were distributed to Faculty of Business and Finance (FBF), 14% were distributed to Faculty of Science (FSC) students, 9.7% were distributed to Faculty of Information and Communication Technology (FICT) students, 12.4% were distributed to Faculty of Engineering and Green Technology (FEGT) students, 13.4% were distributed to Faculty of Art and Social Science (FAS) and 4.8% were distributed to Institute of Chinese Studies (ICS) students, as shown in Figure 4.1. As for gender, 41.9% of the sample students were males, while 58.1% of the sample students were females, as shown in Figure 4.2. Based on Figure 4.3, in term of age, all of the sample students were between 17 to 26 years old. Among them, 55.4% of them were younger than 21 years old, while 44.6% of them were older than 21 years old.

Recalling Section 2.4.2, Otitoju & Lau (2014) stated that age, gender and educational level will not affect a person's perception towards waste segregation. Assuming this statement is also applicable to UTAR students, for this study, the relationship between age, gender and area of study of students and their awareness about waste segregation will not be investigated. However, the findings of this study may represent all university students of same age range in other parts of Malaysia.

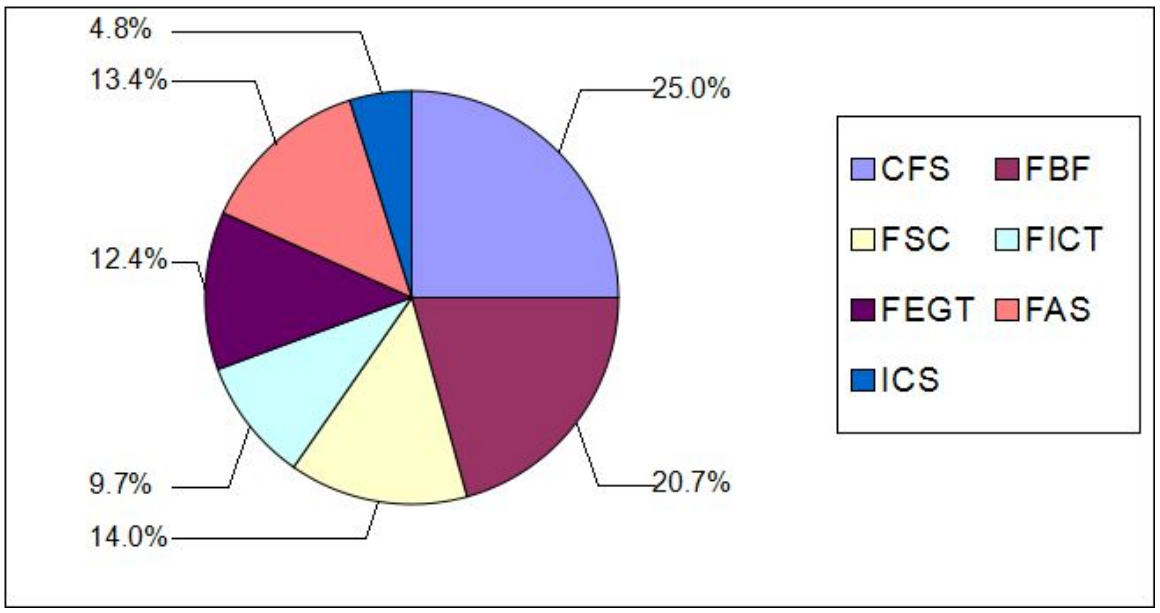


Figure 4.1: Number of sample students from each faculty involved in the first student survey in July 2015.

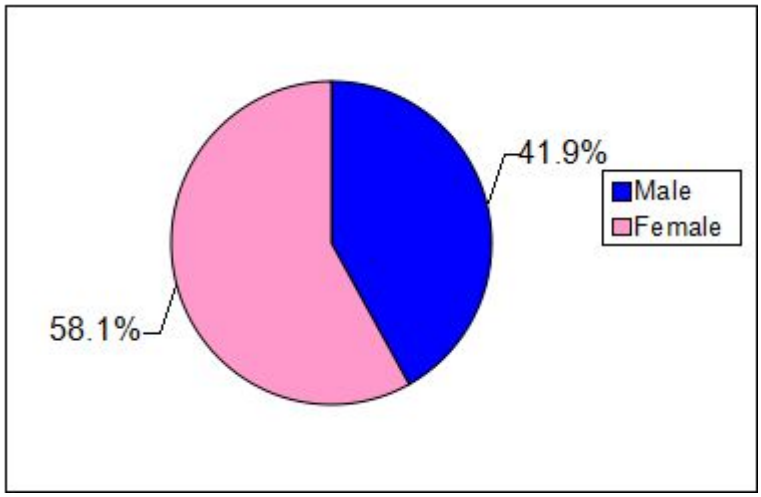


Figure 4.2: Gender distribution of sample students involved in the first student survey in July 2015.

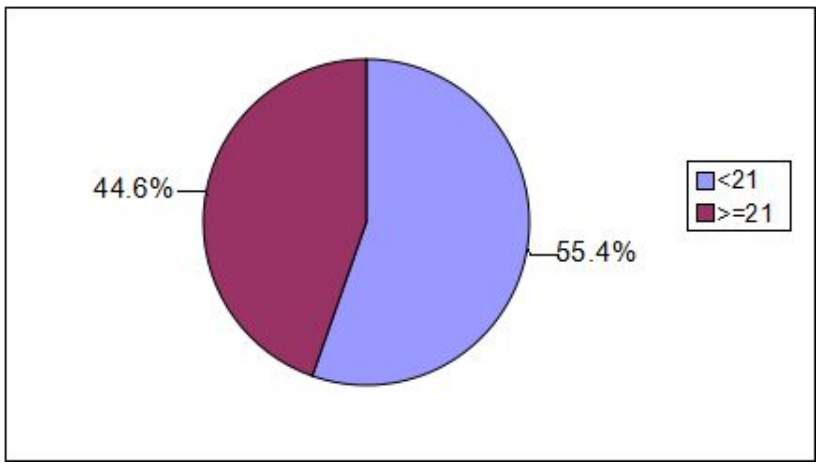


Figure 4.3: Age distribution of sample students involved in the first student survey in July 2015.

4.2 Students' Awareness and Waste Segregation Practice Before and After The Waste Segregation Programme

Refer to Figure 4.4, before waste segregation programme was organized, 69% of the students were aware about waste segregation, while the remaining 31% were not aware. After the waste segregation programme had been organized for three months, there was a slight increase of number of students who are aware about waste segregation. The percentage of students who are aware about waste segregation rose from 69% to 75%, indicating that waste segregation programme does help to create awareness about waste segregation.

Despite more than half of the students were aware about waste segregation even before the waste segregation programme was organized, Figure 4.5 shows that only 38.7% of the students were actually practicing waste separation. Therefore, the inconsistency of awareness and behavior of Malaysians on waste segregation as mentioned in Section 2.4.1 is occurring among UTAR students as well. Among the 61.3% of students who did not practice waste separation prior to the waste segregation programme, 52.7% of them were willing to separate waste in the future, and only 8.6% of students did not have future plan for waste separation.

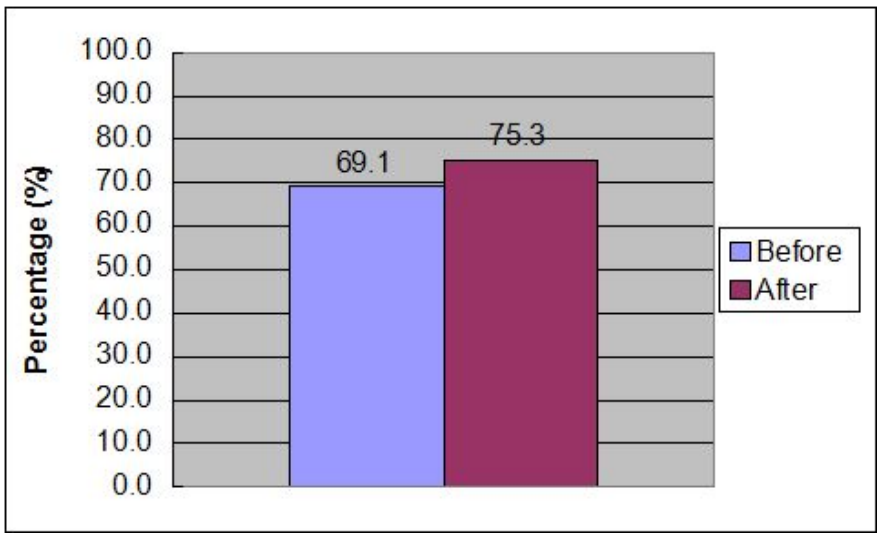


Figure 4.4: Awareness of students about waste segregation before and after the waste segregation programme.

However, after waste segregation programme had been organized for 3 months, Figure 4.6 shows that only 24.7% of students do not practice waste segregation, which is larger than the expected percentage of non-participants (8.6%) shown by Figure 4.5, thus this further justifies the inconsistency of awareness and actual practice. Fortunately, based on Figure 4.6, the waste segregation programme still managed to increase the percentage of students who practice waste segregation from 38.7% to 44.1% through direct participation of programme activities (19.2%) and other recycling activities unrelated with this programme (24.9%). The remaining 31.2% of students claimed that they were not aware about the waste segregation programme during the second student survey, but they will take part in it if they are aware about the existence of the programme. To encourage these 31.2% of students to practice waste segregation, promotion and execution methods of programme activities had to be improved based on students' opinions about the encouraging factors and discouraging factors of waste segregation, which is discussed in Section 4.3 and 4.4.

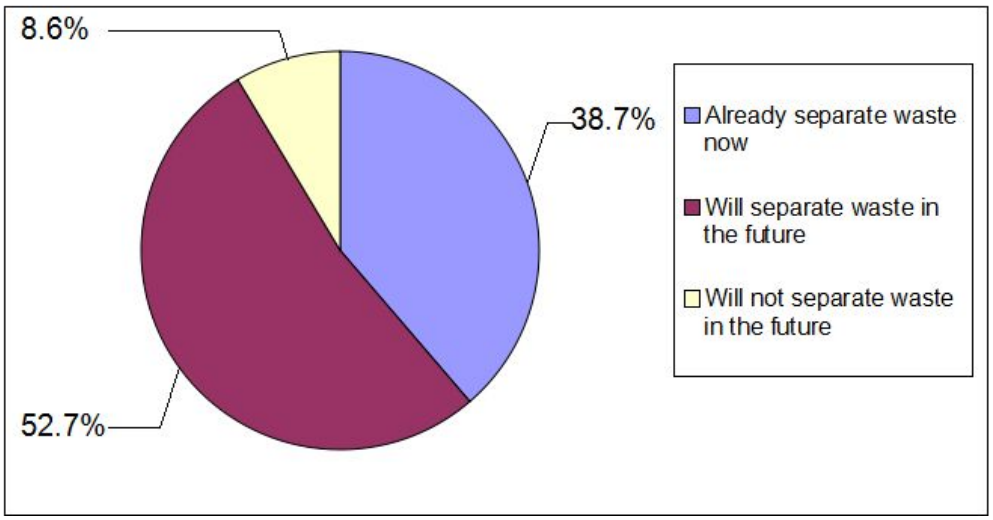


Figure 4.5: Students' waste segregation practice before the waste segregation programme.

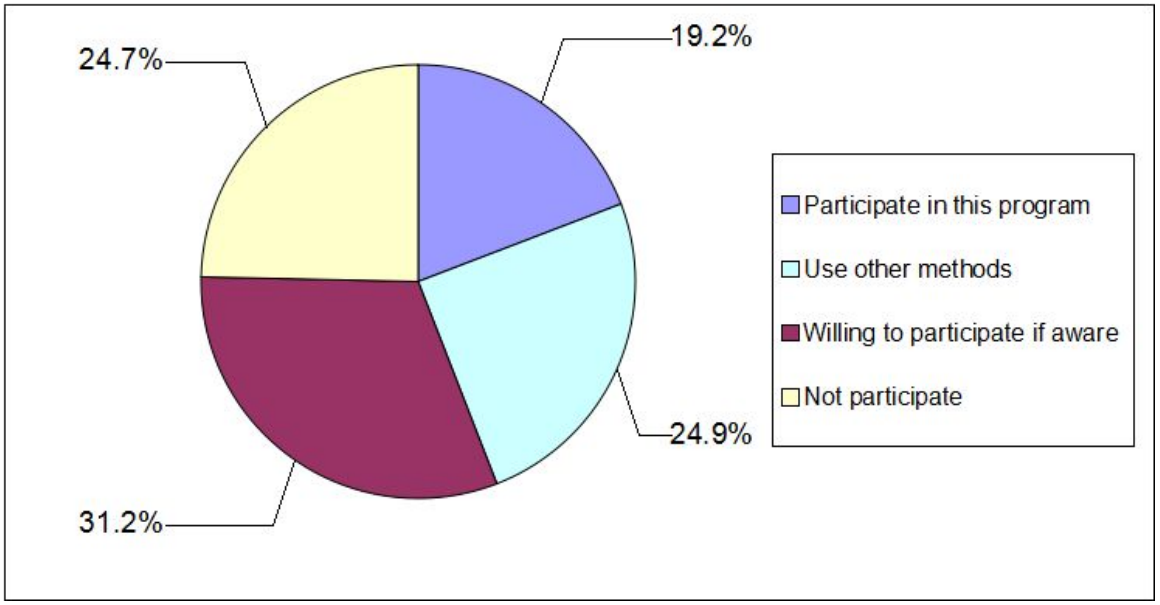


Figure 4.6: Students' waste segregation practice after the waste segregation programme.

Beside student survey, the awareness and behavior of students in waste segregation were also investigated through observation of students' usage of recycle bins and food waste bins and their participation in kerbside collection throughout the programme (Appendix 10). When recycle bins and food waste bins were first introduced into West Lake area, misuse of these bins as ordinary trash bins still happened frequently. For instance, non-recyclable waste can be found together with food waste in the food waste

bins. Besides, there were a lot of confusion among the students regarding what types of plastics are acceptable for recycling in local area. Furthermore, quite a number of students were also uncertain about how to place their recyclable waste outside of their hostel on Sundays, thus leading to problems such as contamination of the recyclable waste and recyclable waste not being collected.

Fortunately, as the programme progressed, it appears more and more students are getting used with the new collection system, followed by reduction of bin misuse frequency. This shows that with continuous training, supervision and follow-up, the students can adapt to the new culture gradually, and the culture can be sustained for long period of time.

4.3 Students' Opinions about Waste Segregation's Encouraging and Discouraging Factors Before and After The Programme

Figure 4.7 shows the level of agreement of students on factors that encourage people to practice waste segregation before the programme started. While majority of students agree with all of the five encouraging factors as the agreement levels are all higher than 70%, it was found that more students agree with Factor A, C and D. Majority of students thought that people are encouraged by extra income, proper education about waste segregation and its benefits, and availability of recycling facility. As the participation rate of the coming waste segregation programme is uncertain, it is impossible to implement incentive system into the programme immediately. However, it is possible to provide education about waste segregation (seminar, class presentation and website) and recycling facility (transportation of recyclable waste and materials for food waste composting) when the programme is run to increase the chance to motivate students to practice waste separation.

Figure 4.8 shows the level of agreement of students on factors that discourage people to practice waste segregation before the programme started. One notable observation in Figure 4.16 is that, there is only agreement level of 67.6% for Factor F. In other words, majority of students thought that low money return from recycling is not the main reason of not practicing waste separation, which suggests that absence of incentive system in the

coming waste segregation system may be indeed a correct decision as mentioned in the previous paragraph.

The three discouraging factors with the highest agreement level are Factor A, D and G. Most students agree that laziness is the main cause of low participation rate in waste separation. Unfortunately, laziness is a matter of personal attitude, therefore eliminating this factor through waste segregation programme may be very challenging. Nevertheless, majority of students also agree that people are unlikely to practice waste segregation if there is low participation rate of waste segregation around him/her, suggesting that chain reaction by participants who are encouraged by other factors is still required to influence the non-participants to practice waste segregation. This is supported by one of the responses in the first student survey, as Figure 4.9 shows that 80.9% of students claimed that they will teach their friends to separate waste if they practice it. Besides, since there is no recycling facility such as recycle bin and recyclable waste transportation in West Lake prior to the waste segregation programme, it is legit to find that majority of students also find absence of recycling facility another most influencing discouraging factor.

If Figure 4.7 and 4.8 are compared, it is noticeable that both figures suggest availability of recycling facility to be one of the most influencing factor. Therefore, this strongly indicates that availability of recycling facility in West Lake will definitely play significant role in influencing the performance of the whole waste segregation programme.

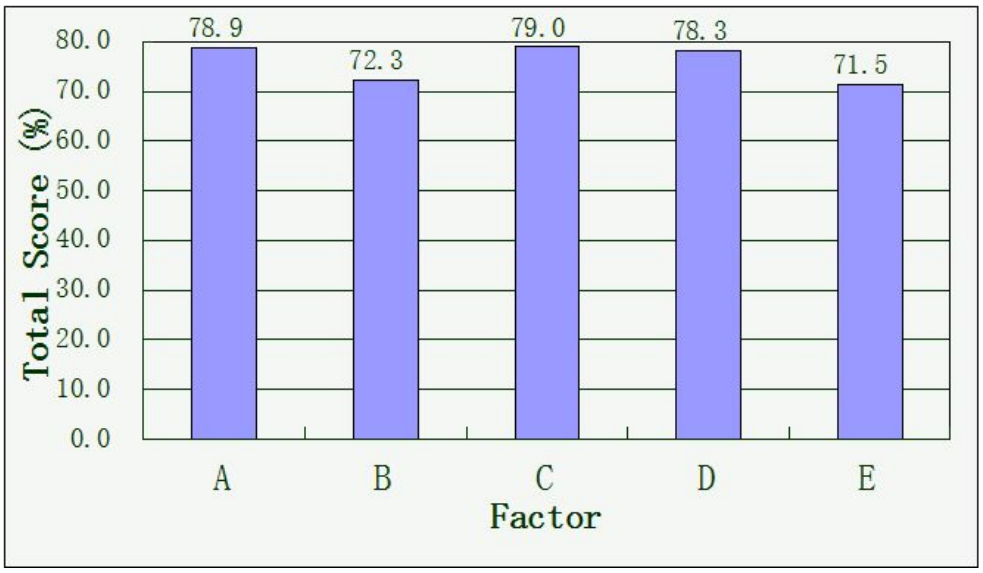


Figure 4.7: Level of agreement of students on factors that encourage people to practice waste segregation. A, The recyclable waste can be sold for extra income; B, Enforcement by government; C, Existence of proper education about waste segregation and its benefits; D, Availability of waste segregation facility near housing area; E, Surrounding people are doing it.

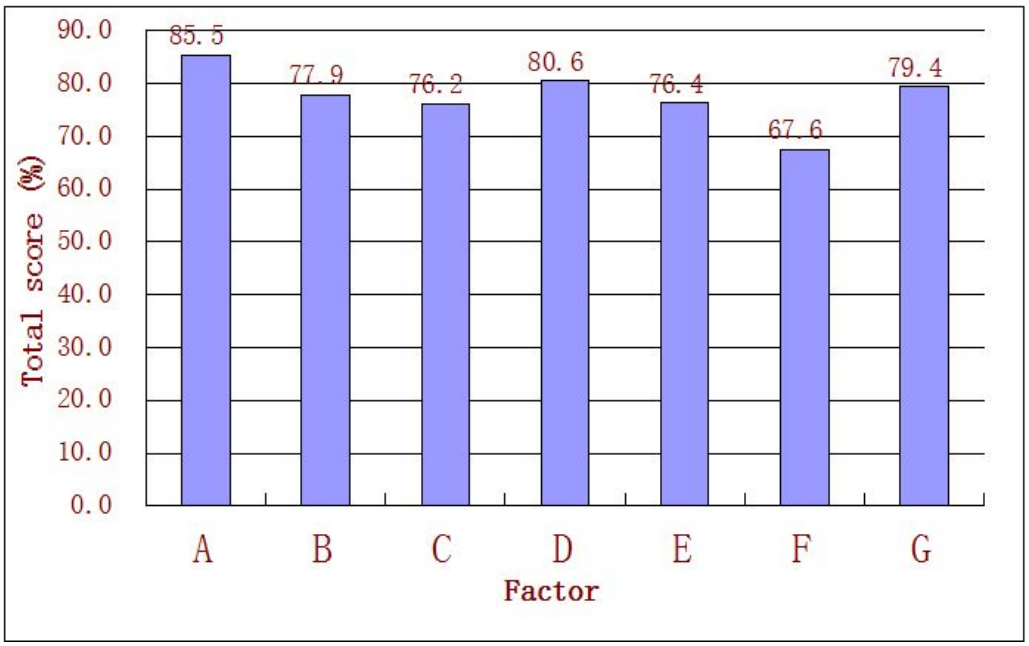


Figure 4.8: Level of agreement of students on factors that discourage people to practice waste segregation. A, Laziness; B, Time consuming; C, Lack of enforcement by government; D, Not many people are doing it; E, Lack of knowledge about waste

segregation and its benefits; F, Not profitable; G, Absence of waste segregation facility near housing area.

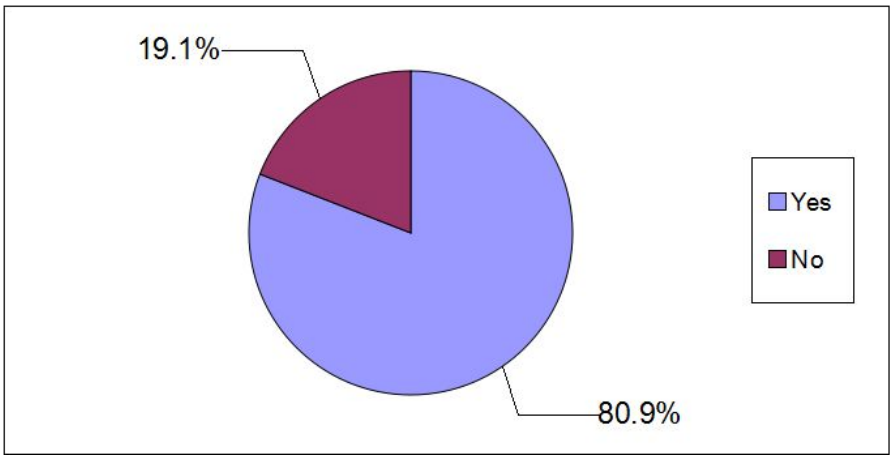


Figure 4.9: Willingness of students to teach their friend about waste segregation (Before programme started)

After three months, when the students who take part in the programme activities were asked about their reasons of participation, their responses were as shown in Figure 4.10. The outcome displayed in Figure 4.10 has proven that "People around me are doing it" is indeed not the main factor to encourage people to practice waste segregation, as discovered from the result of the first student survey in Figure 4.7.

While some students are encouraged to practice waste sorting due to existence of similar programme in hometown, presence of waste separation habit prior to the programme and easy way to get rid of the recyclable waste, majority of them (68.6%) participate in the programme activities because they understand the environmental benefit of waste segregation. Therefore, this indicates that if we want to get more people to do waste separation and recycling, we first need to use effective ways to spread the knowledge about its environmental benefits to the public. Refer to Figure 4.12, one finding of the first student survey shows that 78% of the students were interested to learn more about waste segregation.

Likewise, during the first student survey, when students were asked about the local waste management system, only 40.6% of students responded that MDK is responsible for the waste collection in West Lake, as shown in Figure 4.13. The remaining students

either responded with wrong answers or were uncertain about the related authority that manages the waste. 23.1% of the students thought that Danish House is responsible for the waste collection since they are the hostel owner. 24.2% of the students mistook Tzu Chi as the authority who manages the local waste collection although Tzu Chi is actually a charity organization that collects recyclable waste privately for charity purpose. 4.6% of the students suggested Kontraktor Swasta, 1.3% of the students suggested other organizations, and the remaining 6.2% simply responded that they do not know about it.

Refer to Figure 4.14, among the students who are aware that MDK is responsible for the waste collection, 42.4% of them responded that the waste will be sent into landfill without separation, which is indeed the true ultimate fate of waste in Malaysia as described in Section 2.2.3. However, 41.1% of the students responded that the waste will be separated by the workers before landfill disposal, which is a huge misconception because the students thought they are not responsible to separate the waste on their own. In fact, it has been mentioned in Section 2.2.3 that waste separation from source is necessary to enable recycling, composting and selective disposal in order to divert waste from direct landfill disposal. In addition, 15.9% of the students responded that the waste will be incinerated, which is also not municipally utilized in Malaysia currently due to mixing of moist waste and dry waste. The remaining 0.7% of the students responded that they do not care about the ultimate fate of the waste. Despite of the misconception, as suggested by Desa et al. (2012) in Section 2.4.2, if people understand why it is so important for them to separate their waste at source, and are educated about the real MSW management scenario in Malaysia, recycling rate of the community will definitely increase. This also explains why proper education about recycling is one of the most influencing factors to encourage people to separate waste as shown in Figure 4.7, and it was also proven to be effective by Akil et al. (2012) as mentioned in Section 2.4.3.

Next, Figure 4.11 shows the response of the students about what causes them to not take part in the programme activities aside from being unaware about the programme. Majority of them (50.3%) claimed that they are using other ways to manage their recyclable waste, including usage of recycle bins in UTAR, donation of recyclable waste to charity organization and selling of recyclable waste to some private recyclers. This is actually a positive outcome showing that what makes a recycling programme successful

is not solely depending on the participation rate of that single programme, but also depending on the participation rate of other recycling activities although they are not related with the programme. Therefore, this programme has indeed successfully influenced many UTAR students to practice waste segregation directly or indirectly.

Ignoring factor c, the major cause of students not taking part in the waste segregation programme is due to their perception of waste separation being troublesome and time consuming (26.5%). As mentioned by Otitoju & Lau (2014), people who suggest convenience and time as the limiting factors believe that waste segregation is a matter of personal choice and it is not required to be put as priority in daily life. It is hard to change the view of people regarding their opportunity cost of time in waste management unless we can try to eliminate other limiting factors in order to improve participation rate.

Other two discouraging factors with the third and fourth highest percentage as shown in Figure 4.11 are absence of local enforcement (19.3%) and "other" (12.2%) respectively. The former is one of the main problems in Malaysia's solid waste management. Although Figure 4.7 and 4.8 show that enforcement does not play significant role in encouraging students to practice waste segregation, it appears that after a few months of implementation of this programme, students start to realize that in order to practice waste separation for long term, enforcement is required to give them a legal reason to maintain the habit. Unfortunately, enforcement of waste segregation can only be executed under the decision by federal government or state government, so this is something MDK does not have power to change (Goh, 2011).

As for the students who chose "other", most of them are complaining that the time of the kerbside recyclable waste collection is not flexible. This is because many students are going back to hometown during every weekends. Some of them also said that they either forget about the collection time or they oversleep and miss it. These responses however show that these students are trying to find excuse to not separate waste. Firstly, the students may get help from their housemates who stay in their hostels during weekend to keep their recyclable waste and put them outside of their hostels every Sunday morning, if they really have the will to do waste segregation. The absence of this action shows that there is no cooperation among these students in waste management. To them, waste segregation is a personal matter, not a community matter. In addition, there is lack of

discipline among these students in waste management. Without self-control, the students will not be able to cope with the schedule of the kerbside collection.

Nevertheless, the time inflexibility may still be one of the weaknesses of the kerbside collection which was not taken into consideration when it was first implemented, therefore some changes of the waste collection system under this programme may be required to solve this problem. In other way, this may even indicate that kerbside collection may not be suitable for local culture in West Lake in the first place. More about suitability of kerbside collection in West Lake is discussed in Section 4.4.

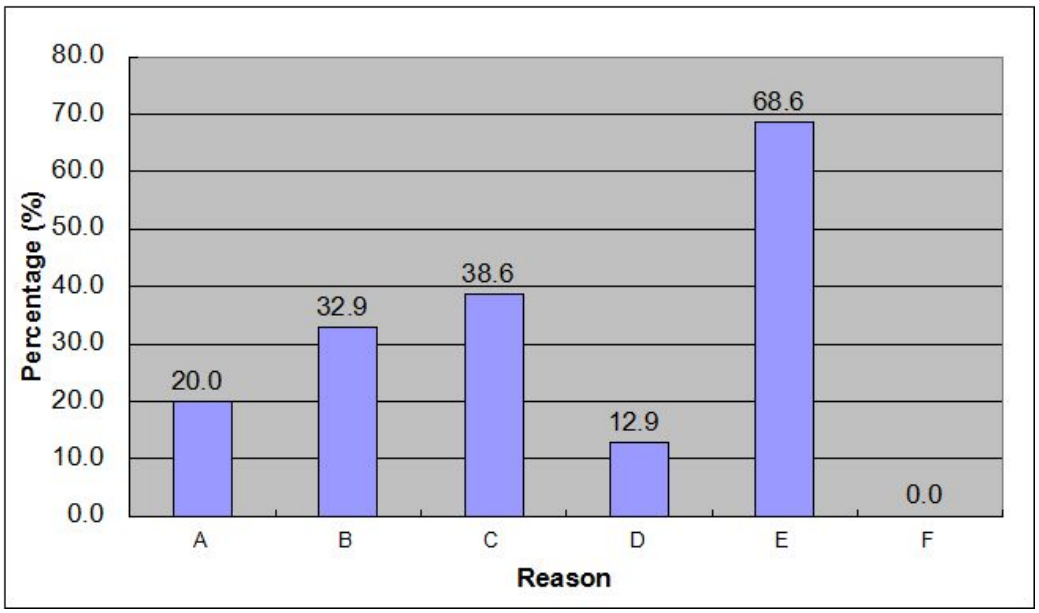


Figure 4.10: Students' reasons for participating in the programme. A, There is similar programme in my hometown; B, Waste segregation is already my habit for a long time; C, To get rid of recyclable waste easily; D, People around me are doing it; E, I understand the benefits of waste segregation to the environment; F, other.

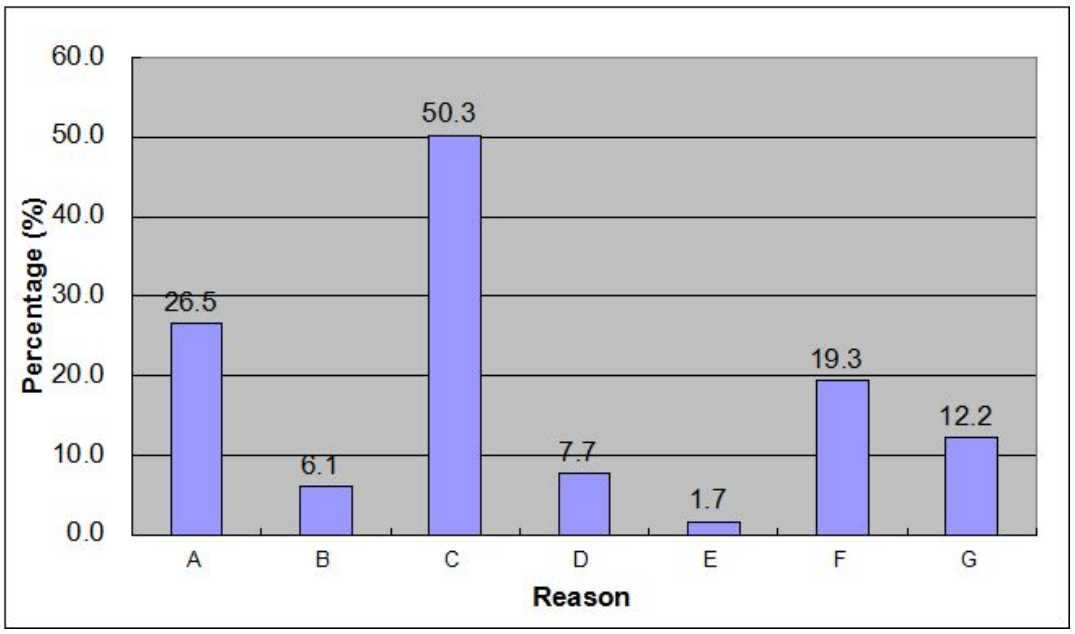


Figure 4.11: Students' reasons for not participating in the waste segregation programme. A, Waste segregation is troublesome and time consuming; B, I don't like the methods implemented in this programme; C, I use other ways to handle my recyclable waste; D, I don't know what benefit this programme can bring; E, Waste management is not my responsibility; F, Waste segregation is not enforced in local area; G, Other.

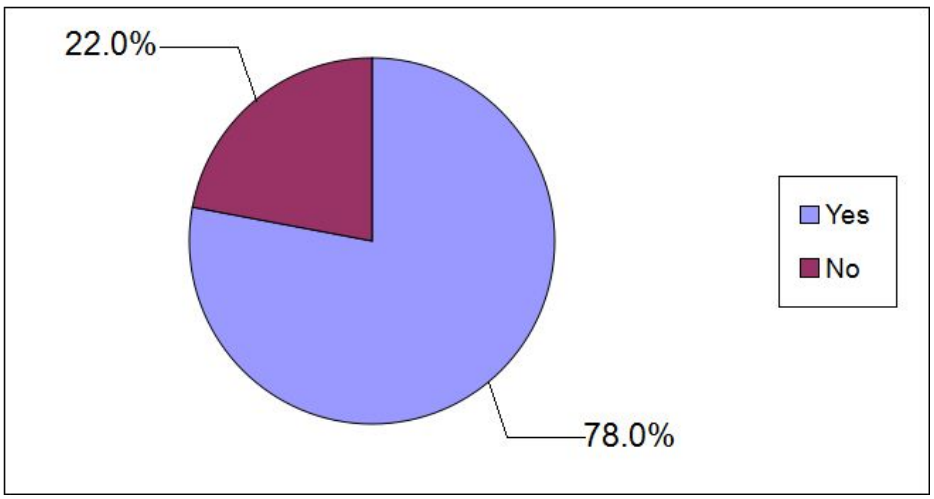


Figure 4.12: Willingness of students to gain knowledge about waste segregation (Before programme started)

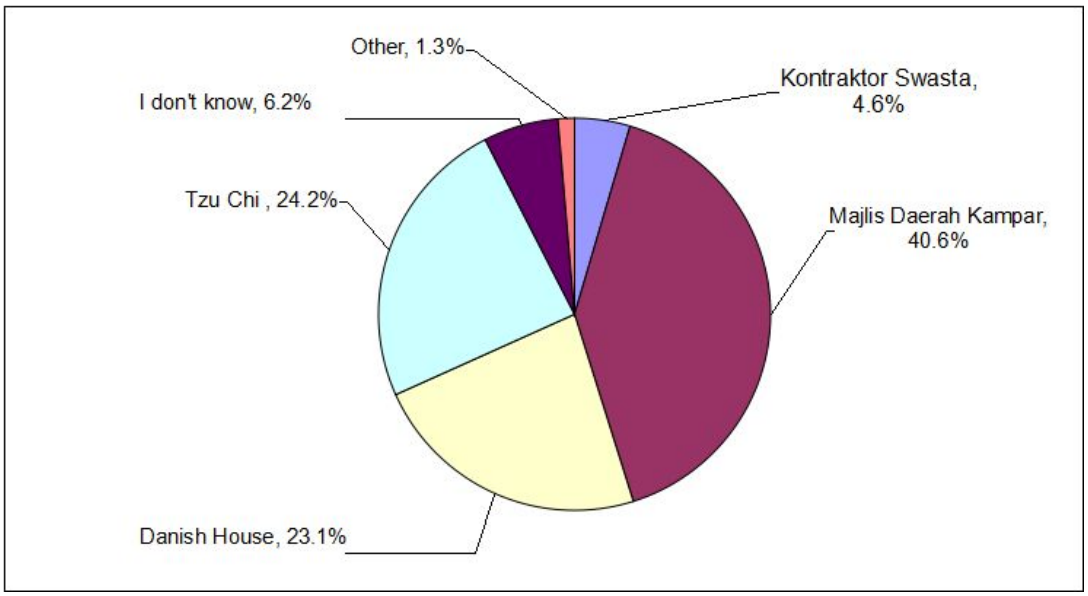


Figure 4.13: Students' awareness about the organization responsible for the waste collection in West Lake (Before programme started)

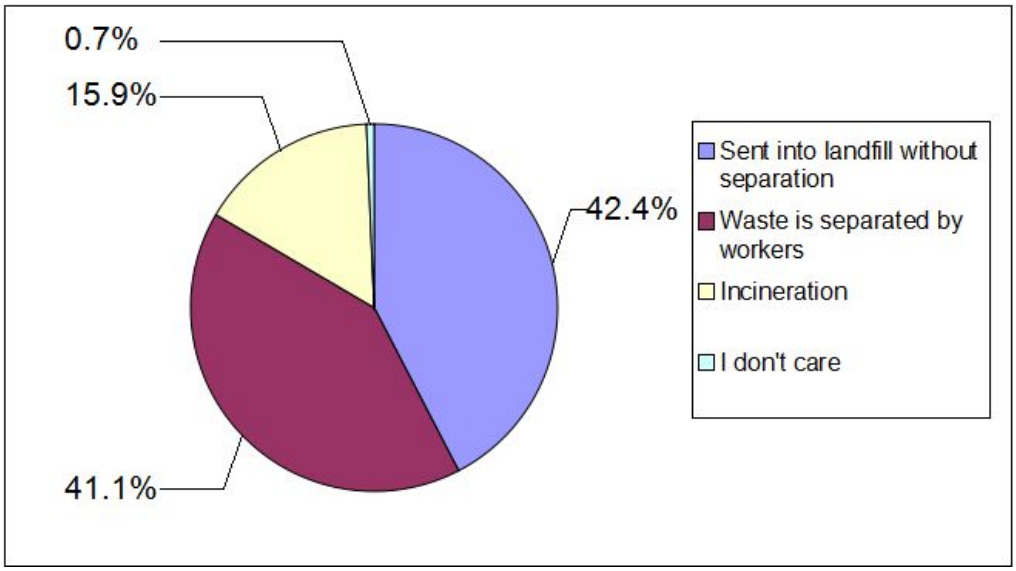


Figure 4.14: Students' awareness about the ultimate fate of waste if they are aware that MDK is responsible for the MSW collection (Before programme started)

4.4 Students' Opinion about The Performance of The Waste Segregation Programme

According to Figure 4.15, it appears that majority of the students (83.5%) hope that

waste segregation can be a part of local culture. Unfortunately, it is uncertain that whether they want to keep this culture through continuous campaigns, education or enforcement. Nevertheless, it is certain that they do not simply feel interested to separate waste themselves since the agreement level of the statement "More motivated to do waste segregation" is quite low (69.1%). While it is impossible to test the effect of education and enforcement on students' awareness and behavior about waste segregation unless there is formal change of Malaysia's education and legal change, the effect of continuous campaigns on the sustainability of this culture in the student hostel area could be tested by extending the period of this programme beyond January 2016 with some improvement. So, the third waste composition study in March 2016 could be conducted to check whether there is any positive change of waste disposal pattern of the students in West Lake.

In addition, it is also discovered that the waste segregation programme does not really successfully motivate the students to separate waste and encourage the students to influence their friends to do so, as the agreement levels of these two statements are lower than 70%, which are 69.14% and 68.49% respectively. The problem regarding the motivation may be due to the poor promotion which is discussed in later part of this section, or lack of formal education and enforcement about waste segregation.

As for the second statement, it seems to be contradicting with the result in the first student survey because Figure 4.9 shows that 80.9% of the students claim that they will teach their friends to separate waste. The behavior of the students seem to change after the waste segregation programme began, as the result based on Figure 4.11 shows that there is lack of cooperation between students to manage their recyclable waste together. This justifies the inconsistency of awareness and behavior mentioned in Section 2.4.2 as well. Before the programme started, the students had a thought that they will teach their friends about waste segregation, but as soon as the programme started, it is possible that as they had already tried to actually separate waste, they feel that it is troublesome to communicate with their friends and housemates to separate the waste more efficiently, indicating that many students are not interested to work as a neighborhood or a community. This also implies that there is deterioration of neighborhood culture among the younger generation nowadays.

Furthermore, the agreement levels for the Benefit A, B and C as refer to Figure 4.15 are also quite high (78.8%, 77.7% and 76.0% respectively), which are all between 75% to 80%. This shows that the waste segregation programme does indeed help to teach the students about the benefits of waste segregation, teach the students about the knowledge of recycling and change the students' lifestyle. However, to further enhance these benefits of the programme, formal education and enforcement are still necessary.

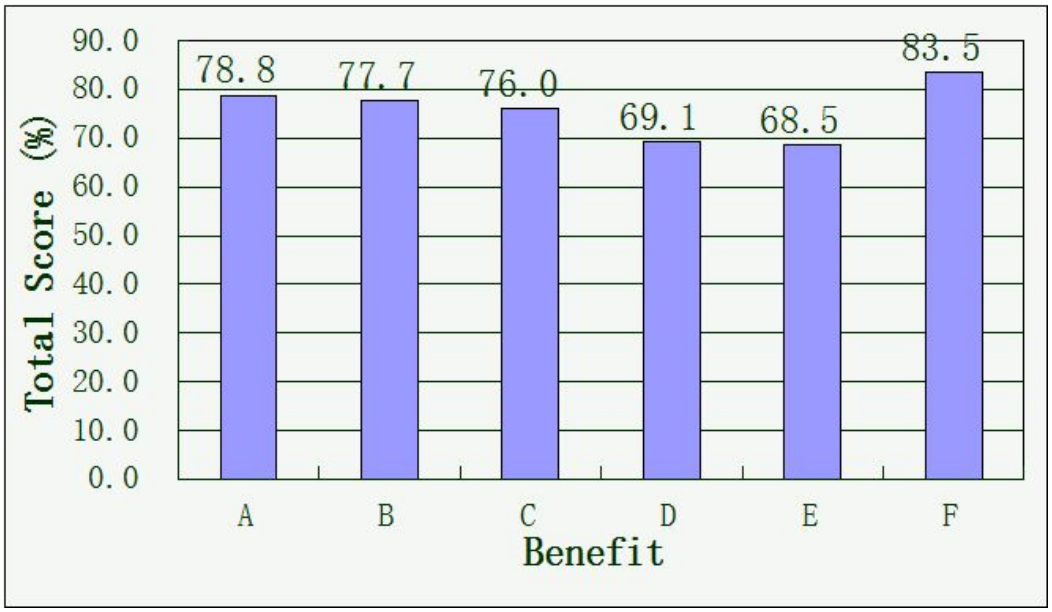


Figure 4.15: Level of agreement of students on benefits of waste segregation programme. A, Understand the environmental benefits of waste segregation; B, Learn more knowledge about recycling; C, Change the lifestyle of students; D, More motivated to do waste segregation; E, Encourage students to influence friends and relatives to do waste segregation; F, Students hope that waste segregation can be part of the local culture.

Figure 4.16 shows the level of agreement of the students regarding the performance of the programme from different aspects. Most students (81.51%) are agree that this programme's initiative is good, as one of the objectives of this programme is to introduce the culture of waste segregation into West Lake, which is a meaningful culture that should have been practiced by local people for a cleaner environment. There is also high agreement level of students about waste segregation being a good solution to solve local solid waste problems such as uncontrolled solid waste disposal (79.89%).

The agreement level for “Promotion methods used are appropriate” and “Methods of collection are appropriate” are decent (77.31% and 76.45% respectively). However, many students neither agree that the information about this programme can be easily obtained, nor the overall performance of the programme is outstanding (71.29% and 70.32% respectively). To further understand the reasons behind the result, the last question of the second student survey requests the students to express their opinion about the programme in words if they have any (Appendix 9). The students’ opinions are grouped into different categories as shown in Figure 4.18.

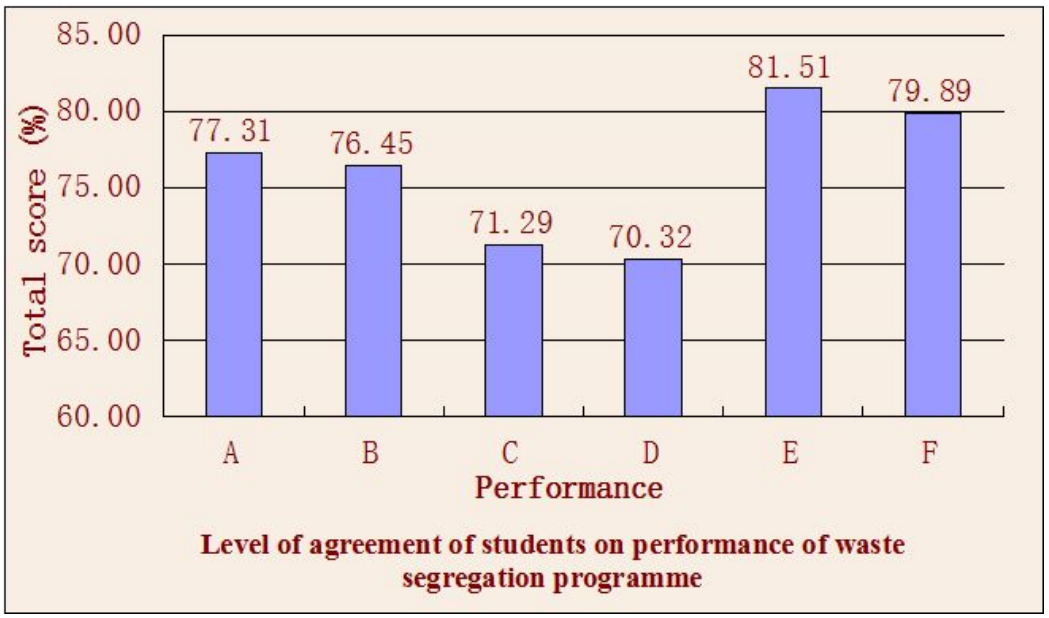


Figure 4.16: Level of agreement of students on performance of waste segregation programme. A, Promotion methods used are appropriate; B, Methods of collection are appropriate; C, Information about this programme can be easily obtained; D, The overall performance of the programme is outstanding; E, The initiative of this programme is good; F, This programme is a good solution of local solid waste problem.

According to Figure 4.17, among the students who are aware about the programme, majority of them heard about the programme from 5 minutes class presentation. On the other hand, only 4.79% of the students knew about the programme through seminars. Although the content of the 5 minutes class presentation is just a summary of the 2 hours seminar, it appears that most students are not interested to learn detailed knowledge about

waste segregation and recycling. While this phenomenon contradicts with the result of the first student survey which shows that 78% of the students are interested to learn more about waste segregation, it is recommended that the educational session of the programme to be short but effective to show critical points about why waste segregation should be done. This is not only applied on students, but also to general citizens who are busy with their daily work and activities.

Furthermore, social media such as Facebook and the presence of recyclable waste collection lorry in West Lake are also very effective in promoting the programme as they have reached 34.57% and 34.04% of the students respectively. As the target participants are students of age 17 to 26, it is quite easy to promote the programme through Facebook which is a social media network commonly accessed by young people nowadays. However, the publicity contributed by Facebook is still lower than 5 minutes class presentation. This suggests that direct public confrontation is actually more effective than social media advertisement in promoting the programme. Despite of this, it is undeniable that social media is still performing well in promoting the programme.

One possible reason is that, to enable the news to reach the students on Facebook, the news about the programme need to appear on the news feed of the students' facebook accounts, which in most of the time will not happen as there are plenty of other advertisements, news and posts that will push down the news about the waste segregation programme. Besides, to enable a post to gain popularity on Facebook, the post also has to be shared by the users who are interested with the content of the post. So there is no guarantee that the news about the programme can spread as fast as the other viral contents on Facebook. In the contrary, for every 5 minutes class presentation, 100 to 200 students can be covered at once. By repeating the same process for several classes, we can deliver our message to large number of UTAR students, especially the one who live in West Lake.

As for the presence of the recyclable waste collection lorry, the speaker announcement is effective to acknowledge the students about the existence of the programme even when they are staying indoor. The appearance of the lorry which is different from the other lorries, as shown in Appendix 8, is also an eye-catching element that will make the students know that there is a special event going on around their hostel

area. This promotion method is very useful to get attention from the students who do not know the programme from social media, friends, hostel company and UTAR.

However, the presence of food waste recycling bins around West Lake (covered 10.64% of students) does not increase awareness of the students about the programme as good as the presence of the recyclable waste collection lorry. According to Mohamad & Keng (2013), even though Malaysia government has long attempted to solve the solid waste problem throughout Malaysia through various recycling campaigns and policies, they only emphasize on waste materials like paper, plastic, glass and metal. Food waste recycling is still a very new kind of recycling activity which is not commonly known by local people. Therefore, most students will not immediately recognize that food waste collection is part of the recycling programme. This suggests that more national plan and education about food waste recycling is required to tackle one of the biggest solid waste problem in Malaysia.

The fourth most effective promotion method according to Figure 4.17 is the banners at the main entrances of West Lake student hostel area. As soon as the students enter into or exit from the hostel area, there is chance that they will notice the programme banners and some of them may even look carefully at the content of the banners. Placement of programme banners near the entrances of the hostel area will certainly make the students aware that some kind of programme is going on in the area they are living in. This may also be applicable in places other than student hostel area to acknowledge the residents about the existence of a recycling campaign, service or even policy.

Aside from the fourth most effective promotion methods mentioned above, other methods listed in Figure 4.17 also reach about 10% to 15% of the students, indicating that they are still workable promotion methods. However, all of these methods could only reach 52% of all West Lake students, as shown in Figure 4.18.

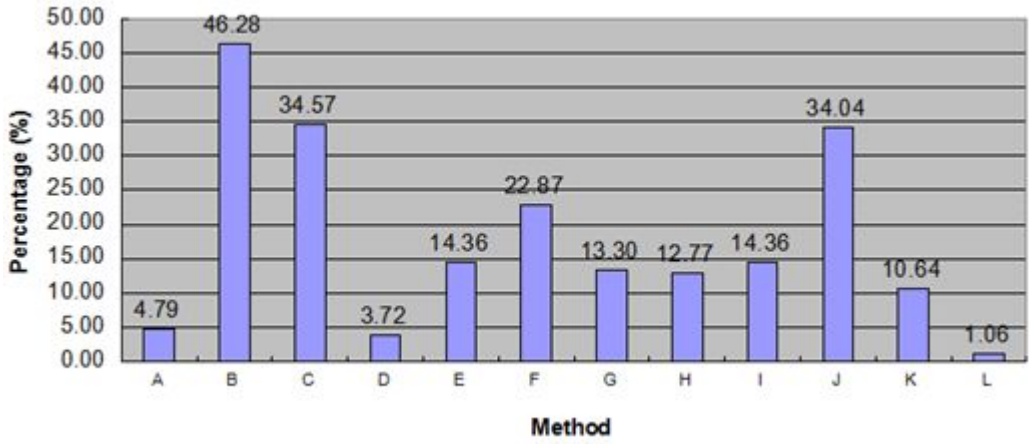


Figure 4.17: Methods used by students to know about the waste segregation programme. A, Seminar; B, 5 minutes class presentation; C, Social media (Facebook); D, Informed by faculty staffs/lecturers; E, Posters around UTAR; F, Banners at the entrances of West Lake; G, Housemate/coursemate/friend; H, Flyers at Danish House offices; I, Web announcement by Danish House and KT Management; J, Aware of the presence of recyclable waste collection lorry in West Lake every Sunday morning; K, Aware of the presence of food waste bins around West Lake; L, Other.

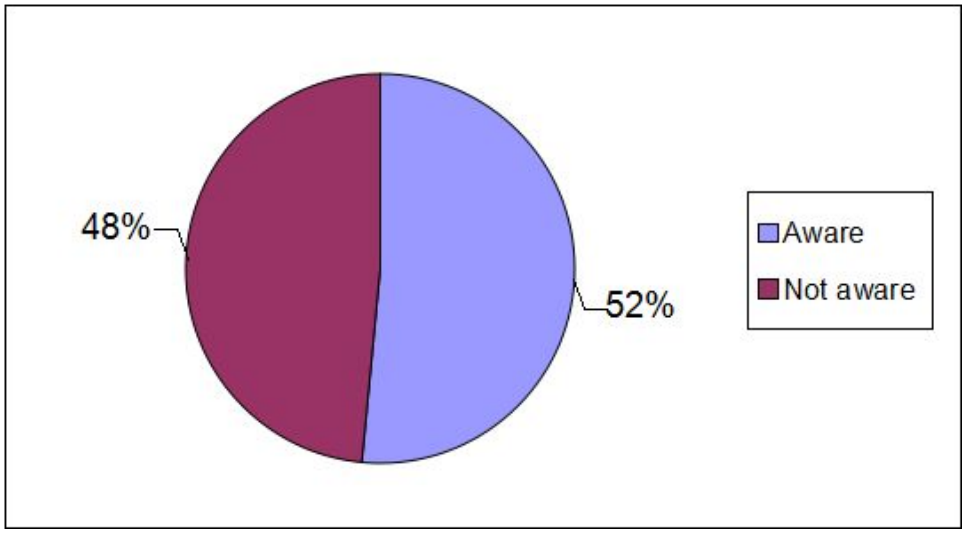


Figure 4.18: Awareness of students about the existence of waste segregation programme in West Lake student hostel area.

Among 365 students who are involved in the second student survey, 184 of them had

answered the last question. It appears majority of them (54.35%) complain that the promotion of the programme was not effective, according to Figure 4.19. Despite the programme did deliver educational message about waste segregation, many students found the promotion to be boring and lack of creativity. Some of them claim that the promotion is not frequently conducted and the methods are limited. Aside from class presentation, social media, banner and poster, there should be road show, and even news on newspaper and advertisement on television regarding this programme. And there should be promotion about this programme house by house. Coincidentally, the weaknesses mentioned above are also some of the causes of low participation rate in the waste segregation system under Solid Waste and Public Cleansing Management Act 2007. In order to catch the attention of the 31.2% students who are not aware about the programme's existence as shown in Figure 4.6, methods listed in Figure 4.17 are not sufficient.

In addition, 17.39% of the students suggested that there should be an actual campaign that promotes this programme. Activities such as exhibition, seminar and competition should be organized to attract more students. Ironically, similar campaigns had already been organized by Community Service Society (CSS), Green Team and Public Relations (PR) students in the past, but even after those campaigns, there is small to zero change of students' awareness and behavior in waste segregation. This is because the campaigns only emphasize on the promotion of the concepts without giving chance to the students to practice them exactly in their hostels. Nevertheless, it is uncertain that what will happen if a related campaign and the new waste collection system are run simultaneously. It is interested to test their coexisting effect to the students' awareness and behavior through programme improvement starting from January 2016.

Furthermore, 9.78% of the students suggested that recycle bins should be placed in the student hostel area, and 6.52% of the students complained that the kerbside collection is not flexible with respect to time Some of them also suggest that the frequency of kerbside collection should be increased, so aside from Sunday, the collection should also be available on weekdays. However, since majority of the residents in West Lake are students, it is certain that weekdays are definitely not suitable as collection days because most of them will be having classes in UTAR. It is difficult to arrange a collection

schedule that can satisfy all students with different class timetables. Some students also have classes during Saturdays. Therefore, Sunday is supposedly the most appropriate day since all UTAR students do not have class on that day.

Unfortunately, many UTAR students have the habit of going back to hometown during weekends and getting up late on weekend morning. Also, as mentioned before, there is lack of cooperation between students in managing their waste. While it is difficult to change these cultures, the responses regarding these issues suggest that kerbside collection may not fit well in the local culture of the student hostel area. Instead, drop-off collection with recycle bins may be more welcomed by the students. Although there is frequent misuse of recycle bins in UTAR campus area, it is interested to find out the effect of the existing waste segregation programme on the students' behavior in using recycle bins.

In addition, 7.61% of the students suggested that this programme requires more support. It was thought by the students that this programme would be more persuasive if the student representative is a team of students. Besides, students also hope that there is official support from UTAR and Danish House to make this programme more successful. Unfortunately, waste segregation is still not an official long term policy in UTAR like in UKM (Desa et al., 2012). Despite Danish House helps to promote the programme, they have yet to permit to make the new waste collection system official in the hostel area under their management unless the environmental and economical benefits of the new waste collection system to them can be verified, which is impossible prior to the programme. Nevertheless, if this programme gives positive result after a few months of implementation, it may help to influence the decision of UTAR and Danish House.

Next, 4.35% of the students suggested that more students will be attracted to take part in the programme activities if the programme area is expanded. For instance, aside from West Lake student hostel area, they requested to have the recyclable waste collection service in other student hostel areas such as Taman Kampar Perdana, West City and Kampar Putra. Since there are still some students who suggested the programme expansion as a way to improve, this might still be taken into consideration during the attempt to further improve the result of the third waste composition study.

There are also 4.35% of the students suggested that incentive system should be

included into this programme in order to motivate the students through rewards. However, there are several reasons that make incentive system ineffective for this programme. Firstly, the economical value of recyclable waste per unit mass is not high in Malaysia, so large amount of recyclable waste has to be collected at once to make paying upon collection feasible.

Secondly, incentive can be more easily applied to employees through tax reduction for solid waste management, but this method is not going to work on students who do not have salaries. Although it is possible to motivate the students through the reduction of hostel fee or study fee, it heavily relies on the willingness of Danish House and UTAR to cooperate in this matter, not to mention it is quite new in Malaysia to create a system which can effectively measure the amount of recyclable waste separated by each residents and reward them with something that is of equal value. More studies are required to design that system which is not the main scope of this project. While it is difficult to implement a systematic incentive system, it is possible to reward the participating students with simple items such as parking tickets.

As for the remaining responses of the last question, 0.54% of the students suggested that instead of awareness, recycling technology should be emphasized to overcome the solid waste problem, which is already stated to be not effective in Section 2.2.3. Lastly, 2.17% and 4.89% of the students claimed that the only ways to promote waste segregation in local area are through enforcement and formal education. Unfortunately, nothing about these two can be done to improve this programme unless Solid Waste and Public Cleansing Management Act 2007 is taken seriously by federal government and also all involved citizens.

Based on the opinions from the students above, several improvement methods of this programme which are feasible with the current resources could be formulated to meet with the needs of the students. Firstly, recycle bins were placed around West Lake to enable the students who find kerbside collection to be inconvenient to also take part in waste separation (Appendix 12). Secondly, starting from January 2016, aside from Westlake Home and Harvard area, the programme activities will also be available for students staying in Stanford area and Taman Kampar Perdana (Appendix 13), so this provides chance to more students to participate in waste segregation. In spite of the

expansion, the result of the third waste composition study would still depend solely on Westlake Home and Harvard area.

To improve the publicity of the concept of waste segregation, we were also cooperating with PR students who were doing their final year project about recycling (Appendix 14). It was expected that the combining effort of their specialised promotion skill and the waste collection system of this programme would improve UTAR students' awareness and behavior in waste separation. Besides, promotion of waste reuse was done by providing recyclable waste to other events including Wushu Club's Hou Dak Yi Chinese New Year Festival to make decoration and tools of stage performance (Appendix 15). Lastly, free car parking tickets are gifted to the students who gather more than 10 kg of recyclable waste during kerbside collection every Sunday as a simple form of incentive (Appendix 16).

It was anticipated that through this series of programme improvement, the recycling rate of the recyclable waste and food waste in West Lake would increase more after another 3 months. The third waste generation and composition study in March 2016 was used to evaluate the validity of the prediction above.

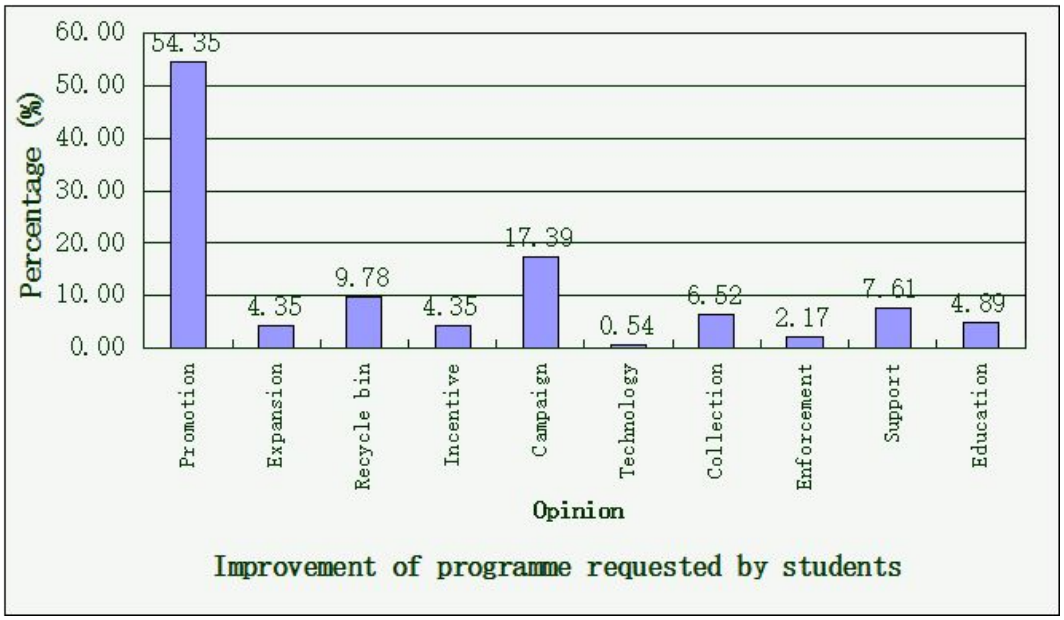


Figure 4.19: Improvement of programme requested by students.

4.5 Waste Generation and Composition in West Lake Student Hostel Area throughout The Programme

Based on Figure 4.20, before the waste segregation programme in West Lake began, it was found that the waste generated per capita per day was 0.165 kg/capita/day, which was less than the average waste generation by normal Malaysia citizens. This suggests that students are generating less waste than normal citizens, which may be due to the fact that students do not have the ability to work and gain income by themselves. Most of them are receiving allowance from parents for living, therefore comparing with citizens with working ability, students have lower flexibility in purchasing activities. However, this also shows that it is more effective to train a person to reduce waste generation and disposal before he/she starts to work. Once the person starts to become self-sustaining, it will be harder for him/her to change his/her current consuming habit.

In November 2015, the waste generated per capita per day was 0.152 kg/capita/day, which was lower than the waste generated per capita per day in August 2015. This shows that the waste segregation programme had successfully diverted some of the MSW of West Lake from landfill after 3 months of implementation. The reduction of the MSW continued even until March 2016, as Figure 4.20 shows that the waste generated per capita per day in March 2016 was 0.124 kg/capita/day. This indicates that through the improvement methods mentioned in Section 4.4, the performance of the programme could be sustained.

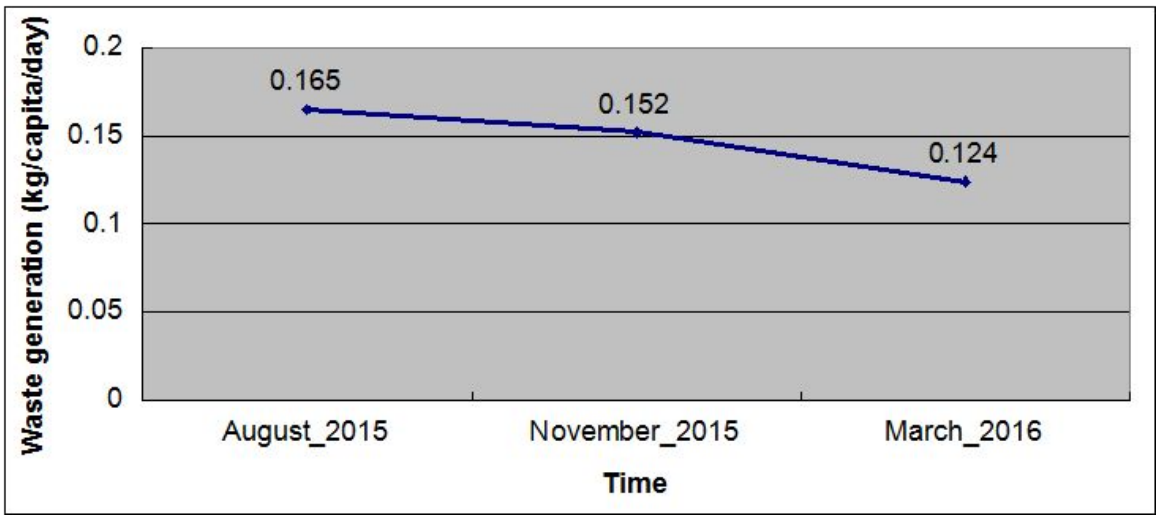


Figure 4.20: Waste generation throughout the programme (kg/capita/day).

The changes of the waste generation can be justified with the outcome of the waste composition study as shown in Figure 4.21. In August 2015, it appears that only 34.2% of the solid waste from West Lake was food waste, which is lower than the percentage of food waste in the waste composition of whole Malaysia (about 50%) as shown in Section 2.1. This is because many students in the hostel area do not cook in their hostels. One of the reasons is the prohibition of cooking activities by Danish House in certain types of hostels including Manchester and Tsing Hua (Appendix 2), despite cooking is still allowed in other types of hostels with cooking facilities provided. Besides, many students do not know how to cook by themselves. Due to busy university life and availability of restaurants and food courts in Bandar Baru which is a small town close to West Lake, it is more convenient for the students to go to Bandar Baru to have their meals. Moreover, food delivery service is also a very common service available in Bandar Barat and West Lake, so this gives students more reason to not cook by themselves.

As for the other types of waste, percentage of paper waste in West Lake (12.3%) appears to be almost similar as the percentage of paper waste among solid waste in Malaysia (13%) as shown in Figure 2.1. Percentages of metal waste and glass waste in West Lake, which are 1.6% and 1.2% respectively, are lower than the percentages of the same types of waste in Figure 2.1, which are 3% and 4% respectively. In addition, the recyclable plastic waste comprises only 5.9% of the waste stream in West Lake, which is about one third of the percentage of all plastic waste in Malaysia. The lower percentages of the recyclable waste in the waste stream of West Lake thus cause the percentage of non-recyclable waste to become much higher than the percentage shown in Figure 2.1.

According to the result of the first student survey, 39% of UTAR students in West Lake practice waste segregation. The reduction of percentage of recyclable waste in the waste composition of West Lake may be due to the presence of recycling activities among the students even before the waste segregation programme begins. However, there is insufficient data about the exact amount of solid waste being recycled by students prior to the waste segregation programme due to the lack of local tracking of private recycling activities, so it is still necessary to conduct second waste composition study after the

waste segregation programme has been conducted for three months to investigate the effect of recycling habit on the waste composition in West Lake.

Refer to Figure 4.22, before the waste segregation programme started, the percentage of recyclable waste and food waste among the waste stream from West Lake was 55.1%. In other words, 55.1% of the solid waste from West Lake should can be diverted from West Lake if waste segregation is practiced by majority of the students in West Lake. It is anticipated that the waste segregation programme will reduce the percentage of recyclable waste and food waste among the waste stream from West Lake.

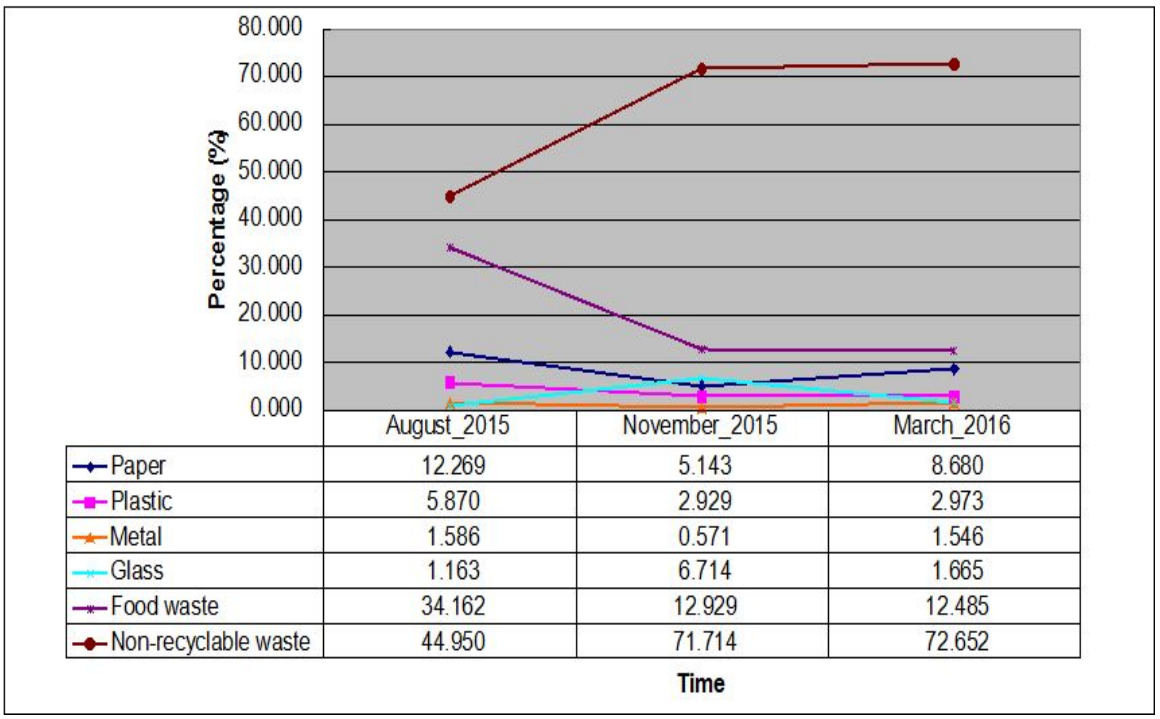
After 3 months, the anticipation was found to be correct as there was almost 50% reduction of percentage of recyclable waste disposed into landfill in November 2015, from 55.1% to 28.3% according to Figure 4.22. In terms of programme activities, based on Figure 4.23, almost all of the participating students (91.43%) take part in the kerbside recyclable waste collection, which is predictable because paper, glass, plastic and metal are the common recyclable waste recycled by local community. Refer to Figure 4.21, among the recyclable waste, paper and plastic had the highest rate of reduction, as paper was reduced from 12.3% to 5.1%, while plastic was reduced from 5.9% to 2.9%. The reduction was probably related with a finding of the second student survey as shown in Figure 4.24, which shows that paper recycling and plastic recycling have the highest participation rate among the students in West Lake. As the third highest in Figure 4.24, percentage of metal also dropped from 1.6% to 0.6%.

On the other hand, since there was only participation rate of 24.3% in glass recycling as shown in Figure 4.24, the percentage of glass in waste stream had increased from 1.2% to 6.7%. Despite of the low participation of students in food waste recycling activities, it is unexpected to find that glass's recycling rate is lower than food waste's although glass is one of the commonly known recyclable waste, supposedly. Nevertheless, during a visit to a recycling shop near Gopeng, Perak (Appendix 11), it was learned that glass recycling company is rarely found in Malaysia. Therefore, even though glass is listed as recyclable waste under Solid Waste and Public Cleansing Management Act 2007 (Act 672), collection of glass for recycling is uncommon among private sectors, so this may create a misunderstanding among consumers including the students regarding the recyclability of glass. The virtually-non-existence of glass recycling in Malaysia was also reported as a

news by Chiew (2012). Thus, more awareness about glass recycling should be spread among the citizens. For this programme, more promotion about glass recycling needed to be done after November 2015.

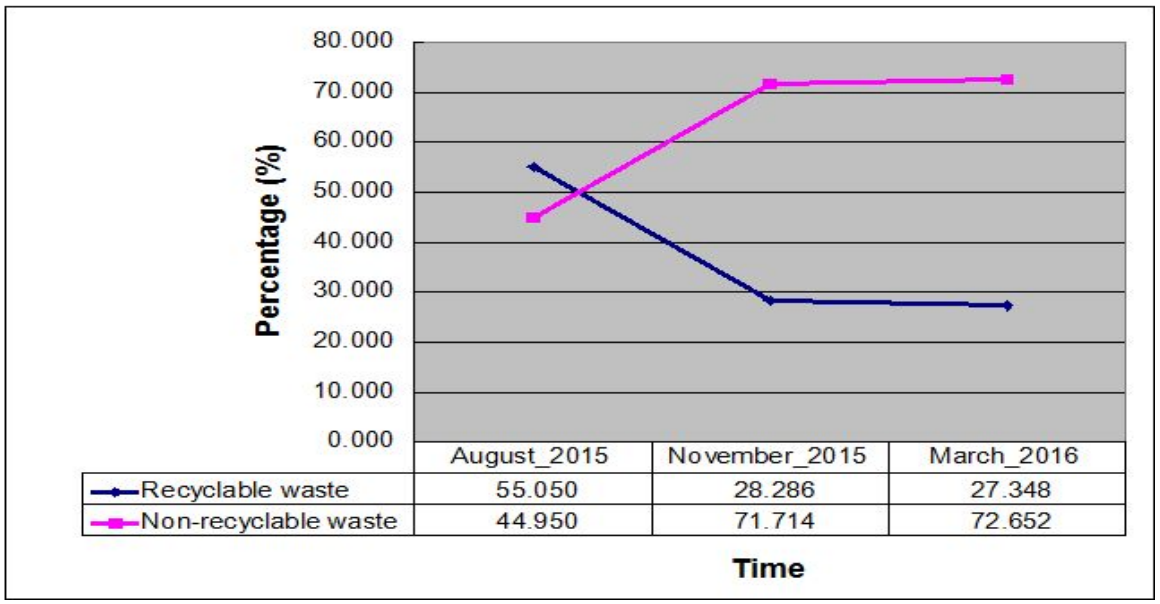
Refer to Figure 4.23, only 22.9% and 14.3% are participating in food waste composting and food waste collection, which proves that the awareness of local community regarding food waste recycling is indeed low. However, the percentage of food waste also declined from 34.2% to 12.9% although the participation rate of food recycling is lower than paper's, plastic's and metal's. This may be related with the general lifestyle of UTAR students, which majority of the students do not cook themselves in their hostels. It is possible that most of the students who participate in food recycling are those who have cooking habit. Therefore, even with the contribution from this minority of students, the food waste can be reduced greatly. Unfortunately, there is lack of study that investigate the relationship between the students' cooking habit and their food recycling habit. Perhaps a future study about this matter can be conducted to verify the relationship.

In March 2016, Figure 4.21 shows that plastic and food waste had quite stable percentage among the MSW, while paper and metal experienced some increment. Glass was found to experience significant reduction, indicating that the promotion about glass recycling after November 2016 did bring some effect. In spite of the fluctuation of percentage of some waste above, Figure 4.22 shows that there was still slight reduction of recyclable waste among the MSW sent into landfill from 28.3% to 27.3%.



	August_2015	November_2015	March_2016
Paper	12.269	5.143	8.680
Plastic	5.870	2.929	2.973
Metal	1.586	0.571	1.546
Glass	1.163	6.714	1.665
Food waste	34.162	12.929	12.485
Non-recyclable waste	44.950	71.714	72.652

Figure 4.21: Waste composition in West Lake student hostel area throughout the programme (in terms of percentage).



	August_2015	November_2015	March_2016
Recyclable waste	55.050	28.286	27.348
Non-recyclable waste	44.950	71.714	72.652

Figure 4.22: Percentage of recyclable waste and non-recyclable waste generated in West Lake student hostel area throughout the waste segregation programme.

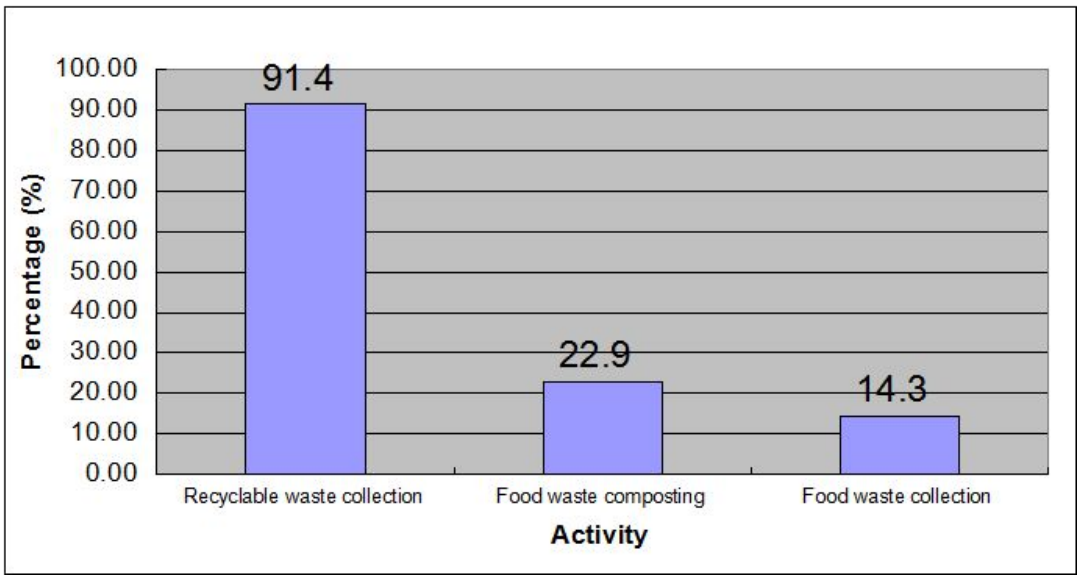


Figure 4.23: Participation of students in the programme activities.

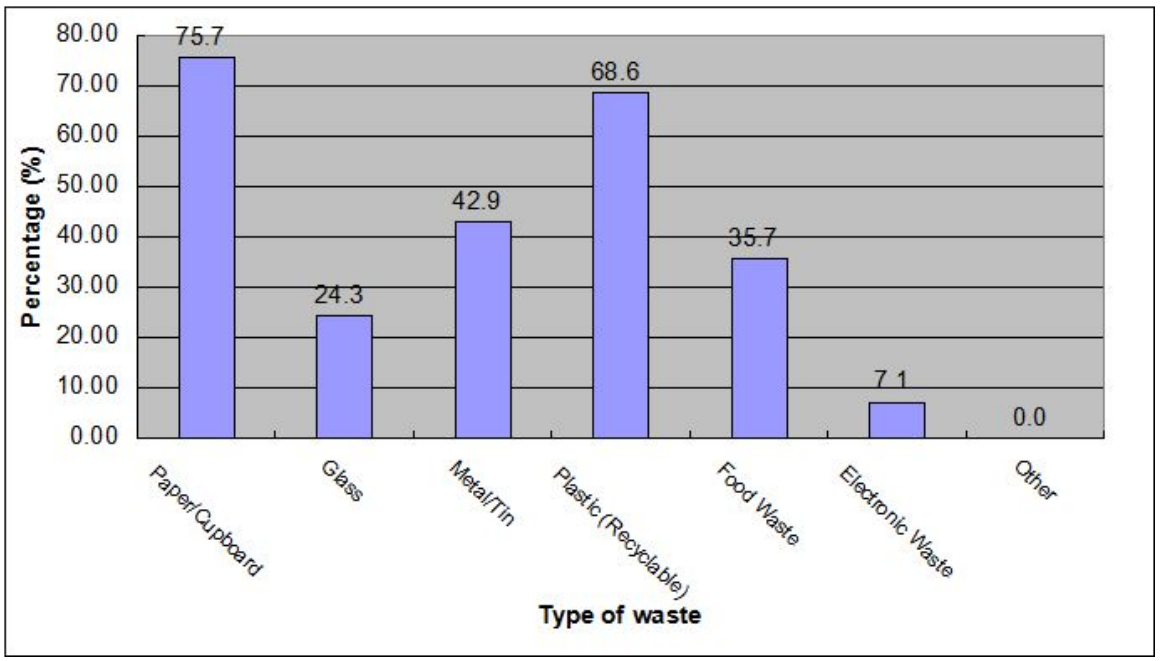


Figure 4.24: Types of recyclable waste recycled by students in West Lake.

Aside from percentage, the waste composition can be expressed in terms of waste generated per capita per day as displayed by Figure 4.25 and Figure 4.26. In this form, the reduction of all recyclable waste except glass waste from August 2015 until November 2015 was still significant. In addition, Figure 4.25 also shows that the changes of amount

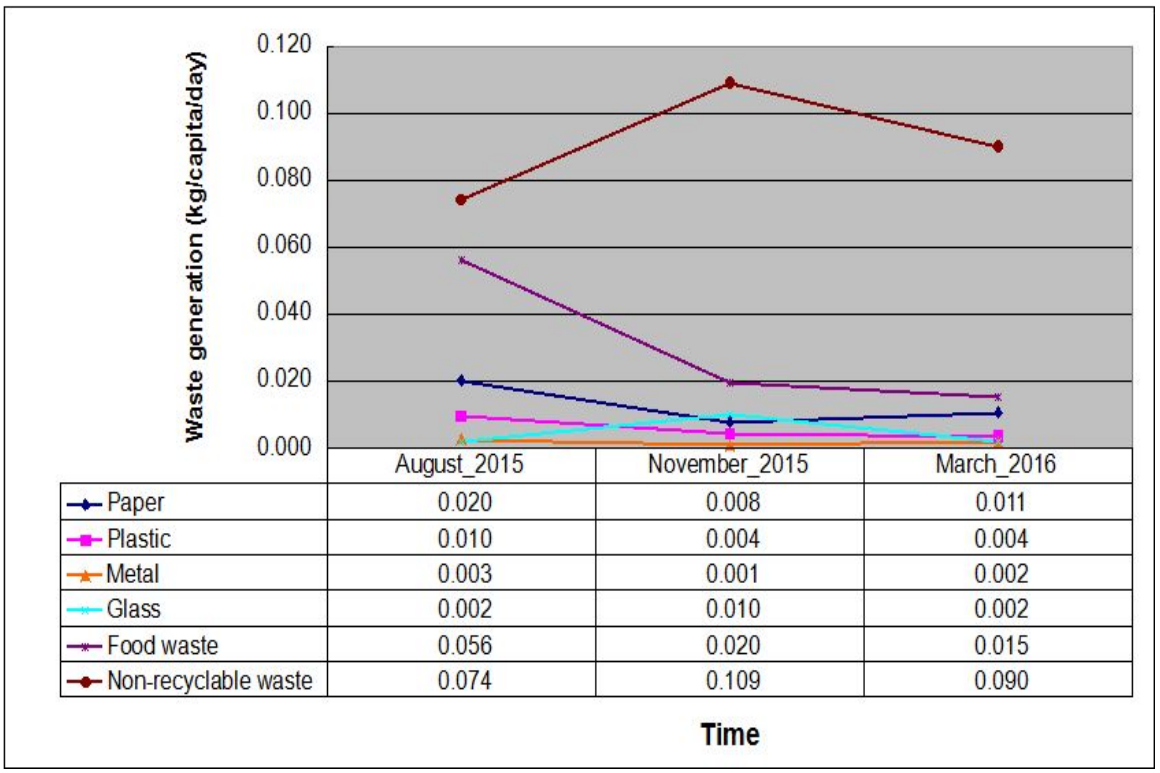
of not-recycled recyclable waste were as little as in Figure 4.21. Nevertheless, if Figure 4.22 and Figure 4.26 are compared, in terms of waste generated per capita per day, it appears there was quite notable drop of recyclable waste from November 2015 to March 2016 (from 0.043 kg/capita/day to 0.034 kg/capita/day). This further justifies the continuous success of the waste segregation programme in controlling the landfill disposal of recyclable waste. In spite of the positive change, the reduction rate of the amount of recyclable waste seems to become lower as time passes. From the pattern of the graph in Figure 4.26, it can be deduced that the reduction is going to reach a threshold level. In other words, until some time in the future, there will be no more reduction of not-recycled recyclable waste. In order to allow the amount to drop beyond the threshold level, formal education and enforcement may need to be integrated into the programme to influence the remaining students who are not willing to separate waste voluntarily.

As for the non-recyclable waste, from August 2015 to November 2015, the amount rose greatly from 0.074 kg/capita/day to 0.109 kg/capita/day. Even though there was reduction from November 2015 to March 2015 for uncertain reason (from 0.109 kg/capita/day to 0.090 kg/capita/day), the amount was still larger than in August 2015. This implies that waste segregation is only useful to minimize the waste disposal through separation of recyclable waste and food waste from the other MSW, thus making incineration more feasible to replace the conventional landfill disposal. However, in order to really reduce the waste disposal, change of lifestyle and development of new waste management technology are required.

Change of lifestyle refers to the application of “reduce” among the 3R practice in our daily life. One of the easiest way is to reduce the usage of polystyrene and plastic bags. For example, polystyrene waste problem has long existed in many parts of Malaysia, including West Lake student hostel (Appendix 17). Reduction of polystyrene usage among the students will certainly minimize the environmental impact of the polystyrene , aside from reduction of waste disposal. Another way of waste reduction is through the change of shopping habit by controlling the amount of items purchased, because more waste will be generated as we purchase more. If “reduce” is unavoidable, “reuse” and “recycle” of waste should always be all consumers’ secondary and tertiary priority respectively.

Development of new waste management technology can be done during production phase and end of life phase. For production phase, the products, especially those made of composite materials, can be designed and manufactured so that the consumers can easily disassemble the materials of the products and separate them for different recycling processes. As for end of life phase, new recycling technology can be developed and introduced into local area to recycle some types of MSW which are considered as non-recyclable or difficult-to-recycle currently.

By knowing how much waste are disposed into landfill, we can use reverse method to estimate the recycling rate in West Lake student hostel area. Reduction of waste generation from 0.165 kg/capita/day to 0.124 kg/capita/day implies that the recycling rate in West Lake is about 25%, which is considered a huge improvement over the overall recycling rate in Malaysia (5%). However, this value may be inaccurate due to fluctuation of amount of non-recyclable waste. Besides, the result only takes the effect of this waste segregation programme on the amount of waste generated into consideration. To get more accurate recycling rate, more data about the amount of waste recycled through private recycling companies and charity organization before and after the programme have to be obtained, therefore a systematic monitoring system of all local recycling activities is required.



	August_2015	November_2015	March_2016
Paper	0.020	0.008	0.011
Plastic	0.010	0.004	0.004
Metal	0.003	0.001	0.002
Glass	0.002	0.010	0.002
Food waste	0.056	0.020	0.015
Non-recyclable waste	0.074	0.109	0.090

Figure 4.25: Waste composition in West Lake student hostel area throughout the programme (in terms of waste generated per capita per day).

	August_2015	November_2015	March_2016
Recyclable waste	0.091	0.043	0.034
Non-recyclable waste	0.074	0.109	0.090

Figure 4.26: Amount of recyclable waste and non-recyclable waste generated in West Lake student hostel area throughout the waste segregation programme.

4.6 Economical Aspect of Waste Segregation Programme

Throughout the programme, selling of recyclable waste to YSR Recycling, a recycling shop near Gopeng, Perak is carried out every three months (Appendix 11). After the recycling shop purchases the recyclable waste, the recyclable waste will be sold to the recycling factories around Kinta Valley according to the types of waste they process. Table 4.1 shows the money earned during the first three months of the programme from selling recyclable waste. Based on Table 4.1, it can be estimated that, in average, regardless of waste type, every kg of recyclable waste is worth RM 0.15. The low average price of recyclable waste renders money-based incentive system ineffective due to low waste generation by students. Nevertheless, items such as parking coupons can be awarded to students who provide more than 10 kg of recyclable waste at once. As for food waste, according to MDK, the fertilizer produced through composting process in Sahom composting center is worth RM 2.00 per kg food waste composted. While incentive system is hard to be implemented for food waste as composting process takes a lot of time, it is still possible to sell these compost fertilizer to agriculture workers to maintain the food cycle in the ecosystem.

Table 4.1: Money earned from selling recyclable waste collected from August 2015 to November 2015.

Waste type	Recycling price per kg (RM)	Quantity (kg)	Total price (RM)
Cardboard	0.20	371	74.20
Paper	0.10	1877	187.70
Alloy	0.20	87	17.40
Iron	0.15	143	21.45
Tin	0.10	58	5.80
PETE/HDPE	0.40	216	86.40
Aluminium	3.00	4	12.00
	Grand Total	2756	404.95

Several economical problems regarding the recycling industry in Malaysia nowadays could be observed during this project. One of them is the low availability of recycling

factories for certain types of recyclable waste, especially glass waste, plastics with resin code of 3 and above (PVC, LDPE, PP, PS and other hard-to-recycle plastics) and composite materials. Poor investment of recycling technologies for these materials is generally due to high cost of recycling process which makes the retrieval of used materials not worthy. This also further increases the transportation cost of the recyclable waste above because they may need to be transported over long distance before they reach the factories that can process them. For example, glass waste generated in Perak have to be transported to a glass recycling plant in Kuala Lumpur in order to be recycled. Hence, selling of glass waste only occurs at most once per half year. Sometimes, the glass waste collected will be too much that some of them have to be disposed into landfill before they have chance to be recycled due to limited storage capacity.

Another weakness of the local recycling industry is that, the recycling process and the production process are not integrated. Without integration, the cost of raw materials made from used materials may still be higher than the raw materials extracted from the nature directly due to multiple level of material retailers and high transportation cost as the recyclable waste are not transported directly from the waste generators to the recycling plant. In addition, lack of proper life cycle assessment in most manufacturing factories leads to product and process design that do not take end-of-life phase into consideration. Most local manufacturers do not realize that they are also responsible in waste management. They have the mindset that the waste generated due to their product usage are to be recycled by third parties. While recycling plants that process recyclable waste listed in Table 4.1 are readily available in Malaysia, the recycling plants that process the hard-to-recycle waste are rare or non-existent. Instead of waiting for someone to invest to build that kind of recycling plant, it would be more convenient if the manufacturing factories can retrieve the used products and process them into new raw materials themselves.

In spite of the problems encountered, this waste segregation programme did bring up a potential plan that can be set as a new direction for the economical development of local recycling industry. Around March 2016, news about a scavenger called Uncle Keong who lives in Bandar Baru was spread around UTAR community (Appendix 18). A lot of students decided to help him by providing him recyclable waste to sell so he can earn for

living while he can avoid searching for the recyclable waste in poor hygiene condition. Seeking this as an opportunity to demonstrate the ability of recycling activity to create job opportunity, MDK decided to implement an outsourcing waste collection system, where scavengers are given permit and assigned to in charge of particular area's drop off recyclable waste collection. In this case, Uncle Keong was assigned to take care of the drop off collection of recycle bins around West Lake and Bandar Baru.

Aside from safe and clean working condition, this outsourcing system brings economical benefits to both scavengers and government. Firstly, since the scavengers are now working together with government, their working status change from scavengers to green collar workers. They receive stable income because they now have a more uniform pricing system for recyclable waste. According to Uncle Keong, when he sells recyclable waste to other vendors, the prices of the recyclable waste are not fixed. Secondly, since every vendor accept different types of waste for recycling, working with government increases the variety of recyclable waste to be collected, including the hard-to-recycle plastics, glass waste and e-waste, thus this further increases the income of the scavengers and the recycling rate of that particular area. At the same time, the government can further outsourcing to the recycling companies that accept the uncommonly recycled recyclable waste above, so this can also indirectly help these companies to get more income through easier access to more used materials.

In addition, through outsourcing scavengers as external waste collectors, this can help to reduce the frequency of recyclable waste transportation. Before this system was implemented, recycle bins around West Lake were always full due to students' preference in drop off collection. While increasing number of recycle bins is only a short term solution, assigning Uncle Keong who lives close to the area can help to make sure the recyclable waste does not scatter around the recycle bins if the waste is not collected even when the bins are full. Then, once in a while, MDK staffs will collect the recyclable waste from Uncle Keong's house all at once and pay him the respective amount of money. Moreover, this also makes monitoring of recycling performance in the area much easier since it is easier to keep track to the amount of waste being recycled instead of using the reverse method used in this project. To make monitoring easier, there should also be cooperation between government and other organizations that collect recyclable waste

either for profit or charity to record the amount of recyclable waste diverted from final disposal.

It is possible that the outsourcing system above can also be applied on manufacturers and other private waste collectors. Through this, all parties in the society will have direct involvement in local waste management system. Hence, plan-do-check-act (PDCA) cycle can be utilized among all stakeholders, making all processes of waste management including production, marketing, waste generation, waste transportation, waste processing and waste disposal more efficient in solving the waste problem and turning waste into a valuable resource for sustainable development.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

To summarize, the waste segregation programme in West Lake student hostel area does indeed help to improve the students' awareness and behavior in waste management and divert recyclable waste from landfill disposal. After the programme was implemented for 3 months, the percentage of UTAR students aware about waste segregation increased from 69.1% to 75.3%, while the percentage of UTAR students who actually practice waste segregation increased from 38.7% to 44.7%. As a result, within 8 months, there was reduction of waste generation in West Lake student hostel area from 0.165 kg/capita/cay to 0.124 kg/capita/day. Among the waste, amount of recyclable waste generated was reduced from 0.091 kg/capita/day to 0.034 kg/capita/day. These changes indicate that more and more recyclable waste in the area are separated from other MSW for recycling. Once a waste is recycled, it is no longer a waste. And thanks to the continual improvement of the programme through student feedback and constant follow-up, the performance of the programme could be sustained for 8 months.

However, from November 2015 until March 2016, in spite of programme improvement, the rate of waste reduction dropped, suggesting that training programme and implementation of waste collection system which suits the waste segregation habit are not sufficient to influence more people to practice waste segregation. Formal education and enforcement may still be required to make this culture more sustainable. In addition, the findings of this study may only be appropriate for residential area that consists of multi-storey terraced houses with residents made up of students of age between 17 and 26. Further investigation will be required to apply waste segregation programme which is suitable for other areas with different types of building structure and

residents.

Furthermore, this study only focuses on separation of the four main recyclable waste, food waste and E-waste from general MSW. Other types of waste including medical waste and hazardous waste are not strongly emphasized in this programme although these two types of waste are supposed to be disposed separately. Nevertheless, it is recommended to slowly broaden the scope of the waste segregation programme and introduce more types of waste to the public one by one in the future, so this can minimize public confusion since it will take time for the public to get used to separation of new waste types, just like what being observed from the food waste separation activity in this study. Besides, E-waste may also be included as a parameter of waste composition study when the amount of E-waste increases in the future. Another weakness of local MSW management verified during this study is the almost non-existence of recycling facilities of glass and hard-to-recycle plastics, which can only be solved if there is effort from both government and private sector to invest in the related technology. Before this, it is still important to spread awareness to the public regarding the recyclability of these waste so we can get more community attention to work together to overcome the issue.

Last but not least, in order to implement waste segregation programme in the whole community successfully, full cooperation from all parties in the society, including residents, housing area management company, educational institute, private waste collector, government waste management authority, retailer and manufacturer is needed. Following rules and regulations in waste management is not enough, so is mere consultation with each party (for example, through survey questionnaire) to improve MSW management. What we need is delegation of power and role among each individual related with MSW management. For instance, in residential area, the residents should work together as a neighborhood to help each other to manage MSW from the source. There should also be proper communication among the waste management authority, the residents and the housing area management company to regularly follow-up and solve the issues in the waste management system through formation of partnership. As for retailers and manufacturers, they should also implement environmental management system that can allow them to minimize the environmental impact caused by the product life cycle, and enable communication and cooperation with consumers and government to manage

the material flow more efficiently. Only with this integrated and centralized MSW management, MSW problem can truly be solved.

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APPENDICES

Appendix 1

Current Scenario of West Lake Student Hostel Area

Westlake Home area

Harvard area

MSW truck

MSW collection in West Lake

Leachate flowing out from the waste

Absence of waste separation

Absence of waste separation

Overflowing waste

Overflowing waste

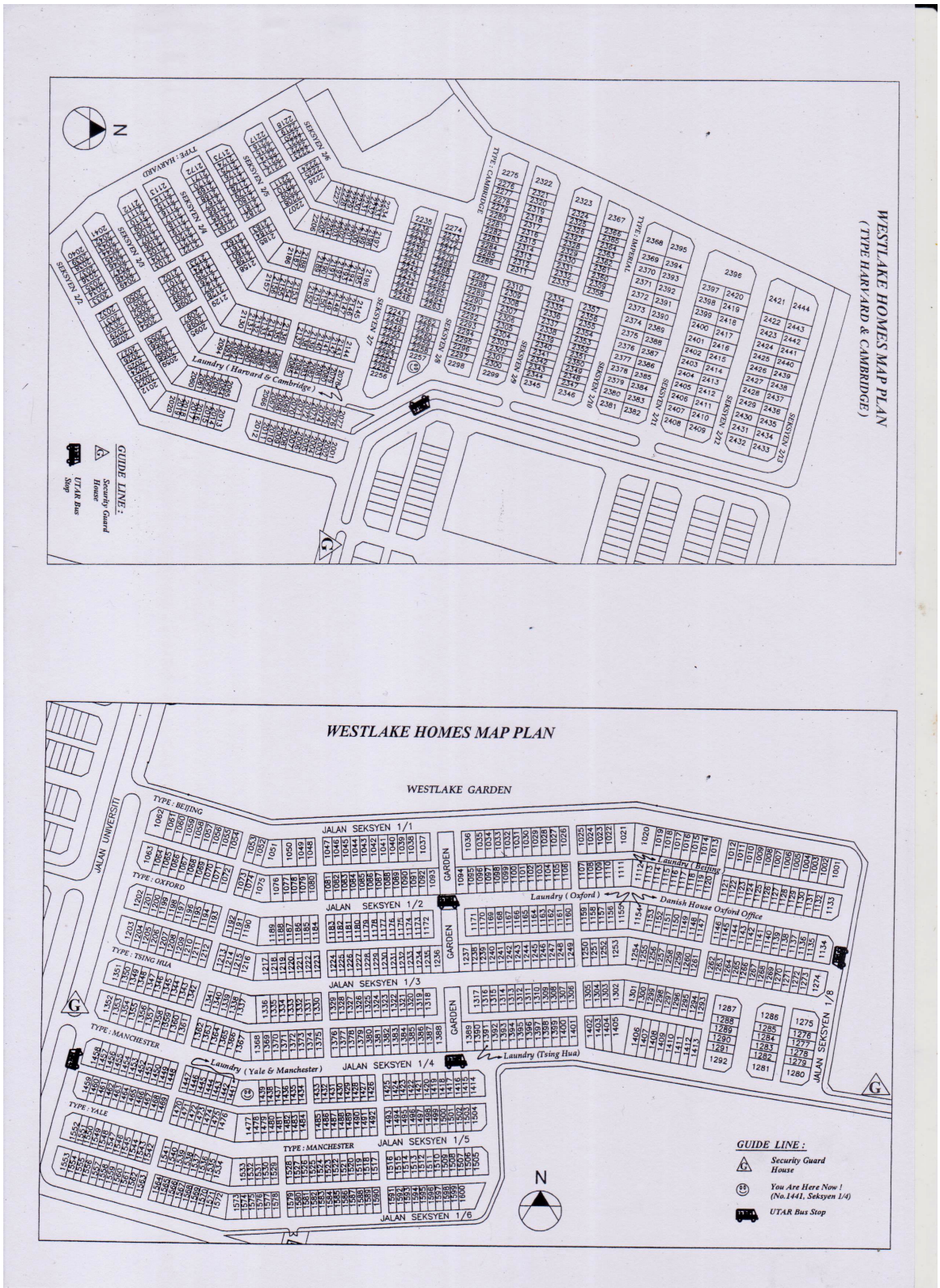
Scattering waste

Scattering waste

Broken waste bin

Appendix 2

West Lake Student Hostels Map



Appendix 3

Current Scenario of Sahom Landfill

Entrance of Sahom Landfill

Composting center (outdoor)

Composting center (indoor)

Leachate treatment pond

Appearance of landfill site

Appearance of landfill site

Appendix 4

Student Survey Questionnaire (Stage 1)

UNIVERSITI TUNKU ABDUL RAHMAN
FACULTY OF ENGINEERING AND GREEN TECHNOLOGY
BACHELOR OF ENGINEERING (HONS) ENVIRONMENTAL ENGINEERING

FINAL YEAR PROJECT

Waste Composition and Students' Acceptance of Waste Segregation in Kampar West Lake Student Hostel Area

Survey Questionnaire

This questionnaire contains 17 questions. The purpose of this questionnaire is to study the awareness of students about waste segregation. Please answer all of them honestly. Your answers will be kept PRIVATE and CONFIDENTIAL and used solely for academic study purpose.

Part 1: Personal information

1. Please circle your faculty:
   a) Centre for Foundation Studies (CFS)
   b) Faculty of Business and Finance (FBF)
   c) Faculty of Science (FS)
   d) Faculty of Information and Communication Technology (FICT)
   e) Faculty of Engineering and Green Technology (FEGT)
   f) Faculty of Arts and Social Science (FAS)
   g) Institute of Chinese Studies (ICS)

2. Please state your age: _____

3. Please select your gender:
   ( )Male ( )Female

Part 2: Awareness about general practice

4. Are you aware about waste management and waste segregation?
   ( )Yes ( )No

5. Did you take part in any campaign, activity or talk related with waste management?
   ( )Yes ( )No

6. Do you separate waste according to their types before disposal?
   ( )Yes ( )No
   If your answer is 'yes', answer Question 7 and 8, but skip Question 9.
   If your answer is 'no', skip Question 7 and 8, but answer Question 9.

7. Please circle the type(s) of waste that you separate (You can circle **more than one** answer).
   a) Paper/Cardboard
   b) Aluminium/Metal
   c) Recyclable plastic
   d) Glass
   e) Food/kitchen waste
   f) Non-recyclable waste
   g) Other, please specify: _____

8. After waste separation, in which way(s) do you manage it? (You can circle **more than one** answer)
   a) Donate the recyclable waste to charity organization
   b) Sell the recyclable waste to recycling center
   c) Reuse the reusable waste in your daily life
   d) Compost food/kitchen waste
   e) Feed the food/kitchen waste to pet
   f) Bury the food/kitchen waste
   g) Put them into different plastic bags and throw them into rubbish bin
   h) Other, please specify: _____

9. If you do not separate waste by now, are you willing to do it in the future?
   ( )Yes ( )No

10. Would you like to gain more knowledge about waste segregation?
    ( )Yes ( )No

11. Will you teach your friends to do waste segregation if you have this habit?
    ( )Yes ( )No

Part 3: Awareness about local waste management system

12. Do you know which authority is responsible for waste collection in West Lake, Kampar? (Choose **only one** answer)
    a) Kontraktor Swasta
    b) Majlis Daerah Kampar
    c) Danish House Sdn. Bhd.
    d) Tzu Chi organization (慈济)
    e) Other, Please specify: _____

13. What do you think will happen to the waste collected by the authority above? (Choose **only one** answer)
    a) Sent it to landfill without separation
    b) Waste will be separated by workers according to their types before sent to landfill
    c) Sent it to incinerator
    d) Other, please specify: _____

14. Have you heard about the waste segregation program which will be implemented by the government in states including Kuala Lumpur, Putrajaya, Pahang, Johor, Malacca, Negeri Sembilan, Perlis and Kedah starting from September 2015?
    ( )Yes ( )No

15. If the program above will really be implemented, will you practice it by now, whether your hometown belongs to the listed states or not?
    ( )Yes ( )No

Part 4: Opinions about waste segregation

16. The list below shows some possible factors that **encourage** people to practice waste segregation. Please tick your level of agreement for each factor.

Factor	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The recyclable waste can be sold for extra income					
Enforcement by government					
Existence of proper education about waste segregation and its benefits					

Availability of waste segregation facility near housing area					
Surrounding people are practicing waste segregation					

If you think of other factor, please state: _____

17. The list below shows some possible factors that **discourage** people to practice waste segregation. Please tick your level of agreement for each factor.

Factor	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Laziness					
Time consuming					
Lack of enforcement by government					
Not many people are doing it					
Lack of knowledge about waste segregation and its benefits					
Not profitable					
Absence of waste segregation facility near housing area					

If you think of other factor, please state: _____

End of questions. Thanks for your cooperation!

Appendix 5

Waste Composition Study

A truck was assigned to collect waste from the dustbins of 50 randomly selected hostels.

The waste were sent to Sahom landfill and separated manually into different plastic bags/baskets based on their type.

The mass for each type of waste was measured to estimate its proportion among the waste stream.

Appendix 6A

Waste Segregation Program Seminars

Mr. Goh Seng Chee, Environmental Health Officer, Kampar District Council

Lee Jia Yi, Year 4 Sem 1 Environmental Engineering student

Content of the seminar

Audience (12 August 2015)

Audience (13 August 2015)

Appendix 6B

Waste Segregation Programme Seminar Poster

Appendix 7A

Waste Segregation Programme Poster

Note: Food waste collection was implemented earlier in September 2015.

Other activities remained unchanged.

Appendix 7B

Waste Segregation Programme Flyer

Note: Due to high acceptance of program as shown from the result, the program duration was extended beyond January 2016.

Summary of the program

Starting from September 2015, Malaysia government is going to implement a new waste collection system in Kuala Lumpur, Putrajaya, Pahang, Johor, Malacca, Negeri Sembilan, Perlis and Kedah. Citizens who live in these states are required to separate their waste into plastic, paper, cardboard, glass, metal, food waste, bulk waste and garden waste before disposal. This **final year project** serves **as a preparation for the students who live in West Lake student hostels to adapt to the new lifestyle.**

The title of this project is "**Waste composition and students' acceptance on waste segregation in West Lake Student Hostels, Kampar**". This project consists of three phases:

1. Initial waste composition study and survey about student's awareness on waste segregation.
2. **Promotion and implementation of new waste collection system in West Lake with support from Majlis Daerah Kampar, Danish House and KT Management**.
3. Evaluation of project result based on waste composition after implementation, students' acceptance on the new system and economical benefits of the project.

This project will be very helpful to the development of Kampar and Malaysia in general from environmental, economical and social aspects. So, **please support this project as much as possible!**

How to participate?

1. **Please attend one of the related seminars** between 12 August to 13 August to learn more about this program. Please follow our Facebook page for news about the venue, date and time.
2. Please put **only non-recyclable waste** in the dustbins provided by Danish House, KT Management or other respective hostel owners. They will be collected on **every Tuesday, Thursday and Saturday**.
3. Please put your **recyclable waste** outside of your hostels for collection on **every Sunday morning.**
4. **Page 3 & Page 4 show the types of waste acceptable/not acceptable for this recycling program**.
5. **Please spread the awareness among your friends.** Let's join together to make green society a reality!
6. If you have any questions regarding the program, please do not hesitate to ask us on our Facebook pages, or contact Lee Jia Yi (012-6198765) or Majlis Daerah Kampar.

2

Note: Aerosal can is recyclable if the hazardous substance in the can is removed.

Note: E-waste and food waste are handled as recyclable waste starting from September and October 2015 respectively.

Appendix 7C

Programme Banner

Banner near hostel entrance

Banner near hostel entrance

Content of programme banner

Appendix 7D

Facebook Page of the Waste Segregation Programme

Appendix 8

Recycling Activities in West Lake Student Hostel Area

Recycle truck

Recycle truck

Kerbside recyclable waste collection

Kerbside recyclable waste collection

Food waste composting container

Food waste bin

Detailed sorting of recyclable waste after kerbside collection

Detailed sorting of recyclable waste after kerbside collection

One of the participants of food waste composting

One of the participants of food waste composting

Appendix 9

Student Survey Questionnaire (Stage 2)

UNIVERSITI TUNKU ABDUL RAHMAN
FACULTY OF ENGINEERING AND GREEN TECHNOLOGY
BACHELOR OF ENGINEERING (HONS) ENVIRONMENTAL ENGINEERING

FINAL YEAR PROJECT

Waste Composition and Students' Acceptance of Waste Segregation in Kampar West Lake Student Hostel Area

Survey Questionnaire 2

This questionnaire contains 15 questions. The purpose of this questionnaire is to study the effect of waste segregation program in West Lake student hostel area (organized by Department of Environmental Engineering and Majlis Daerah Kampar with the cooperation from local hostel companies including Danish House and KT Management) on students' awareness and practice of waste segregation. In addition, this survey also serves as a platform for the students to give feedback to the program organizers for future improvement. Please answer all of them honestly. Your answers will be kept PRIVATE and CONFIDENTIAL and used solely for academic study purpose.

Part 1: Personal information

18. Please circle your faculty:
    a) Centre for Foundation Studies (CFS)
    b) Faculty of Business and Finance (FBF)
    c) Faculty of Science (FSC)
    d) Faculty of Information and Communication Technology (FICT)
    e) Faculty of Engineering and Green Technology (FEGT)
    f) Faculty of Arts and Social Science (FAS)
    g) Institute of Chinese Studies (ICS)

19. Please state your age: _____

20. Please select your gender:
    ( )Male ( )Female

Part 2: Participation in the program

21. Are you aware about waste management and waste segregation?
    ( )Yes ( )No

22. Are you aware about the waste segregation program in West Lake student hostel area?
    ( )Yes [Proceed to Question 6, 7]

( )No [Skip Question 6, 7, 8, 9, 10; Proceed to Question 11]

23. How do you know about this program? (You can select **more than one** answer)
    a) Seminar
    b) 5 minutes class presentation
    c) Social media (Facebook)
    d) Informed by faculty staffs/lecturers
    e) Posters around UTAR
    f) Banners at the entrances of West Lake
    g) Housemate/coursemate/friend
    h) Flyers at Danish House offices
    i) Web announcement by Danish House and KT Management
    j) Aware of the presence of recyclable waste collection lorry in West Lake every Sunday morning.
    k) Aware of the presence of food waste bins around West Lake
    l) Other: _____

24. Do you participate in this program?
    ( )Yes [Proceed to Question 8, 9, 10, Skip Question 11, 12]
    ( )No [Skip Question 8, 9, 10; Proceed to Question 12]

25. Which activity(s) of this program do you participate in? (You can select **more than one** answer)
    a) Recyclable waste collection
    b) Food waste composting
    c) Food waste collection

26. Which type(s) of waste do you separate? (You can select **more than one** answer)
    a) Paper/cardboard
    b) Glass
    c) Metal/tin
    d) Plastic (Recyclable)
    e) Food waste
    f) Electronic waste
    g) Other: _____

27. Why do you participate in this program? (You can select **more than one** answer)
    a) There is similar program (by government or by private sector) in my hometown.
    b) Waste separation is already my habit for a long time.
    c) To get rid of recyclable waste easily.
    d) People around me are doing it.
    e) I understand the benefits of waste separation to the environment.
    f) Other: _____

28. If you know there is a waste segregation program in your hostel area, will you take part in it?

( )Yes [Skip Question 12] ( )No [Proceed to Question 12]

29. Why are you not interested to take part in this program? (You can select **more than one** answer)
    a) Waste separation is troublesome and time consuming.
    b) I don't like the methods implemented in this program.
    c) I use other ways to handle my recyclable waste (For example: Donate recyclable waste to charity organization, Sell recyclable waste to known recycling company, Use the recycling facilities in UTAR campus)
    d) I don't know what benefit this program can bring.
    e) Waste management is not my responsibility.
    f) Waste separation is not enforced in local area.
    g) Other: _____

Part 3: Effect of this program on students' awareness and practice

30. Please rate the following statements:

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
This program enables me to understand the environmental benefits of waste segregation.					
This program enables me to learn more knowledge about recycling.					
This program can help to change the lifestyle of students.					
After joining this program, I am motivated to practice waste segregation.					
This program encourages me to influence my friends and relatives to practice waste segregation.					
I hope waste segregation can be part of the culture of local people permanently.					

Part 4: Opinions about this program

31. Please rate the following statements:

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The promotion methods used (as listed in Question 6) are					

appropriate.					
The methods of recyclable waste collection and food waste collection are appropriate.					
Information about this program (activity procedure and detail) can be easily obtained.					
The overall performance of this program is outstanding.					
The initiative of this program is good.					
This program is a good solution of local solid waste problem.					

32. In your opinion, how can we improve this program?

_____
_____
_____
_____
_____

End of questions. Thanks for your cooperation!

Appendix 10

On-site Observation of Students' Behavior in Utilizing the Recycling Services

Wrong usage of recycle bins

Correct usage of recycle bins

Wrong recyclable waste placement for kerbside collection

Correct recyclable waste placement for kerbside collection

Wrong usage of food waste bins

Correct usage of food waste bins

Appendix 11

Recyclable Waste Selling

Recyclable waste collected from August 2015 to November 2015

Mass measurement

Move to the lorry

YSR lorry

YSR Recycle Shop

YSR Recycle Shop

Appendix 12

Drop-off Collection with Recycle Bins

Recycle bins in Westlake Home 1

Recycle bins in Harvard area 1

Recycle bins in Harvard area 2

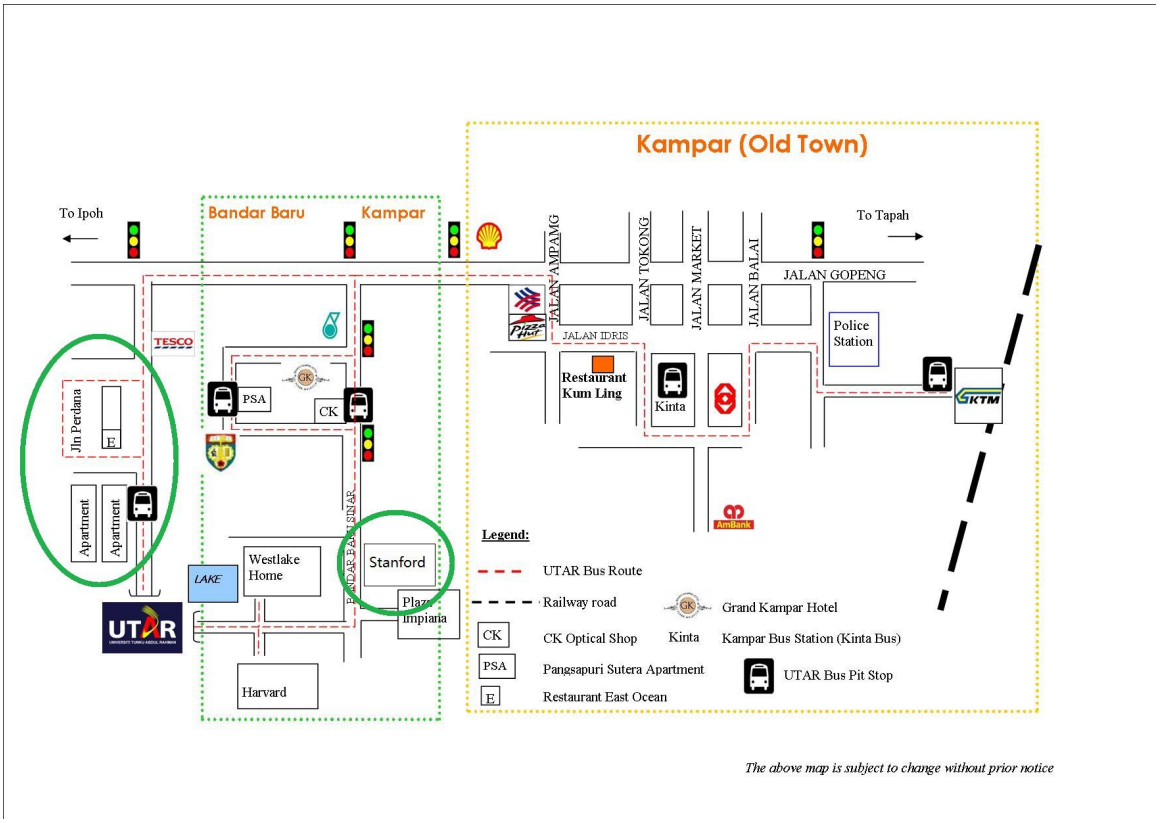
Recycle bins in Westlake Home 2

Appendix 13

Programme Area Expansion

Stanford area

Taman Kampar Perdana (East Lake)



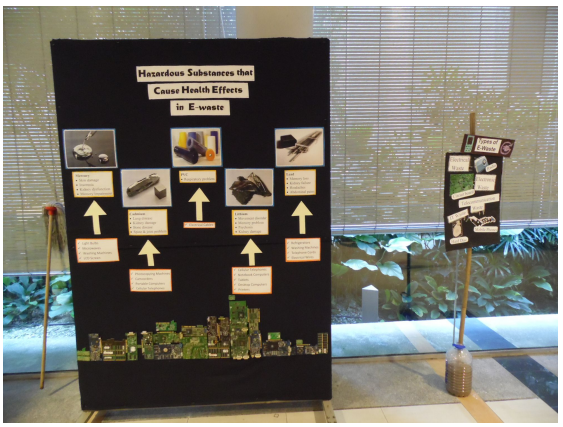
Location of Taman Kampar Perdana and Stanford with respect to Westlake Home, Harvard and UTAR

Appendix 14

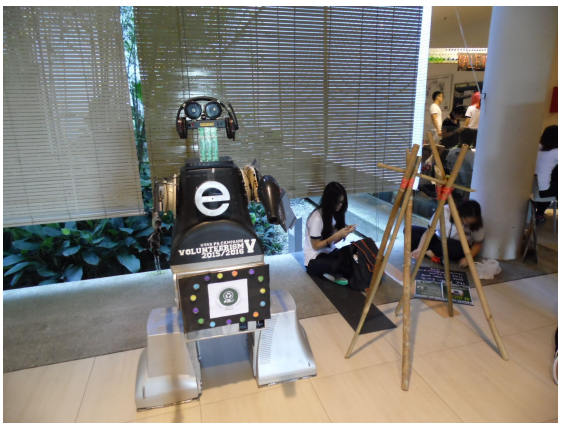
UTAR PR Campaign 2015/2016: Volunteerism V - Recycling by Group 3

Reuse of plastic bottles collected from student hostels to make decoration

Promotion of paper, plastic, metal and glass recycling



Information board about recycling knowledge



Reuse of E-waste to make robot sculpture

Promotion of E-waste recycling

Promotion of food waste recycling

Entrance of outdoor exhibition in Old Town, Kampar

Opening ceremony of outdoor exhibition

Various booths in outdoor exhibition

Fashion show with clothes made from recyclable materials

Entrance of Fallen Earth Drama Night in UTAR Perak Campus

Drama Night performance

Appendix 15

Reuse of Recyclable Waste in Other UTAR Events

Cardboard collected from student hostels

Wushu Club's Hou Dak Yi event chairpersons

Stage and outdoor decorations made from recyclable materials

Appendix 16

Gifting of Parking Coupons as a Form of Incentive

More than 10 kg of recyclable waste gathered during one kerbside collection

Gifting of parking coupons to participants who fulfill the requirement

Appendix 17

Polystyrene Waste Problem in Kampar

Polystyrene food containers in waste stream

Food waste in polystyrene food container

Usage of polystyrene for takeaway

Usage of polystyrene for food delivery

Usage of polystyrene in night market

Usage of polystyrene to carry food

Appendix 18

Scavenger Issue

Scavengers spotted in Bandar Barat

News about scavengers spread around UTAR community

Uncle Keong and his storeroom

Appendix 19

Formal letters sent to and received from MDK

Note: The letters are in Malay language.

Lee Jia Yi
Universiti Tunku Abdul Rahman,
Jalan Universiti Bandar Barat,
31900, Kampar, Perak.

MAJLIS DAERAH KAMPAR
DITERIMA
17 JUN 2015
UNIT KORPORAT,
JABATAN
KHIDMAT PENGURUSAN

Yang Dipertua Majlis Daerah Kampar
Kompleks Pentadbiran MDKampar,
Jalan Iskandar,
31900 Kampar, Perak.

15 Jun 2015

Tuan,

Memohon Bantuan Untuk Menjalankan Projek Tahun Akhir

Saya, Lee Jia Yi, mahasiswa yang kini melanjutkan pelajaran dalam bidang kejuruteraan alam sekitar (Environmental Engineering) di Universiti Tunku Abdul Rahman (UTAR), sedang menjalankan projek tahun akhir yang berkaitan dengan kajian komposisi sampah serta kesedaran pelajar terhadap pembagian sampah di Taman Asrama Bandar Barat.

2. Pada September 2015, kerajaan Malaysia akan melaksanakan program pembagian sampah skala besar di negeri-negeri termasuk Kuala Lumpur, Putrajaya, Selangor, Melaka, Negeri Sembilan, Johor, Pahang, Kedah dan Perlis. Walaupun senarai tersebut tidak termasuk Perak, projek tahun akhir tersebut boleh dijadikan peluang baik untuk menguji penerimaan aktiviti pembagian sampah dalam kalangan rakyat generasi muda sebelum pelaksanaan program rasmi.

3. Projek tersebut akan dibahagikan kepada tiga sesi. Dalam sesi pertama, saya akan melakukan kaji selidik untuk menguji kesedaran pelajar terhadap pembagian sampah. Lepas itu, saya akan mengaji komposisi sampah yang dihasilkan dari Taman Asrama Bandar Barat. Dalam sesi kedua, kami akan mengadakan satu kempen untuk mengajar pelajar UTAR tentang cara untuk mengasingkan sampah mengikut jenis. Kemudian, dalam sesi ketiga, saya akan mengaji komposisi sampah dari Taman Asrama selepas sistem pengurusan sampah diubah. Akhirnya, saya akan mentafsir keputusan projek tersebut daripada sudut pandang ekonomi, sosial dan alam sekitar.

4. Saya bercadang untuk meminta bantuan daripada pihak tuan untuk menjalankan kajian komposisi sampah sesi pertama dari 21 Julai hingga 1 Ogos dan menganjurkan kempen yang dinyatakan di atas pada minggu pertama bulan Ogos (Tarikh sebenar masih belum ditentukan). Selain itu, saya juga ingin meminta tuan mengubah sistem pengurusan sampah Taman Asrama untuk menyesuaikan pelajar dengan habit pembagian sampah yang diajar dalam kempen tersebut. Kemudian, kajian komposisi sampah sesi kedua akan dijalankan dari bulan Ogos hingga bulan Disember selepas kempen tersebut.

5. Besarlah harapan saya jika pihak tuan dapat meluluskan bantuan ini bagi menjayakan projek tahun akhir saya ini. Tambahan pula, projek tahun akhir juga mungkin mampu

mendatangkan manfaat kepada perkembangan negara kita.

Keprihatinan pihak tuan didahulukan dengan ucapan terima kasih.

Yang Benar

16/6/2015

Lee Jia Yi

Diperiksa oleh

16.6.2015

Dr. Mohammed J.K. Bashir
Penyelia Projek Tahun Akhir

16/6/15

Dr. Sumathi Sethupathi
Ketua Jabatan Kejuruteraan Alam Sekitar

16/6/2015

Dr. Tan Kok Tat
Timbalan Dekan
Fakulti Kejuruteraan dan Teknologi Hijau

DR. TAN KOK TAT
DEPUTY DEAN
FACULTY OF ENGINEERING AND GREEN TECHNOLOGY
UNIVERSITI TUNKU ABDUL RAHMAN

مجلس داءرة كلمة قيراق دار الرضوان

MAJLIS DAERAH KAMPAR

KOMPLEKS PENTADBIRAN, MAJLIS DAERAH KAMPAR,
JALAN ISKANDAR, 31900 KAMPAR, PERAK DARUL RIDZUAN.

MAJU DAN MEMBANGUN

Bil.(39)dlm.MDKpr (JKP) 4/4 Jld.12

8 Ramadan, 1436
25 Jun, 2015

Lee Jia Yi,
Universiti Tunku Abdul Rahman,
Jalan Universiti Bandar Barat,
31900 Kampar.

Tuan,

PERMOHONAN BANTUAN UNTUK MENJALANKAN KAJIAN PROJEK TAHUN AKHIR

Dengan segala hormatnya saya merujuk kepada perkara di atas dan surat tuan bertarikh 15 Jun 2015 adalah berkaitan.

2. Sukacita dimaklumkan bahawa pihak Majlis tiada halangan untuk tuan menjalankan kajian bagi projek tahun akhir di Majlis dari Julai hingga Disember 2015.

3. Walau bagaimanapun, tuan dipohon untuk mengemukakan 1 (satu) salinan laporan kajian kepada pihak Majlis setelah selesai projek berkenaan bagi tujuan rujukan.

Sekian, terima kasih.

BERKHIDMAT UNTUK NEGARA

Saya yang menurut perintah,

(NOR AKMAL BIN YANG GHAZALI)
Setiausaha
b.p. Yang Dipertua
Majlis Daerah Kampar
Perak Darul Ridzuan

s.k. - Fail timbul

"PEMBUDAYAAN INOVASI PEMANTAPAN PRESTASI"

TEL: 05 4671020, 4671030
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LAMAN WEB: *www.mdkampar.gov.my*

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Setiausaha	: 05 4671011	Penilaian & Pengurusan Harta	: 05 4671042
Khidmat Pengurusan	: 05 4671015	Perkhidmatan & Perbandaran	: 05 4671035
Perbendaharaan	: 05 4671021	Perundangan	: 05 4671043
Sistem Maklumat	: 05 4671022	Penguatkuasaan	: 05 4671044
Kejuruteraan	: 05 4671031	Taman & Rekreasi	: 05 4671057

Appendix 20
Acknowledgement Certificate from MDK

Note: The certificate is in Malay language.

Appendix 21
Acknowledgement Letter from MDK

Note: The certificate is in Malay language.

مجلس داءرة كامڤر فيراق دار الرضوان
MAJLIS DAERAH KAMPAR
KOMPLEKS PENTADBIRAN, MAJLIS DAERAH KAMPAR,
JALAN ISKANDAR, 31900 KAMPAR, PERAK DARUL RIDZUAN.

"MAJU DAN MEMBANGUN"

Bil. (124) dlm.MDKpr. (KES) 32/17 Jld. 5

2 Zulkaedah, 1436H
17 Ogos, 2015

Dr Yap Vooi Voon,
Fakulti Dean,
Fakulti Kejuruteraan dan Teknologi Hijau (Kampus Perak),
Universiti Tunku Abdul Rahman (UTAR),
Jalan Universiti Bandar Barat,
31900 Kampar.

Tuan Dr,

Penglibatan Komuniti dalam Projek 3R (Pengasingan Sisa Pepejal)di Westlake, Bandar Barat, Kampar

Perkara diatas dirujuk. Terlebih dahulu saya ingin merakamkan setinggi tinggi penghargaan kepada pelajar dan pensyarah Fakulti tersebut khasnya Dr. Mohammed JK Bashir dan Encik Lee Jia Yi yang sudi menjayakan projek ini bersama dengan Majlis Daerah Kampar. Projek ini merangkumi kajian impak program kitar semula di kawasan Westlake, Bandar Barat, komposisi sisa pepejal dan tahap kesedaran komuniti setempat. Objektif spesifik projek ini adalah :

a) Kajian penjanaan dan komposisi sisa pepejal
b) Kajian kesedaran dan tahap penerimaan projek pengasingan sisa pepejal
c) Kajian impak pengurusan dan tren pelupusan sisa pepejal

Sehubungan itu, Majlis ini memperakukan akan bersama sama pihak UTAR menjayakan projek ini dari segi memberi bantuan peralatan dan bahan seperti berikut :

a)	Pencetakan risalah dan banners	: RM 1,081.00
b)	Penyediaan tong kitar semula	: RM 2,247.20
c)	Bakul kompos	: RM 364.00
d)	Kopon Parkir (insentif)	: RM 414.00
e)	Tong & papantanda sisa makanan	: RM 248.00
f)	Lain-lain	: RM 645.80
g)	Jumlah	RM 5,000.00

Sekian dimaklumkan dan diharap kolaborasi antara UTAR dengan Majlis Daerah Kampar akan membawa nilai dan kesejahteraan kepada komuniti setempat.

Sekian dimaklumkan, terima kasih.

TEL: 05 4671020, 4671030
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Khidmat Pengurusan	: 05 4671015	Perkhidmatan & Perbandaran	: 05 4671035
Perbendaharaan	: 05 4671021	Perundangan	: 05 4671043
Sistem Maklumat	: 05 4671022	Penguatkuasaan	: 05 4671044
Kejuruteraan	: 05 4671031	Taman & Rekreasi	: 05 4671057

"BERKHIDMAT UNTUK NEGARA"

Saya yang menurut perintah,

(NOR AKMAL BIN YANG GHAZALI)
Setiausaha,
b.p. Yang DiPertua,
Majlis Daerah Kampar,
Kampar.

GSC/