CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 INTRODUCTION

The waste composition studies in Petaling Jaya (PJ) were conducted to determine the rate of plastic waste generation, as well as, respondents' opinion to improve plastic recycling. The analysis also focused on:

a) Waste composition especially plastic waste generated by householders

b) The respondents' attitudes and their perceptions towards recycling

c) The effects of demographics (i.e., age, race, education, family income, marital status), as well as, other explanatory variables (i.e., family size, years living in the housing unit, ownership status, and concern for recycling) on respondents' recycling activities (i.e., selling and reuse of plastic, and home separation activities) and the amounts of household wastes.

4.2 WASTE COMPOSITION IN PETALING JAYA

The result of the study indicated that the waste components in PJ include 42% organics, 24% paper, 21% plastic, 4% glass, 4% metals, 1% textile, and 4% of others (Figure 4.1).

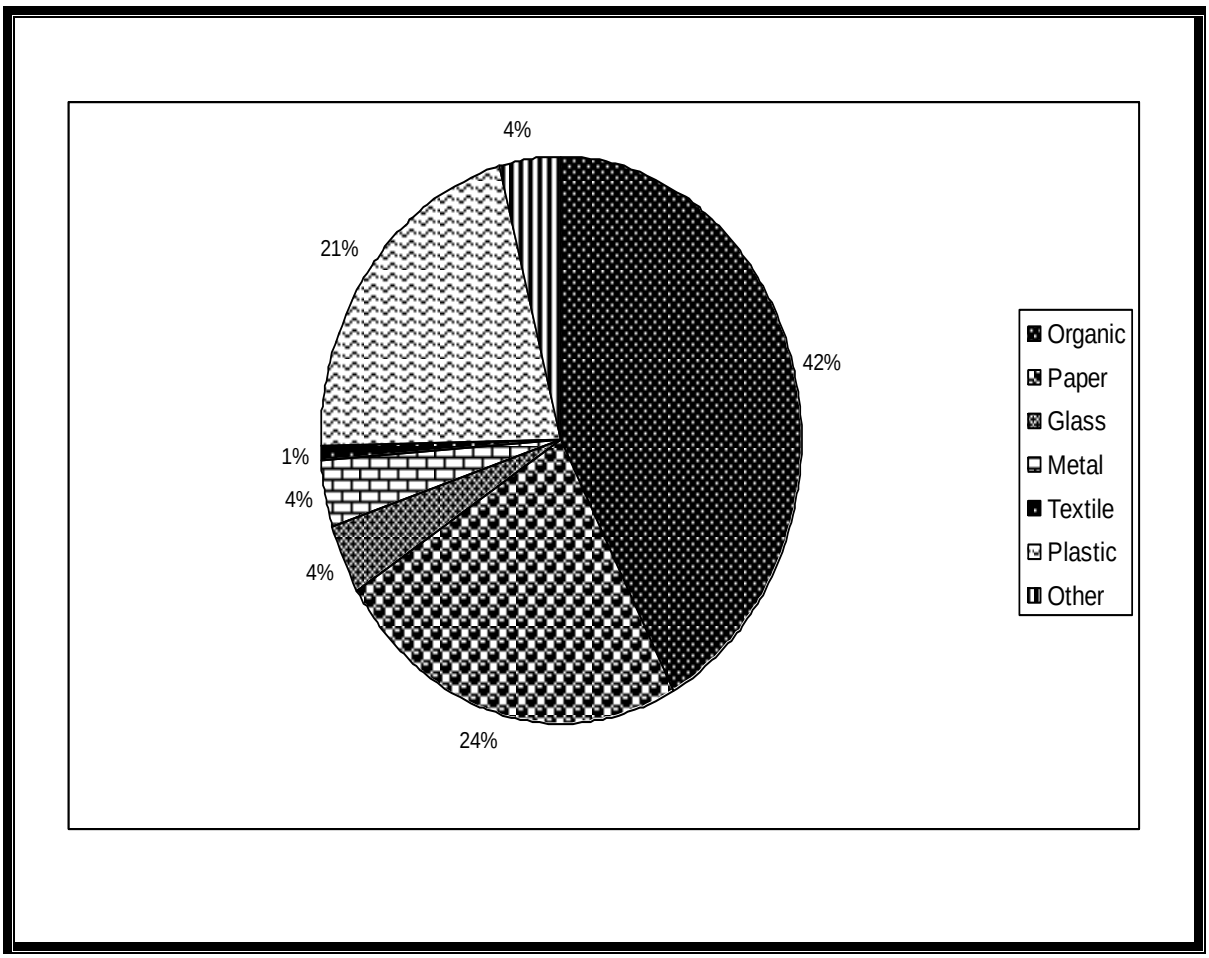

Figure 4.1: Average Waste Component in PJ (% FW)

Organic waste constitutes the highest percentage of municipal solid wastes (MSW) in PJ. This might be due to the habits of frequent cooking and quantity of left-over foods; thus, organic waste contributes nearly half of the total waste stream. The results were found to be similar to the previous findings that show that organic waste forms the highest portion of the MSW stream (Mohamad *et al*., 2009; Agamuthu *et al.,* 2004; Fauziah *et al.,* 2004; Mohd.Badruddin, 2004). Similarly, organic waste has been known to be the core of waste components in developing countries like Malaysia, Cuba, and etc. (Claudia and Mosler, 2007; Agamuthu *et al*., 2004; Fauziah *et al*., 2004). Organic component is potentially suitable for conversion to compost. In Malaysia, composting is marketable in landscaping and other agricultural sectors. Application of compost can

reduce substantial cost in waste disposal (Agamuthu *et al.,* 2004; Agamuthu, 2001; Juzhar, 2002; Mohd. Nassir, 1996).

The second highest percentage of waste generated in PJ was paper, averaged at 24%. This may be due to the purchasing power and lifestyle of people. Paper is widely used in PJ which includes newspapers, magazines, reusable cardboard packages, and food containers in fast-service restaurants. Therefore, the quantity of paper-based wastes generated was also high. This is agreeable with findings in many rapidly developing countries such as China (Ackerman, 2005). A comparison of paper-based wastes generated in PJ in 2003 (Kathirvale et al., 2003) and the one from this study in 2011 showed no significant change in quantity ratio. This might be due to the fact there were not much changes in the pattern of paper usage from 2003-2011.

Plastics were the third highest composition generated by household in PJ with 21% of the total waste stream (Figure 4.1). The result of the study in PJ showed that around 42% of plastics in MSW is PET. Through observation and sampling plastic such as soft drink and detergent bottles, food wrappings, ice cream boxes and others can be easily separated from other waste components. Among the domestic users, plastic was abundantly used because it can be obtained easily and it is cheap. As for PET usage, it is highly favored since PET bottles have high strength against impact and they will not break easily (Najafi *et al.,* 2006; Omrani, 2005). The high percentage of plastic bottles and packaging materials probably is due to its wide use in PJ area and the increasing demand. The percentage of plastic waste is considered high (21%) and is typical of a fast developing nation (Agamuthu, 2001). Though landfilling is the utmost method of waste disposal in Malaysia, sending plastic waste to landfills not only caused a loss in

the economic value but also gave negative influence to the environmental wellbeing. Therefore recycling of plastics should be encouraged as a step to improve on the existing 5% level of recycling in Malaysia to a higher percentage.

Also, there is a significant variation over the quantity of plastic wastes generated in this study (21%) when compared to quantity generated in 2003 (9%) from PJ (Figure 4.2) (Kathirvale *et al.*, 2003). This might be attributed to increased population, changes in economic status, some attitudinal variation/ lifestyle etc.

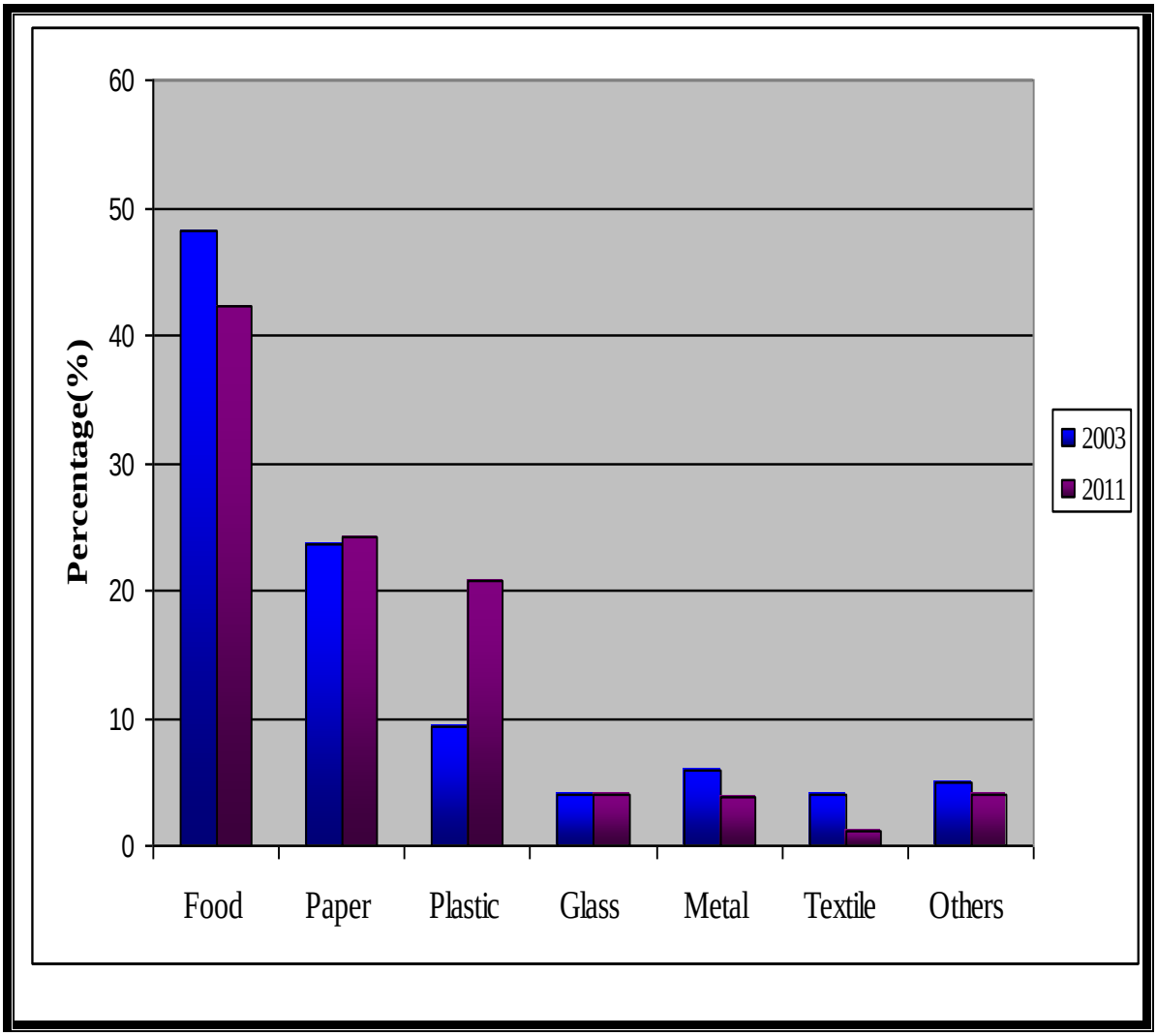

Figure 4.2: Relative Comparison of Waste Composition (% FW) in PJ.

Source: Kathirvale *et al.*, 2003.

From the waste composition study, PJ is one of the fastest developing urban areas in Malaysia. The degree of waste generation is high due to associated residential and industrial activities. The results indicated that MSW in PJ has a good recyclability potential especially for plastics waste based on the total plastic percentage which is 21% (Figure 4.1). The study indicated that though recycling activity in PJ is rising, yet significant quantity of plastics (60%) are still dumped at the landfill sites. This is due to insufficient attention from the authorities towards plastic recycling.

Basic background information of the survey respondents is discussed in the following section.

4.3 INDEPENDENT FACTOR IN SURVEY

400 respondents between 20 to 55 years of age were interviewed and this consisted of 33% male and 67% female (Table 4.1).

Table 4.1: Frequency of Respondents' Gender in PJ Area

		Frequency	Percent
Valid	Male	126	33.0
	Female	255	67.0
	Total	381	100.0
Missing	System	6	
Total		387	

They were further categorized into students, housewives and workers. Ethnical group in PJ area were 37% Malays, 43% Chinese, 17% Indian, and 3% others (Table 4.2).

Table 4.2: Frequency of Respondents' Ethnicity

		Frequency	Percent
Valid	Malay	141	37.0
	Chinese	163	43.0
	Indian	67	17.0
	Other	12	3.0
	Total	383	100.0
Missing	System	4	
Total		387	

Chinese residents formed the greater percentage of total respondents in the study area. Table 4.3 summarized the background information of the respondents in the study area based on the majority group (Appendix L).

Table 4.3: Brief Description of the Majority Group among Respondents

Area	**Age range**	**Profession**	**Income**	**Education level**
Petaling Jaya	20-55	Student Employer Housewife Employee	RM 300-2000	SPM/STPM and tertiary education

The survey indicated a strong influence between income and waste quantities in PJ area. Higher income groups tend to consume more products and thus generated more wastes (Mohd.Badruddin, *et al*, 2006; Agamuthu, 2001, 1997; Mohd.Razman and Sabarinah, 1994; Mohd Nazri, 1994; Ahmad Termizi and Fadil, 1992). This study indicated that respondents with big families and those who cooked more often at home generated more wastes. The result disagrees with Kemper and Quigley (1976) who found insignificant effect of family size on the waste amount generation. Some believe that factors such as income, age and gender, as well as, housing and ownership did not appear to be important explanatory variables in a study area (Mohd. Nazri, 1994; Ahmad Termizi and Fadil, 1992; Rahim, 1992; Richardson and Havlicek, 1978; Wertz, 1976; Kemper and Quigley, 1976).

4.3.1 Public View on Plastic Recycling Concept

Based on the question proposed in PJ area among residents when asked whether they have heard or even read about plastics recycling, 67% of the participants responded "yes" that they have read and heard about plastics recycling (Table 4.4). The positive response might be attributed to media advertisements, literacy levels of respondents and exposure to such practices from other nations. However, this is not to conclude that those that said "No" were illiterate, rather might be ignorant of their immediate environment and its associated awareness programmes/ concerns.

Table 4.4: Public's Awareness of Recycling Concept

		Frequency	Percent
Valid	No	127	33.0
	Yes	254	67.0
	Total	381	100.0
Missing	System	8	
Total		389	

With regards to the public perception and behavior towards recycling practices, this finding indicated that even though majority of the respondents in PJ knew the meaning of recycling, only 22% of respondents practiced it (Figure 4.3). This most probably was due to citizens' lack of awareness on the importance of plastic recycling (Refsgaard and Magnussen, 2009). This might also be associated to insufficiency of facilities, including collection schedule or inappropriateness in the location of recycling facilities (Agamuthu *et al.*, 2009). Continuous awareness creation programs can encourage the existing recyclers while the ignorant ones can as well be encouraged to start the recycling exercise. Recycling which serves as an income generator can also be a motivating factor to the residents (Chenayah *et al.,* 2007).

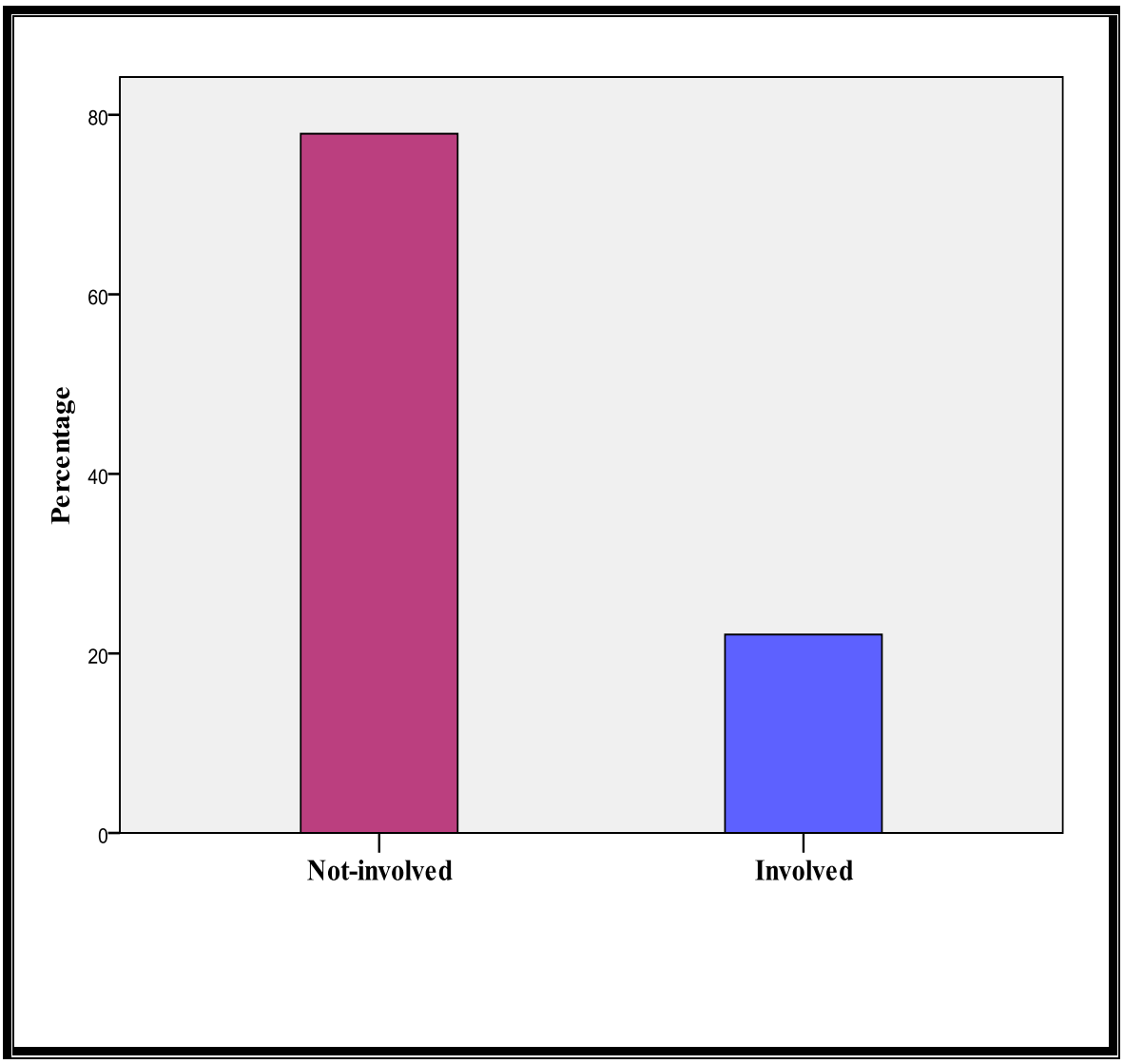

Figure 4.3: Citizens' Involvement in Plastic Recycling in PJ

In accordance with the participants that know the meaning of recycling, it can be inferred that majority had not heard or even read of plastic recycling from different sources. Hence, the findings showcased newspapers as the main source of information for about 35% of respondents. Table 4.5 detailed the respondents' various sources of obtaining information about recycling.

Table 4.5: Sources of Information on Recycling

		Frequency	Percentage
Valid	Newspapers	132	35.0
	Magazines	43	12.0
	TV	108	29.0
	Radio	50	13.0
	Leaflet drops	32	9.0
	Other	9	2.0
	Total	374	100.0
Missing	System	15	
Total		389	

The result of the study indicated that on average, 55% of respondents knew about plastic recycling through advertisements in the newspapers, magazines and leaflet drops, namely of reading material. About 42% of the respondents pointed out that television and radio advertising are the best way of getting information on plastic recycling. The rest of the respondents (2%) pointed out that they got information about recycling via billboards and advertisement in buses and LRT stations. They may be getting the information while using the public transport. Similarity, they might have gotten informed via witnessing open campaign programmes or road shows. However, integrated use of all media can increase public participation which is agreeable with Abdelnaser et al (2006a).

The liner regression was used to test and show the degree that family size, marital status and occupation can predict the getting information about plastic recycling. The summary of results is provided in Table 4.6. The analysis indicated that family size is statistically significant predictor of getting information about plastic recycling in the population (B=0.615, t = 4.343, p< 0.05, R2 Adjusted = 0.358). It means that about 39% of the variance in getting information about plastic recycling can be explained by family size in the population.

Table 4.6: Relationship between Family Size and Getting Information about Recycling

Variable			
IV	Beta	t-test	Sig
Family size	0.62	4.34	0
R2	0.38		
Adjusted R2	0.36		

Liner regression was used to test and show the degree that occupation can predict the getting information about plastic recycling. The summary of results is provided in Table 4.7. The analysis indicated that occupation is a statistically significant predictor of getting information about plastic recycling in the population, (B= 0.591, t = 4.081, p<0.05, R2 Adjusted = 0.329. About 32% of the variance in getting information about recycling can be explained by occupation in the population.

Table 4.7: Relationship between Occupation and Getting Information about Recycling

Variable			
IV	Beta	t-test	Sig
Occupation	0.591	4.081	0
R2	0.350		
Adjusted R2	0.329		

It means that residents with occupation that have big family size tend to be more interested in getting information on the recycling of plastics. The result showed that citizens with different types of occupation have different willingness to get information from different sources. Employers and students are more willing to get information from the newspaper while also housewives are more often get information from TV programmes and magazine. In contrast to mentioned group (employer, student and housewife), employees prefer to get information about plastic recycling via radio. This might be due to the nature of their job which does not give them enough time for reading or watching magazine, newspaper and TV programmes. Other parameters such as education, income and marital status have no significant effect on getting information about plastic recycling from a different source. The reason might be based on the lifestyle and behaviours of the respondents in PJ area.

4.3.2 Actual Recycling Activities

This study indicated that 38% of respondent segregate recyclable materials. Majority of respondents (62%) did not separate their wastes (Table 4.8). These respondents point

out that they do not know how to segregate waste for recycling purpose. They also do not know what they do with separated waste and where they should deliver their wastes.

Table 4.8: Waste Separation Practices among Respondents

		Frequency	Percentage
Valid	No	239	62.0
	Yes	148	38.0
	Total	387	100.0
Missing	System	2	
Total		389	

Recycling as a long-term strategy aims to transform the "throw-away" culture to that of a "conserving" one (Omran, 2008). In this regard, the MBPJ authority has implemented some programs to enhance recycling. The efficiency of a recycling program is dependent upon several requirements including adequate data on citizens' experience, understanding of recycling activities, and positive attitudes of residents about recycling. Most of these are still lacking in PJ.

On average, 37% of respondents indicated that they segregate recyclable plastics (Figure 4.4). This is a reflection of respondents' willingness to recycle plastics based on their ability to segregate. However, such response is poor considering the fact that the daily rate of utilizing recyclable plastics is high. The respondents therefore might not

have much willingness to segregate recyclable plastics due to absence of immediate market.

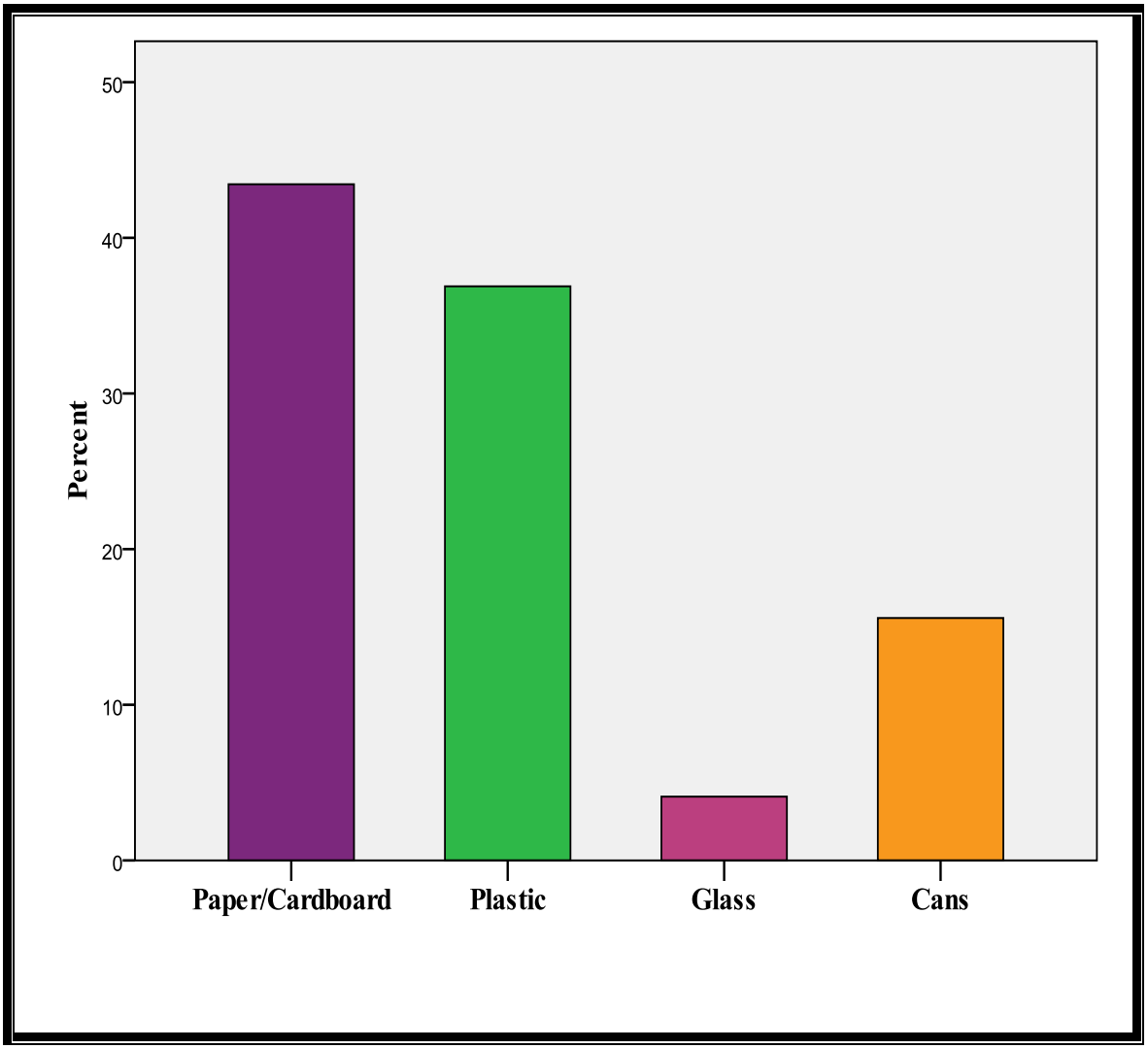

Figure 4.4: Type of Waste Being Recycled by Respondents

Based on the linear regression (Table 4.9), personal factors such as marital status (a beta value of 0.192) as well as family size (a beta value of 0.166) influence the home separation of wastes among PJ households. Married residents and those living in a big family were more involved in sorting of waste. Other parameters such as age and education do not influence the home separation activities as identified in this study.

Table 4.9: Descriptive Statistics on Home Separation of Wastes in PJ

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-0.556	.105		-5.286	.000
	Marital Status	.175	.039	.192	4.527	.000
	Family size	.115	.029	.166	3.913	.000

4.3.3 Recycling Issues and Solutions

When respondents were asked to give the best description of why citizens did not participate in recycling activities, 39% of the respondents indicated that the level of public awareness on recycling activates can be the main reason of their non-participation in plastic recycling (Table 4.10). This agrees with Imam et al. (2007) that opined that the public can play important role in promoting efficient, financially sound and technically competitive recycling activities. This is where a more active participation is required. The respondents in this study agreed that an appropriate public awareness and participation is required for the enhancement of collection and sorting of recyclable plastic.

Table 4.10: Public View on Recycling Issues

		Frequency	Percentage
Valid	Non-satisfaction from waste management service	83	22.0
	Citizens' lack of awareness on recycling activities	146	39.0
	Lack of education	136	36.0
	Other	10	3.0
	Total	375	100.0
Missing	System	14	
Total		389	

The result indicated that 36% of respondents refer to lack of education as one of the non-cooperative reasons in recycling activities. Educating individuals about what, how, and where to recycle is important. In fact, this is in accordance with Rotter (1954) that said such people believe that their participation in recycling would not make a difference. These individuals may need more persuasion to engage in recycle. Thus it is vital that individuals are aware of the reasons for recycling and the positive impact that recycling has on the environment. Thus, improving education on plastic recycling is very necessary as education allow public to know how to identify and separate types of recyclable materials; hence their ability to participate in plastic recycling activities can be improved. Therefore, public communication, awareness and education systems need to be conducted more effectively.

The remaining 22% of respondents were dissatisfied with the waste management services (WMS).

On average 78% of respondent were satisfied with the WMS. This indicated that satisfaction with WMS can be one of the factors of public cooperation in recycling plan. The citizens with high satisfaction with WMS can cooperate in recycling plan voluntarily. Citizens' lack of confidence in WMS resulted with lack of cooperation in waste collection services. It might be as a result of improper methodology in the WMS to increase public awareness over the past years. If the citizens are not satisfied with the WMS, it might be difficult to convince the public to participate in the recycling activity.

Liner regression was used to test and show the degree that education can predict the public attitude toward plastic recycling. The summary of results is provided in the Table 4.11. The analysis indicated that education statistically significant predictor of the public attitude toward plastic recycling in the population, ($B= 0.410$, $t = 2.417$, $p<0.05$, R2 Adjusted= 0.139. About 13% of the variance in the attitude toward recycling can be explained by education in the population.

Table 4.11: Relationship between Education and Attitude toward Recycling

Variable			
IV	Beta	t-test	Sig
Education	0.410	2.417	0.022
R2	0.168		
Adjusted R2	0.139		

Liner regression was used to test and show the degree marital status can predict the attitude toward recycling. The summary of results is provided in Table 4.12. The analysis indicated that marital status is statistically significant predictor of the attitude toward recycling in the population, (B =0.616, t = 4.216, $p<0.05$, R2 Adjusted=0.359). About 35% of the variance in the attitude toward recycling can be explained by marital status in the population.

Table 4.12: Relationship between Marital Status and the Attitude toward Recycling

Variable			
IV	Beta	t-test	Sig
Marital status	0.616	4.216	0
R2	0.380		
Adjusted R2	0.359		

It means that residents who are highly educated show more interest in plastics recycling. Thus, positive attitude towards recycling is closely related to the increased level of education. This study showed that highly educated groups can understand the necessities of certain action easily as compared to the less educated group (Irina *et al.*, 2004). Similar finding is obtained between participation in recycling and marital status, where married respondents are more positive towards recycling as compared to the not married respondents. Other parameters such as occupation, race and family size have no significant effect on the public attitude toward plastic recycling.

The respondents were also asked of their opinions on how public participation in recycling can be improved. The majority of respondents agreed that more facilities need to be provided and also monetary incentives can encourage recycling participation. In fact, recycling group should be encouraged by monetary incentives and more effort is needed to educate the people on the need and importance of recycling.

Based on the study, respondents when asked on ways to encourage the public to recycle suggested that providing more user friendly facilities can encourage public participation in recycling. Generally the perception was that recycling information is easily available and that sufficient and user friendly recycling facilities is important to make recycling a success (Agamuthu *et al.*, 2009).

When asked whether they will recycle in the future, if all facilities are provided, 86% of the respondents said that they would participate (Table 4.13).

Table 4.13: Respondents' Willingness to recycle if Recycling Facilities are provided

		Frequency	Percentage
Valid	No	52	14.0
	Yes	329	86.0
	Total	382	100.0
Missing	System	7	
Total		389	

Therefore, available facilities can increase public willingness to participate in recycling activities (Agamuthu and Fauziah, 2007). Furthermore, public opinions and attitudes have been cited to be an important part of an effective recycling program (Lokman and Fadil, 1992; Anderson, 1999). In the case of PJ, there is an urgent need for an improved public attitude. Creating public awareness will overcome problem on the general belief held by the public that it is the government's responsibility to ensure cleanliness (Gohari, 2007; Bontoux *et al*., 1996). This public participation concurs with study by Thomas (2001) which emphasized the importance of public understanding in enhancing participation rate. The planning and designing of future recycling systems may be made easier if a clear understanding of the public expectations and perceptions of institutional practices is achieved, as well as, the pattern of waste generation and composition.

When asked about the future of recycling in Malaysia, approximately 84% of the respondents generally agreed that Malaysia can achieve the recycling target of 22% by 2020 (Table 4.14).

Table 4.14: Respondent Agreement on the Achievement of 22% Recycling in 2020

		Frequency	Percentage
Valid	strongly agree	24	6.0
	Agrees	301	78.0
	Disagree	44	11.0
	Strongly disagree	18	5.0
	Total	387	100.0
Missing	System	2	
Total		389	

This is based on the perceived willingness of citizens to embank on source separation. They agreed that the level of plastic recycling in Malaysia will increase in future. Only 16% of the respondents disagreed with this perception. This small group of the respondents disagreed that the existing level of recycling in Malaysia is high and have negative view about improvement of plastic recycling in the future. They pointed out that the existing low consciousness for recycling will be the main factor, as well as, the lack of government efforts.

4.3.4 Factors that Influenced Citizen's Participation in Plastic Recycling

Participation of citizens can improve recycling activities. There are many reasons that affect citizens' non-cooperation towards plastic recycling. With regards to the survey in PJ, two main obstacles namely, government inability to provide basic facilities and the public ignorance themselves were identified. Citizens normally expect provision of

facilities from the government organizations. Thus, the frustration on the unavailable facilities can be translated into their refusal to participate in recycling activities. This hinders the progress of plastic recycling. From Table 4.15, about 31% of the respondents claimed that the lack of recycling bins is the factor that led to their non-cooperation in recycling.

Table 4.15: Issues of non-participation in Plastic Recycling

		Frequency	**Percentage**
Valid	Lack of space to collect plastic waste	80	21.0
	Lack of education	145	38.0
	Lack of recycle bins for separation	118	31.0
	Ignorance	39	10.0
	Other	2	1.0
	Total	384	100.0
Missing	System	5	
Total		389	

This group of respondents suggested that government should make recycling easier by placing more recycling bins in residential areas, particularly outside apartments' area in order to solve some of the related problems such as lack of space for collection of waste. They agreed that recycling bins need to be differentiated by colors, i.e., blue (papers), brown (glass), and orange (cans and plastics) should be better situated around

the city. When respondents who are interested in recycling have bins near to their home, they appear to be willing to recycle more fractions than when they have to walk for a longer time to drop off the waste, due to the inconvenience of carrying the large volumes of waste this type usually occupies.

The small group of respondent in PJ with 21% refers to the lack of space to accumulate waste as another factor for not recycling. Due to the lack of space in apartment residency, separation and collection of the recyclable waste is a problem. Although there is awareness of environmental issues, 10% of respondents ignore it. This group of respondents indicated that inconvenience as the reason for their non-participation. It is also interesting to note that a smaller percentage (1%) of the non-participating respondents indicated that they believed that recycling only waste time (Omran *et al.*, 2009).

With comparison between different dwelling residencies and the reasons for respondents' non-cooperation with plastic recycling, the result showed that lack of education for waste collection is one of the problems of faced by those recycling in apartment, terraces and bungalow. Similarity the respondents opined that lack of space is another obstacle that negates participation in plastic recycling. However, lack of recycle bins was also difficult to only respondents staying in terrace dwellings (Figure 4.5).

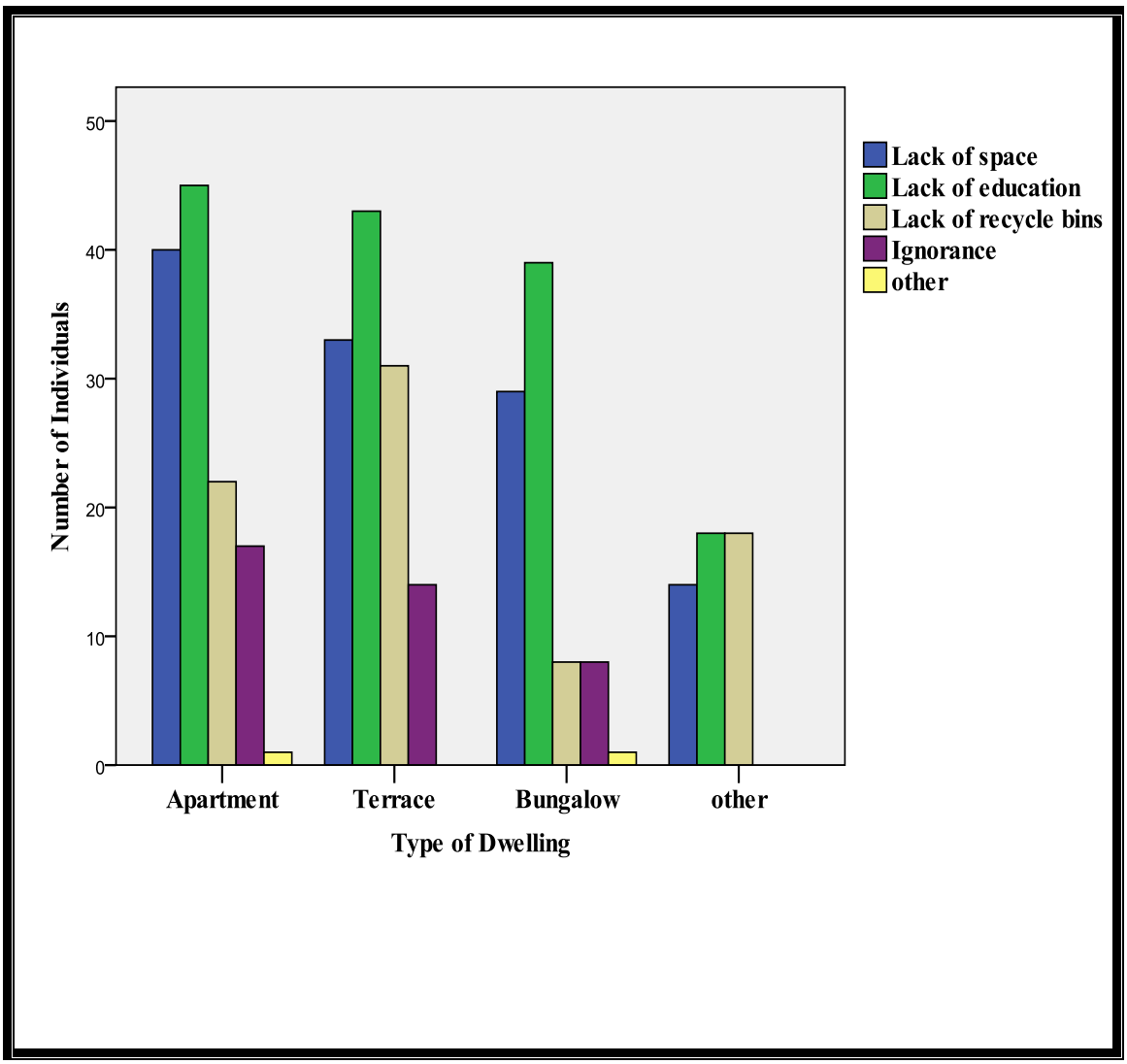

Figure 4.5: Relationship between Diverse Dwelling and Issues Related to Plastic Recycling

Length of stay has influence over residents' cooperation in recycling activities in the study areas. The result of regression linear test (Table 4.16) indicated that those who have been staying their homes for a longer period of time tend to be active cooperators in recycling, particularly in recycling of plastic and home separation of wastes. The significant level is high, in the case of selling of plastic waste among PJ residents (a beta value of -0.112), with a p value < 0.05, i.e., significant at 95 percent confidence level. Respondents with high income have more cooperation to recycle plastic. Unlike

the correlations on the length of stay and income with residents' cooperation, types of dwelling have no significant relationship with residents' cooperation.

Table 4.16: Plastic Recycling with Period of Tenure

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.849	.349		5.302	.000
	dwelling	-.059	.049	-.062	-1.205	.229
	Income	.161	.074	.111	2.155	.032
	Length of Stay	-.074	.034	-.112	-2.173	.030

The finding of this study is also supported by Read (1998) who proved that the success of a recycling scheme depends largely on the public's participation. It also availed the need to understand the respondents' frequency of plastic collection which actually buttresses the participation.

4.3.5 The Frequency of Plastic Collection

The result of the study in PJ indicated that 46% of respondents who are employees and students preferred collection of recyclables once a week (Table 4.17). Both groups (employees and students) claimed that they do not have enough time to deliver recyclable waste during the week; hence they preferred collection of recyclables once a week rather than daily collection. This might be due to the nature of their job which does not give them enough time to observe day-day recycling activity.

Table 4.17: Preference of Plastic Waste Collection Frequency

		Frequency	Percentage
Valid	Once a week	177	46.0
	Twice a week	106	28.0
	Three times a week	76	20.0
	Every day	14	4.0
	Other	9	2.0
	Total	382	100.0
Missing	System	7	
Total		389	

About 28% of respondents particularly apartment residents, housewives and those living in a big family preferred twice a week collection of plastic waste. This group of respondents pointed that keeping the recyclable waste for a long time at home is very difficult because recyclable wastes such as PET bottles take huge space. For this reason, they suggested that their recyclable waste is better to be collected as frequent as possible.

The smallest group of respondents (20%) preferred thrice a week collection. This group of respondents noted that more frequent collection tends to increase recycling intensity. They suggested that they can collect more plastic materials to get more incentives fees. However, it seems that plastic collection three times a week is difficult because of the

cost (labor and transportation). It is important to minimize the travel times and distances of the collection and transferring vehicles in order to improve cost efficiency.

The remaining respondents' (4%) preferred day to day collection of recyclable waste. Hence, this result agrees with Hormuth et al. (1993) and Zimmerman (1989) that supported provision of daily collection facilities to enhance day-to-day collection of recyclable materials which includes plastics.

Therefore, it can be deduced that recycling program may be used to reduce the cost of waste disposal. However, the revenue obtained from the implementation of recycling may fluctuate with the market price of recyclables such as plastic, paper, metal and others with high revenue generation potential (Agamuthu *et al.,* 2009).

4.3.6 The Control of Plastic Waste Generation

The public needs complete and clear information regarding the trends in waste generation, as well as, benefits and effects of source reduction, recycling and reuse. Recycling behaviors and household waste generating behaviors are necessary for designing and planning an effective plastic material reduction from MSW in the near future.

People's participation in 3Rs initiative is anticipated to function in an integrated manner. The result of the study on waste generation control in PJ indicated that majority of respondents (60%) preferred to throw away their waste. However, in PJ, 13% of respondents reuse their products, whereas 19% of respondents recycled their wastes. Only 8% of them prefer reduction (Table 4.18).

Table 4.18: Method of Waste Disposal Practice among Respondents

		Frequency	Percentage
Valid	Throw/Dispose	230	60.0
	Reduction	30	8.0
	Reuse	50	13.0
	Recycle	71	19.0
	Total	381	100.0
Missing	System	8	
Total		389	

Majority of respondents (60%) who throw away their waste rarely think about what happens after they toss their plastic bottle in a trash can instead of the recycling. This group of respondents in fact does not have enough information on 3Rs benefits. When asked why they are unwilling to recycle plastic, some of them claimed that they do not know the location of the nearest collection centers. Others pointed out that location of collection centers is too far away, and so it is easier to throw the recyclables away than to bring them to a collection centers. Thus, there is a strong need to increase the facilities in PJ to encourage public recycling ability. Therefore, a fair distribution of facilities can lead to higher recycling percentage if the facilities are easily accessible to the public (Agamuthu *et al.*, 2009).

When asked whether they knew the location of the nearest collection center for their area, 29% indicated that know some recycling centers at PJ area such as in SS2 (Table 4.19). Yet, this group complained that the collection centers could not be easily located. Without doubt, the farther the location of the collection point, the more discouraged will the householders be. Similarly, Robinson and Read (2005) found that a contributing factor for those who were not recycling was a high lack of awareness of the location of the nearest facility.

Table 4.19: Respondents Awareness on the Location of Recycling Center

		Frequency	**Percentage**
Valid	No	273	71.0
	Yes	112	29.0
	Total	385	100.0
Missing	System	4	
Total		389	

Price is another limiting factor. The result showed that most of the respondents were quite aware of the location of recycling centers but were not encouraged by the unit price of recyclable plastics when compared to unit price of metals, paper etc. These recycling centers pay only RM 0.12 per kg of plastic bottle but RM 2.50 per kg for aluminum cans. As a consequence, residents do not show any willingness to segregate plastic wastes.

Increased in price of recyclable plastics can help the council (MBPJ) to encourage waste management contractors to collect plastics from the plastic stream for recycling purpose. Apart from this, residents will be able to obtain a sizeable supplementary income by selling recyclable items to MBPJ. MBPJ should not only focus on providing facilities but also on awareness creation too. However, awareness creation without easy accessibility to the facilities is not rational. Therefore, a rational strategy should involve increase in the number of recycling facilities, as well as, simultaneous awareness creation.

The respondents were also asked of their opinions on how the situation could be improved. The majority of respondents (76%) suggested citing of local collection centers which are within the reach for each community or housing area. Some opined that if the number of these centers, as well as, payment for plastic increases, it can prompt the residents to easily deliver their plastic materials. Majority of respondents with 80 % pointed out that they were not aware of the existences of recycling centers. The result agrees with whose of Nyamwange (1996) which stated that making recycling more convenient could be an effective motivator. About 19% of the respondents prefer recycling to control waste generation.

The respondents believed that segregation at point source can increase the percentage of recyclable waste. Definitely, they might have believed and experienced that once the waste are segregated at the point generation, it makes collection of recyclable plastics easier. This help to extract all the plastics that are sent to landfills when waste is not segregated. Waste separation is the key activity in any successful 3R initiative. It is also worthy to note the importance of recycling industries or buyers in recycling wastes.

Findings indicated that the best management option for solid waste in PJ area is the integration of all options in waste management hierarchy but with strong emphasis on recycling. This option not only will reduce the waste management cost but will also serve as revenue generator from the marketable products (Chenayah *et al.,* 2007). Similar study had shown that plastic recycling application reduce the cost of plastic waste disposal (Agamuthu *et al.,* 2009).

Approximately 13% of the respondents agreed that reuse option can reduce waste generation. This group of respondents suggested that the best possible way of reducing waste is through reuse of products. Citizens should be aware of the dangers of abundant plastic waste to the environment. Therefore, reuse is preferable since plastic bottles can be kept for their own use such as to be refilled with self-made juice and other drinks. When long lasting goods are reused times and again, it offsets the production of new or same products. This saves new resources and reduces waste generation.

Another group of respondents (8%) preferred reduction of waste as one of the methods of waste generation control. Purchase and careful use of resources can reduce the pace of consumption of resources and energy (Shimizu, 2006). However, 28% of total respondents recommended that the best way of reducing plastic is by using high quality products (Table 4.20). Thus, it can be concluded that reuse of plastic materials and the use of high quality products can reduce waste generation. Some of the respondents believed that giving up past habits of unnecessary purchasing (the more purchasing as the sign of high culture) can help to reduce waste generation.

Table 4.20: Respondents' Opinion on Best Solution to Reduce Plastic Waste Generation

		Frequency	Percentage
Valid	Use of high quality products	109	28.0
	Reuse of products	189	49.0
	Giving up past habits	47	12.0
	Not wasting	20	5.0
	Other	22	6.0
	Total	387	100.0
Missing	System	2	
Total		389	

When asked whether they use their own recycled bags for shopping in market, about 37% of the respondents indicated that they use their own baskets in market when they go for shopping. Since they are aware of the importance of recycling of plastic, they prefer to carry their own basket in order to reduce the rate of the plastic bags in environment. Also, they believed that everyone should be responsible to protect the environment.

In contrast with the above mentioned group, another 63% of the respondents did not use their own basket while shopping (Table 4.21). They pointed out some reasons for not using of their own baskets. Some of them pointed out that they want to use their own

baskets but often forget to carry it. However, some of them felt that plastic bags are cheap and readily available; hence, they do not need paying for plastic shopping bags.

Table 4.21: Frequency of Respondents Who Use their Own Basket When Shopping

		Frequency	**Percentage**
Valid	No	242	63.0
	Yes	140	37.0
	Total	382	100.0
Missing	System	7	
Total		389	

The results from linear regression test showed that race (a beta value of 0.106) has a significant factor in relation to the use of own basket in market (Table 4.22). It was found that Chinese residents show more interest in using their own basket while shopping as compared to that of other ethnic groups. Other parameters such as occupation and marital status have no significant effect on the use of the own basket in market.

Table 4.22: Dependent Variable and Use of own Basket in Market

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.414	.110		12.912	.000
	Race	.063	.031	.106	2.042	.042
	Marital status	-.045	.039	-.060	-1.153	.250
	Occupation	-.022	.021	-.055	-1.056	.291

Similarly, the respondents were asked whether they have the idea that old plastic bag can be reused for shopping. About 42% of the respondent agreed that such bag can be reused whereas 58% were of different opinion (Table 4.23).

Table 4.23: Opinion of Respondent about Reuse of same bag for Shopping Time

		Frequency	**Percentage**
Valid	No	223	58.0
	Yes	161	42.0
	Total	384	100.0
Missing	System	5	
Total		389	

It might be argued that majority did not look at this issue from just the economic (loss price) point of view but may have considered the inconvenience associated to keeping the already use bag for a next- time use and having to bring it all the way to the shopping center. However the majority may have considered the degree of waste generation that will arise from incessant disposal of such plastics. Hence, they opted to reuse the bags in order to ensure the reduction of plastic waste from the total waste stream.

A chi-square test was used to show if there is any statistically significant difference between ethnical factors and income towards recycling of plastic. The racial background factor appears to be in significant than income variable in determining the recycling behavior. The Chinese and Malay respondents were found to be active recyclers only in the activity of selling of plastic in the PJ area. This ethnic variation in response may be as a result of culture and social heritage of the Malays and Chinese that allows to get involve into plastic recycling. Unlike ethnical background, income was significant with $p < 0.05$ on plastic recycling (Table 4.24). The result showed that both reselling and plastic recycling activities are familiar amongst those of lower income groups in PJ area.

Table 4.24: Effect of Ethnical Factors and Income on Recycling Behavior

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.613[a]	8	.006
Likelihood Ratio	22.974	8	.003
Linear-by-Linear Association	3.643	1	.056
N of Valid Cases	380		

a. 3 cells (20.0%) have expected count less than 5. The minimum expected count is .40.

Based on "waste hierarchy", the result of PJ study indicated that residents' dealing with their plastic wastes, is in the disposed process toward least favoured option. In fact, most of PJ residents (60%) are not aware of 3Rs that the majority of plastic waste is still being disposed off into the landfills. Therefore, creating awareness and encouragement of citizens toward 3Rs are crucial in preventing plastic waste from going to the landfill. Indeed, recycling can be one of the best methods to help use resources better and reduce the environmental impacts associated with disposing of waste.

4.3.7 Educational Programs for Public' Pre-cycling Behavior

The result of the study on educational programs in pre-recycling activities in PJ indicated that 50% of respondents obtained training in schools, 34% via media, 8% through educational CD, and 6% from handouts and pamphlets (Figure 4.6).

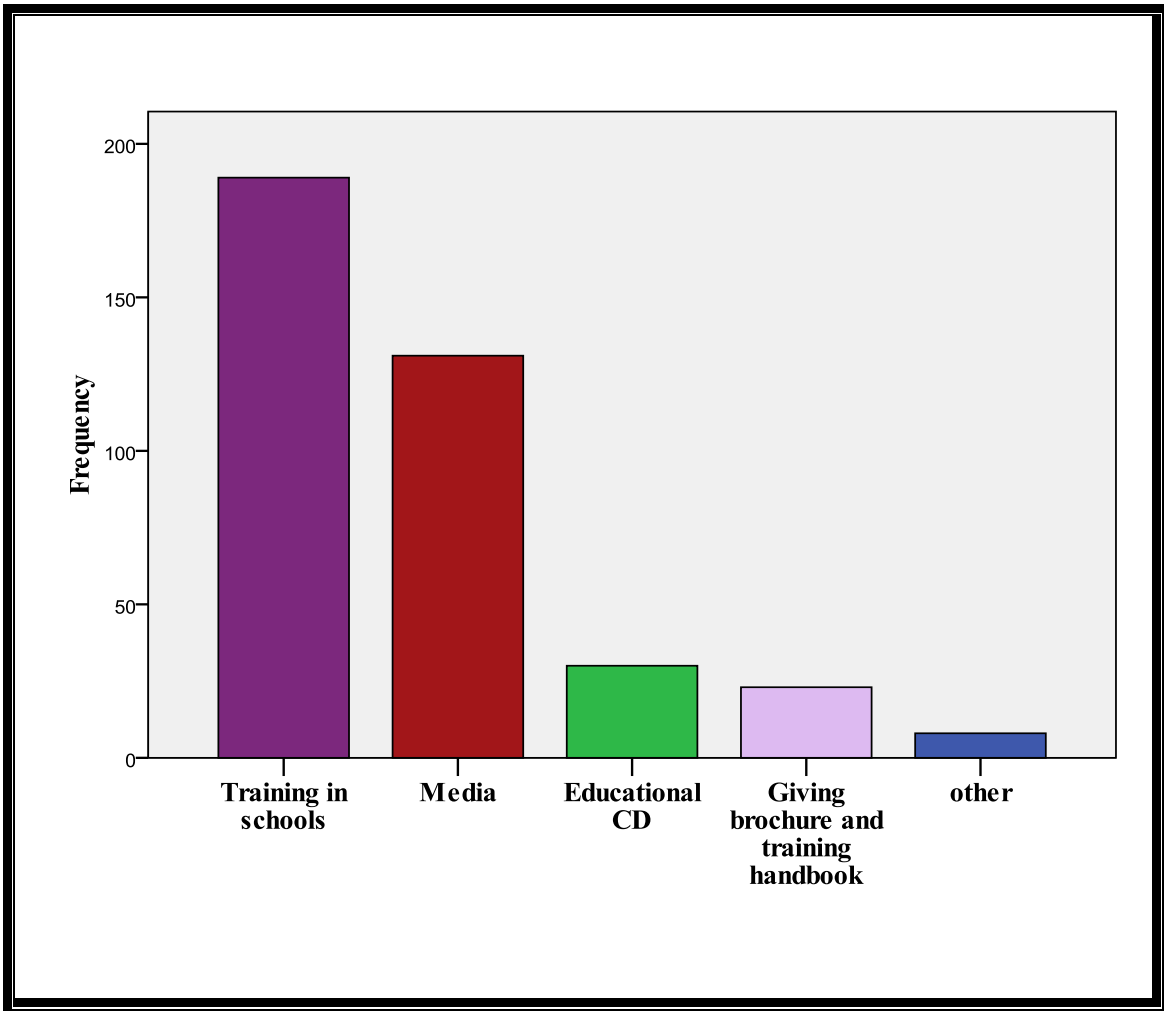

Figure 4.6: Citizen's Preference in Improving Recycling Participation in PJ

Creating awareness and motivation for the public will increase their participation in activities such as waste reduction, waste segregation at source and recycling. There are different ways to encourage citizens to cooperate in plastic recycling program. Training for residents can create awareness for them to participate in plastic recycling. Training can be conducted at school, public hall and some other places, while the importance of plastic recycling can be disseminated via educational CD, handouts and pamphlets or through media. The identification of encouraging factors can increase the efficiency of plastic recycling program.

Based on linear regression test, the income, race, age, and education factors seem to be insignificant in training methods (Table 4.25), except for the recycling of plastic amongst PJ residents.

Table 4.25: Dependent Variable with Method of Training

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.304	.381		3.422	.001
	Income	.091	.076	.063	1.192	.234
	Race	-.073	.063	-.061	-1.171	.242
	Education	.060	.058	.055	1.037	.300
	Age	.027	.046	.031	.582	.561

About 50% of the respondents agreed that creating awareness and giving training on plastic recycling in schools is the most effective method to improve plastic recycling. Awareness of recycling and concern for the environment should be inculcated from early age. Unfortunately, there is no formal subject dedicated to achieving this purpose in the present education system at primary and secondary level in Malaysia.

About 34% of the respondents recognized media as the means of creating public awareness. This group pointed out that getting information on plastic recycling through media is worldwide and broad. The effect of media particularly TV programs to public regardless of their age and education is very important. The regional media to introduce

recycling activities especially separation of plastic bottles from other waste can be an effective option to encourage public to participate in plastic recycling activities. This finding was supported by Abdelnaser et al. (2006b) who claimed that integrated use of all media can increase public participation.

About 8% of respondents in this study agreed that educational CD can enhance citizens' awareness on recycling program. This group of respondents with the majority being students suggested that education through CD serve a better way of introducing the processes of plastic recycling to citizens. They believed that citizens can get clear understanding of the recycling programs via CDs. The small group of respondents (6%) felt that handouts and pamphlets distribution in public places, shopping malls, and resident areas are effective in increasing citizens' awareness on plastic recycling. They can exchange their knowledge on plastic recycling and improve their understanding. The smallest group of respondents in PJ (2%) suggested that public awareness can be enhanced via website and e-mail news. The finding of the study showed that training at school and through media are the best ways for creating public awareness.

Authorities' initiative is needed to generate the appropriate condition for education of the citizens on the importance of recycling through exhibitions, forum, and numerous campaigns through the media (TV, internet, etc). Creating public awareness should be an on-going process by utilizing educational aspects including printed material, as well as, other electronic media. Education plays an important role in creating awareness and enhances public participation in plastic recycling activities. Educational programs to be introduced to communities should be made more aggressive with 'hands-on' approach. Educational programs can be used to enhance cooperation and contribution of the

citizens to the success of plastic recycling (Clarke, 1994). Hence, a study of household pre-cycling behavior allows a better understanding on how to develop future public educational programs along with recycling policies (Davio, 2001; Uche, 1998; Park, 1998).

4.3.8 Benefits of Plastic Recycling

In this survey, four reasons for plastic recycling were listed: the improvement of public health, the reduction in environmental pollutions, economic benefit with direct and indirect effect, and the increase in city's aesthetic condition. Respondents were asked to give the best description of why they recycled. About 43% of respondents believed that public health will increase with proper recycling, whereas, 35% claimed that pollution will be reduced if citizens show adequate cooperation in recycling. On the other hand, 14% of respondents suggested that economic benefit is the main reason for recycling while the remaining 6% takes the aesthetic aspects of a city as the reason for recycling (Figure 4.7).

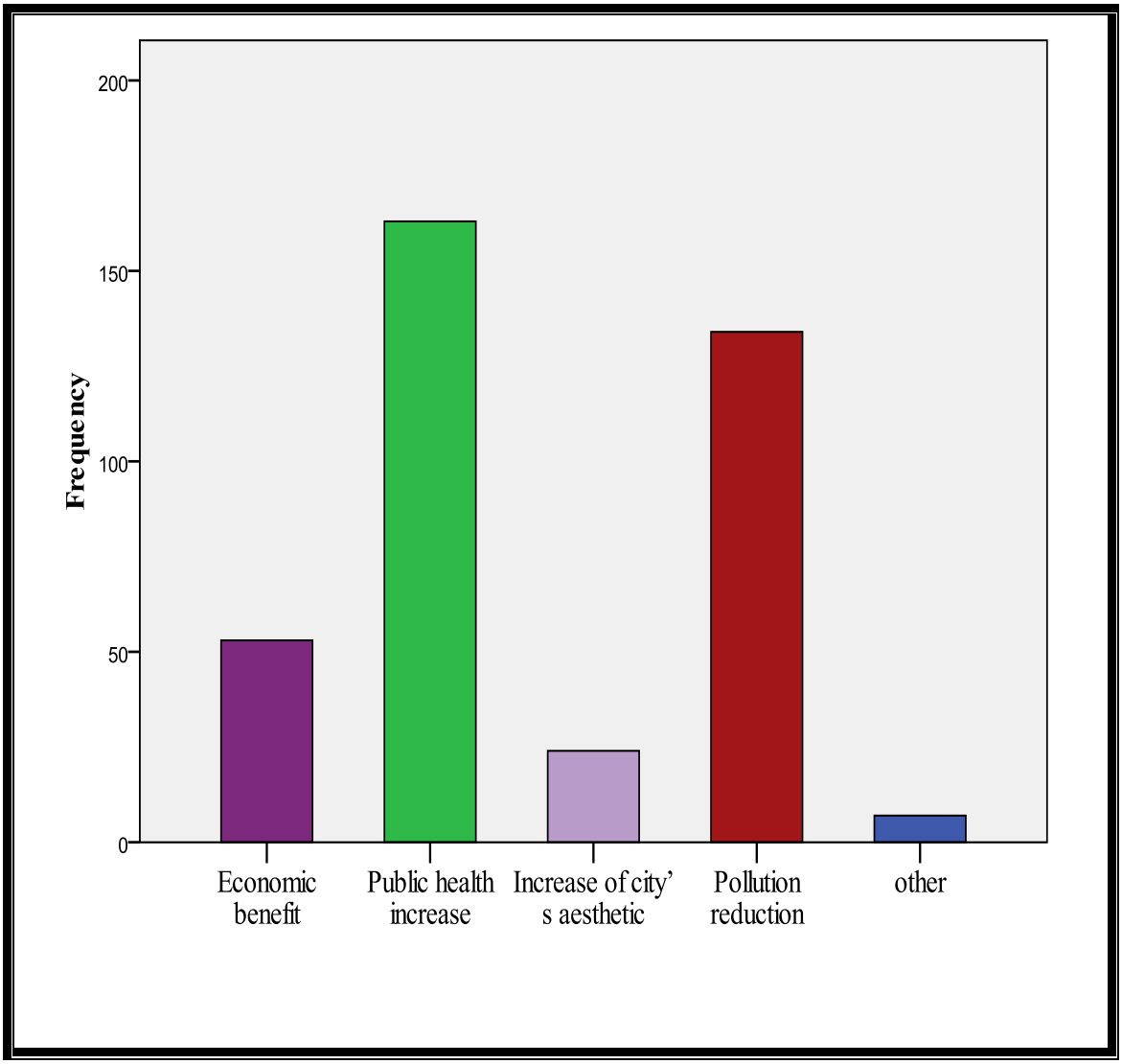

Figure 4.7: Respondent View on the Reasons to Recycle Plastic in PJ

The highest percentage of the respondents (43%) who live in their own house with high income believed that recycling has indirect effects on public health. They thought that the issue of increasing recycling wastes has been importantly linked to the most crucial aspect of health. Due to the strong direct or indirect link between recycling and health issues, some respondents are interested in recycling activities. Therefore, identifying benefits of plastic recycling can increase the efficiency of plastic recycling activities. Implementation of plastic recycling plan in developing countries such as Malaysia is

closely linked to the public for it is considered as an essential part of proper public health and environmental control (Azman, 1995; Mohd.Razman and Sabarinah, 1994).

The linear regression test results showed that income factor (a beta value of – 0.012) and ownership (a beta value of – 0.2) were significant in the need to inculcate the benefits of recycling (Table 4.26). It means that residents with ownership and high income tend to be more involved in the recycling of plastics. Other parameters such as length of stay, occupation and education have no significant effect on recycling benefits. The reason might be based on the fact that some think there is no professional reason to make someone have the quest to recycle; hence occupation and education were neglected. Length of stay may not really be significant since every individual intends to maximize profit at any give opportunity.

Table 4.26: Dependent Variable with Recycling Benefits

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.410	.481		7.089	.000
	Income	-.021	.090	-.012	-.228	.020
	Length of Stay	-.090	.114	-.065	-1.233	.219
	Ownership	-.351	.073	-.200	-3.806	.000
	Occupation	-.017	.049	-.018	-.338	.736
	Education	.039	.067	.031	.587	.558

The second largest respondents (35%) pointed out that recycling can reduce environmental pollution. They referred to frightening fact of pollution levels and they suggested that an immediate action on a global basis can be achieved via recycling activities. For them, the reduction of pollution is the reason why plastic need to be recycled. They stated that plastic recycling has close relationship to environmental degradation. Recycling plastic may be aimed to reduce pollution to the environment, slow down exhaustion of primary resources or simply because it is economically profitable (Isa *et al.*, 2005; Visvanathan *et al.*, 2004; Broek *et al.*, 1998). People who believed that their government was making a reasonable effort to protect the environment were more inclined to adopt environmental-friendly behavior. Therefore, participation of the public in plastic recycling might help in achieving clean environment.

The third group of respondents (14%) with low income pointed out that plastic recycling can bring economic benefit both to the government, as well as, to themselves.

This group opined that economic factors can influence public recycling behavior in terms of cooperating with private sectors. In regards to economic benefits, the recovery of secondary materials is necessary to reduce dependency on other countries. Whereas in industrialized countries, government and WMS play a large role in providing infrastructure and partly subsidizing recycling materials, the developing countries such as Malaysia, do not provide any financial resources to support recycling (Omran *et al.*, 2009).

The fourth reason for public to be involved in plastic recycling is due to aesthetic reason. The remaining 6% of the respondents pointed out that plastic recycling can improve the aesthetic condition. They expressed the need for a clean and unpolluted place to live. They suggested that government should encourage proper placing of recycling bins particularly in public areas. This is because most of recycling waste is generated in public places, schools, and shopping malls (Anon, 2001). They agreed that Malaysia as a country that receives tourists should pay more attention to the aesthetic aspects of the country. Currently, tourism is one of the largest sources of income in Malaysia. This group of respondents noted that PET bottle disposal on streets eventually will clog drains or streams which are unfavorable for tourism. With the reduction of plastic waste, the environment will be cleaner.

CHAPTER 5

CONCLUSION

5.1 CONCLUSION

This study was aimed at determining the factors that influence plastic recycling in PJ in relation to the adopted recycling procedures and encountered problems. In view of the above, this study therefore concludes that waste in PJ is mainly composed of organic components. Among other components of MSW in PJ were paper waste, metal scraps, textile, plastics etc. The concentration of plastics obtained in the waste stream is approximately 21%.

Also, after estimation of respondents' level of plastic recycling awareness, the study concludes that even though majority of the respondents with 67% in PJ knew the meaning of recycling, only 22% of respondents practiced it. This most probably was due to citizens' lack of awareness on the importance of plastic recycling.

However, the research identified a number of problems that hinder efficient recycling of plastic is PJ. Such problems ranged from lack of awareness (39%), level of literacy (36%) to unavailability of recycling facilities (31%). From the survey, it was concluded that 60% of plastic waste from PJ area is still being disposed off at landfills. With regards to this finding, the residents' awareness of 3Rs is low (81%).

Finally, suitable approaches to improve plastic recycling in the studied area must include, increase in number of recycling centers, provision of more recycling facilities, and increasing the unit price of recyclable plastics to encourage recyclers.

5.2 RECOMMENDATIONS

Finding from the study identified the following issues as problem in plastic recycling in PJ:

a. The most important issue in plastic recycling is the lack of effective and coherent programs in creating recycling culture in PJ. Citizens have an important role in the success and the development of recycling activities. Therefore, without establishing a recycling culture, achieving the objective is impossible. Proper training methods are necessary in PJ to increase the motivation of the citizens towards recycling. Training at school and through media proved to be the best and the most effective solution to this problem. In addition to these cases, it is suggested that other programs such as distributing brochures in all areas of cities, performing musical programs for kids in parks, holding exhibitions on recycling products in different places such as mosques and parks, holding seminars on recycling in universities and governmental and private organizations, performing educational programs for students in schools, introducing recycling centers in exhibitions and stadiums, and having educational programs for restaurant workers, are also necessary.

b. The second issue is the lack of unique and arranged educational program. Recycling activities and programs are done through several companies and each

one has different educational program objectives. Due to these differences designing a unique advertising plan for public media becomes difficult.

c. Another issue in the recycling plan is the lack of confidence among the citizens to participate in the recycling program. Recycling is a long term plan. Unfortunately, due to short period of management in most municipalities, most of the recycling plans are incomplete. This problem caused distrust among citizens. It is recommended that new management followed the incomplete recycling plan with application of new methods. Also, advertisement and manipulation of recycling plans should be done continuously and parallel to this action.

d. The next issue is the collection method. Collection of waste in PJ is done with curbside method. Due to high cost of transportation this method is not suitable. It is recommended that drop off collection method is adopted. As it is mentioned in Chapter Two, citizens carry plastic waste to drop off centers and this causes reduction of transportation costs.

e. For the improvement of plastic recycling plan, it also is recommended that manufactures are encouraged to produce high quality products.

f. Insufficient facilities or lack of appropriate facility also staggered plastic recycling. There is no acceptable and enough equipment in transfer stations where tools such as washing conveyors, cutting machine, packing machine, and pressing machines are needed. Transfer stations equipped with press and cutting

machines reduces the costs of transportation by compacting plastic bottles. In Malaysia, most of the separation activities are done manually. In this case, some recycling materials were disposed due to workers' mistake in plastic waste separation. Thus, it is recommended that mechanical method be used in separation centers.

g. Another issue in recycling plan is the presence of many groups of scavengers. This group causes dissatisfaction among citizens due to the scattering of waste. They also create pollution and destroy aesthetic condition of a city. These groups collect recyclables illegally and unhealthily, and mixed them with other wastes. To solve this problem, it is recommended that municipality and relevant organizations control the activities of the scavengers. Educational training and facilities should be provided to encourage them to be an active player in recycling programs. In general, municipality should supervise these groups and use their capacity.

h. One of the biggest difficulties in plastic recycling is non-participation and lack of support from municipality and governmental organizations. Municipality can give factories standard bottles with low contamination to reduce the costs of production line. To encourage plastic recycling towards environmental preservation, municipalities and relevant organizations should provide financial assistance and loans to private sectors as financial and economic support.

i. Another issue in plastic recycling plan is illegal and unorganized plants. In these factories, production of flakes creates high pollution. As a result, value and price of flakes of low quality will plunge causing fluctuation in the market. Hence, municipality needs to create suitable marketing for these flakes.