ASSESSMENT OF AWARENESS IN MOBILE PHONE WASTE RECYCLING PROGRAM AMONG CONSUMERS IN KUALA LUMPUR

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ABSTRACT

Technology become more advance nowadays and the advancement produce a large numbers of electronic devices. The lifespan of the device become shorter when the feature become more tech. Due to the advancement of the technology, a large number of electronic waste were produce. E-waste are also one of the pollution that can affected the environment beside air and water pollution. Each year, roughly about 400 million waste mobile phones were generated around the world and make it as one of the cause of e-waste pollution (Xu, Zhang, He, Li, & Huang, 2016). This research project is to make assessment regarding consumers' awareness and willingness on recycling e-waste mobile phone and tablet. This project also to make some recommendation regarding policies or framework for consumer e-waste recycling for Malaysia. Results shows that most of the respondents (56.67%) have 1-2 units of unused mobile phone. Respondents keeping their unused mobile phone at home as spare mobile phones. Respondents claimed that they changing their old mobile phone because it not working anymore, but choose to keep at home as spare phone. This shows that respondents have personal attachment with their old mobile phone and it will take some time to separate from old mobile phone. Majority of respondents (67.33%) stated that they never heard about any information regarding e-waste recycling. Its shows that lack of information lead to low rate of e-waste recycling. Respondents are aware that e-waste cannot mix with ordinary garbage, but lack of awareness make respondents do not recycle their unused mobile phone. Respondent have basic knowledge about materials inside mobile phone but less knowledge about mobile phone recycling. Information is important in enhancing consumers' participation in recycling and government should provide more information about e-waste to increase consumers understanding especially about laws, regulation and recycling system. As respondents lack about e-waste recycling knowledge, their willingness to recycle their

unused mobile phone are uncertain. The results shows that respondents are somewhat willing to take part if e-waste recycling was organised. This is due to their inadequate of information about the advantage when recycling waste mobile phone. Respondents need some incentive or compensation as motivation for their recycling action. Majority of respondents want cash payment or voucher as an incentive for their recycling action. Only 3.33% of respondents' are willing to pay for recycling fee. Unwilling respondents (42.67%) stated that it is government responsibility to provide the recycling. Some also stated that it will burden their income and they are willing to sell the unused mobile phone to the second-hand market for low price. Experiences from developed countries shows that stable and complete recycling system require cooperation of all shareholder such as government, manufacturers, retailers, telecommunication service and consumers. Results shows that respondents thinks it is a responsibility of all share holder, and it shows they are aware about the cooperation of all shareholder. Improvement in law and regulation, development of e-waste infrastructural and education are some improvement that need to improve e-waste management system in Malaysia.

Keywords: waste mobile phones, e-waste, consumers' awareness, consumers' participation, policy implementation.

ABSTRAK

Pada masa kini, teknologi menjadi semakin maju. Kemajuan teknologi semakin pesat menghasilkan pelbagai jenis alat eletronik.. Jangka hayat peranti menjadi lebih pendek apabila peranti menjadi lebih berteknologi. Disebabkan kemajuan teknologi, sejumlah besar sisa elektronik dihasilkan. Sisa elektonik juga merupakan salah satu pencemaran yang boleh menjejaskan alam sekitar di samping pencemaran udara dan air. Setiap tahun, kira-kira 400 juta sisa telefon bimbit dijana di seluruh dunia dan menjadikannya sebagai salah satu punca pencemaran sisa eletronik. Projek penyelidikan ini adalah untuk membuat penilaian mengenai kesedaran dan kesediaan pengguna terhadap pengitaran semula sisa telefon bimbit dan tablet. Projek ini juga membuat cadangan mengenai dasar atau kerangka untuk kitar semula bagi pengguna sisa elektronik di Malaysia. Keputusan menunjukkan bahawa kebanyakan responden (56.67%) mempunyai 1-2 unit telefon bimbit yang tidak digunakan. Responden mengekalkan telefon bimbit mereka yang tidak digunakan di rumah sebagai telefon bimbit ganti. Responden mendakwa bahawa mereka menukar telefon bimbit lama kerana ia tidak lagi berfungsi, bagaimanapun memilih untuk simpan di rumah sebagai telefon ganti. Ini menunjukkan bahawa responden mempunyai lampiran peribadi dengan telefon bimbit lama mereka dan ia akan mengambil sedikit masa untuk dipisahkan dari telefon bimbit lama. Majoriti responden (67.33%) menyatakan bahawa mereka tidak pernah mendengar tentang maklumat mengenai kitar semula sisa elektronik. Menunjukkan bahawa kekurangan maklumat membawa kepada kadar kitar semula sisa elektronik yang rendah. Responden sedar bahawa sisal elektronik tidak boleh bercampur dengan sampah biasa, tetapi kurangnya kesedaran membuat responden tidak mengitar semula telefon bimbit mereka yang tidak digunakan. Responden mempunyai pengetahuan asas tentang bahan-bahan di dalam telefon bimbit tetapi kurang pengetahuan mengenai kitar semula telefon bimbit. Maklumat penting dalam meningkatkan penyertaan pengguna dalam kitar semula dan kerajaan harus

menyediakan lebih banyak maklumat mengenai sisa elektronik untuk meningkatkan pemahaman pengguna terutama mengenai undang-undang, peraturan dan sistem kitar semula. Oleh kerana responden kurang mengetahui tentang pengetahuan kitar semula sisa elektronik, kesediaan mereka untuk mengitar semula telefon bimbit mereka yang tidak digunakan tidak pasti. Keputusan menunjukkan bahawa responden agak bersedia untuk mengambil bahagian jika kitar semula sisa telefon bimbir dianjurkan. Ini disebabkan oleh kekurangan maklumat tentang kelebihan apabila mengitar semula sisa telefon bimbit. Responden memerlukan beberapa insentif atau pampasan sebagai motivasi untuk tindakan kitar semula mereka. Majoriti responden mahukan pembayaran tunai atau baucer sebagai insentif untuk tindakan kitar semula mereka. Hanya 3.33% responden sanggup membayar yuran kitar semula. Responden yang tidak berbelah bahagi (42.67%) menyatakan bahawa ia adalah tanggungjawab kerajaan untuk menyediakan kitar semula. Ada juga menyatakan bahawa ia akan membebankan pendapatan mereka dan mereka sanggup menjual telefon bimbit yang tidak digunakan ke pasaran terpakai untuk harga yang rendah. Pengalaman dari negara maju menunjukkan sistem kitar semula yang stabil dan lengkap memerlukan kerjasama semua pemegang saham seperti kerajaan, pengeluar, peruncit, perkhidmatan telekomunikasi dan pengguna. Keputusan menunjukkan bahawa responden berpendapat bahawa ia adalah tanggungjawab semua pemegang saham, dan ia menunjukkan mereka mengetahui tentang kerjasama semua pemegang saham. Penambahbaikan undang-undang dan peraturan, pembangunan infrastruktur dan pendidikan adalah peningkatan yang perlu untuk memperbaiki sistem pengurusan sisa elektronik di Malaysia.

Kata kunci: sisa telefon bimbit, e-waste, kesedaran pengguna, penyertaan pengguna, pelaksanaan dasar

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LIST OF SYMBOLS AND ABBREVIATIONS

EPR	:	Extended Producer Responsibility
EAR	:	Elektro-Altgeraete-Register
PCS	:	Producer Compliance Scheme
ARF	:	Advance Recycling Fee
DSWM	:	Department of Solid Waste Management
DOE	:	Director General of Department of Environment
E-WASTE	:	Electronic Waste

LIST OF APPENDICES

CHAPTER 1: INTRODUCTION

1.1 Background

In this 4th Industrial Revolution, everything are based on electronic devices and move towards advance technology. The speedy growth of technology will increase the production of electronic industry and improve the living standard of human population. It also generated a large number of electronic waste (e-waste). E-waste has become one of the pollution problem with speedy development of technology. The most electronic product produce around the world is mobile phone. The brief lifetime of the mobile phones represent the growing issues to the e-waste.

According to the statistic, every year roughly around 400 million waste mobile phone were produce around the world (Xu et al., 2016). An average of "14.5 million waste mobile phones were generated between 2000 and 2007" with every mass production of mobile phones (Jang & Kim, 2010). Due to the fashionable, trend and advance function of the system, consumer frequently changing the mobile phones. With more advance feature in mobile phones, sometimes a consumer have more than one mobile phones with them at one time. This problems shows that more waste mobile phone were generated from consumers.

Developing countries have perfected their waste mobile phones management system. Their system get response from government and citizens. Their citizens aware about recycling the electronic device and them also aware about the effects on their health if they didn't manage the waste mobile phones properly. Beside consumers the producer or importers also take part in the recycling management. Study by (Yin, Gao, & Xu, 2014) stated that the consumers socioeconomic characteristics play an important role in successful recycling management. The characteristics such as education levels, gender, and age are important key regarding behaviour or the willingness of the public. Beside

consumers, another important role that play a key figure in e-waste recycling program are government. Government must educated consumers regarding the legal advocacy, environmental knowledge (Borthakur & Govind, 2017) regarding the effect of un-properly manage the waste mobile phones.

1.2 Research Problem

Successful waste mobile phones management from others countries are due to the law or policies that was created and awareness from the consumers. Malaysia has created the first law regarding e-waste in 2005, but the law only managed and controls the e-waste that was generated by industries and it does not have controls on the e-waste that was produced by the consumers (Afroz, Masud, Akhtar, & Duasa, 2013). Therefor the consumer generate the waste without knowing the effect of the hazardous waste inside the e-waste.

The production of mobile phones increases every year. This is due to the competition in the market. Many mobile phone brands compete with each other to produce better mobile phone with advance technologies. Due to the competitiveness, consumer sometimes have a trend to change their mobile phones. This trends of consumer will produce more waste mobile phones. Due to the trends, consumer doesn't know how to manage their used mobile phones.

Many research has been conducted regarding recycling management system, but only little research regarding consumer behaviour and awareness on waste mobile phones. Researcher mostly conduct their research on the system itself, but they rarely conduct on the behaviours of the consumer that generated the waste. Consumer behaviour on recycling unused mobile phones and awareness are the essential key of any successful waste mobile phones management.

1.3 Research Question

The research question for the project are:

1. What is the usage trend of mobile phones consumers?
2. What is consumer knowledge, awareness and behaviour regarding recycling used mobile phone gadget?
3. How willing is the consumer to participate in recycling waste mobile phone?
4. Do we need a separate policy for consumer e-waste recycling?

1.4 Objective

1. To assess consumers awareness on recycling e-waste mobile phone
2. To assess consumers' willingness on recycling e-waste mobile phone
3. Recommendation to improve consumers awareness and willingness in recycling mobile phone waste

1.5 Scope

Scope of the project is mobile phone user such as secondary students, universities students and working people from age 17 years old to 60 years old.

CHAPTER 2: LITERATURE REVIEW

2.1 E-Waste Management on Developed Countries

As technologies improve for every second, the product of the technology also increased and increasing the discarded product or as called as e-waste. Due to this situation, numerous countries around the world already have legislation, law or guideline regarding e-waste recycling and treatment. Not all countries that have the legislation have an efficient management system.

Some countries applied Extended Producer Responsibility (EPR) or reversed logistic system or voluntary program in handling the e-waste. Nearly all of the advance countries applied (EPR) in their e-waste management. According to the environmental guideline which is EPR, manufacturers have a responsibility for their own product that continue until the product "end-of-life", including collection, recovery and product discarding are extended responsibilities of the manufacturers (de Oliveira, Bernardes, & Gerbase, 2012).

2.1.1 European Union (EU)

An e-waste management was commence to dealing with e-waste that was generate from European countries. The management requires that the producers have a responsibility to collect their own e-waste products, with purpose to minimize the number of e-waste that ends up on the landfill. The take-back e-waste by the producer is free of charge. The management is called the EU WEEE Directive (Ongondo, Williams, & Cherrett, 2011).

Beside take-back the e-waste, producers are accountable to separate and segregate the e-waste collection. Producers must follow the outline from the EU Directive on how to treat and recovery the e-waste. (Ongondo et al., 2011)

There are a variety of ways on how the consumer in Europe discarded or threw their e-waste. The options for consumers are “municipal collection, retailers’ collection social organisation and re-use market”. The municipal collection was financed and managed by local public waste management which is the local authority. This local public management will collect the e-waste by themselves or other parties to collect on their behalf. (de Oliveira et al., 2012)

Collection was performed by retailers themselves or their partners that supply the new product to the consumers. The retailers themselves organised the management and financing of the collection.

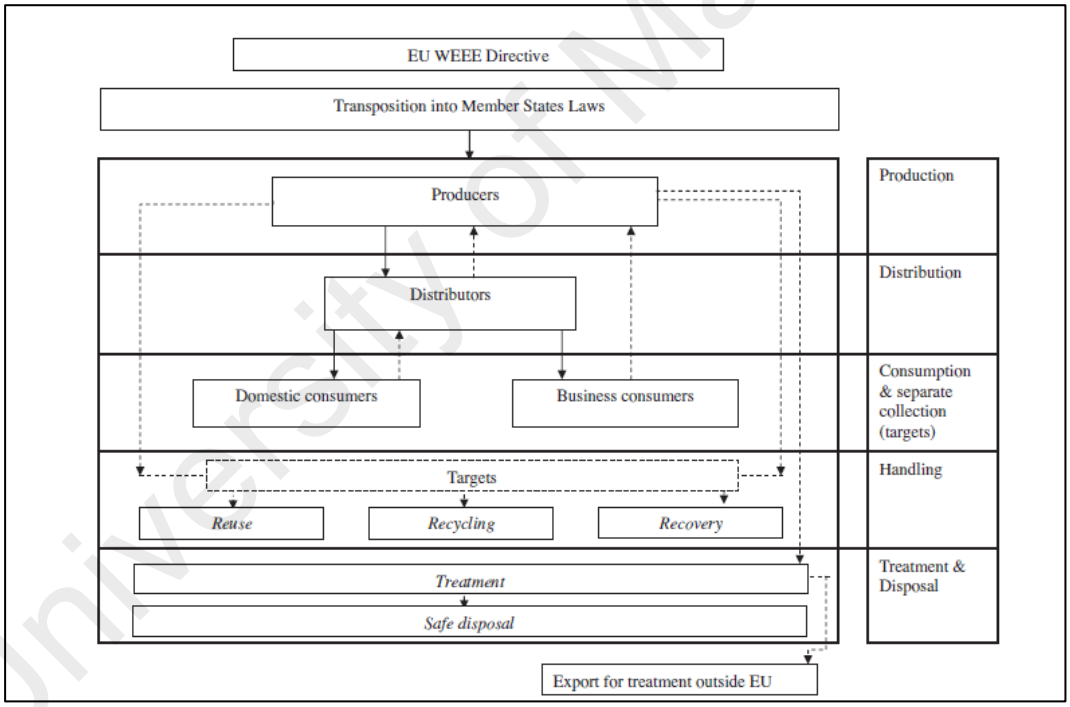

Figure 2.1: Flowchart of the E-Waste System in EU WEEE Directive

2.1.1.1 Germany

The Foundation Elektro-Altgeraete-Register (EAR) is an organisation that was established to organise the e-waste. Pick-up the e-waste and control the target collection for retrieval and recycling are organisation major purpose. The collection of the e-waste is the responsibility of public waste management authority (Ongondo et al., 2011).

Besides the organisation, retailers may voluntary receive the returned of e-waste from consumers and sent the returned e-waste to either produce or public waste management authority. The collected e-waste transported to the disassembly companies which are socially subsidies firm or private organisation. Even with the organisation to handle the collection and treatment of e-waste, there also have illegal disposal and exports product (Ongondo et al., 2011).

Due to the illegal activities, Germany has implemented the EU WEEE Directive by the legal Act Governing the Sale, Return and Environmentally Sound Disposal of Electronic Equipment (Electrical and Electronic Equipment Act or ElectroG) (de Oliveira et al., 2012; Ongondo et al., 2011). ElectroG take EPR as their model in managing the e-waste. ElectroG is not financing producer responsibility. ElectroG is responsible for determining which producer in charge of pick-up container by using specific guidance in choosing the responsible producers (Ongondo et al., 2011).

EU WEEE Directive stated that producer is responsible with the e-waste treatment, but the responsibility for collection of the e-waste does not define clearly in the EU WEEE Directive. Due to this problem, ElectroG differentiates between other parties and private household. Installation of municipal collection point is municipalities' responsibilities where the private household can discard their e-waste for free of charge. Municipalities also in charge for the "collection, transportation and treatment" of e-waste from a private household without charging them (Rotter, Chancerel, & Schill, 2009)

The contradiction between the EU WEEE Directive and ElectroG is financial responsibility. In the EU WEEE Directive, it is producers responsible to financially their product waste from consumers. While ElectroG does not relate the responsibility to producers product, they rather doing the calculation of pick-up container in the current take-back system (Rotter et al., 2009).

2.1.1.2 United Kingdom

To assist and clarify the UK WEEE Regulation, non-statutory guidance not was publish by the United Kingdom government. The non-statutory guidance note outline the product that was include in the regulation and also stated the responsibility and roles of each different stakeholder (Ongondo et al., 2011).

Manufacturers are mandatory by the law to get involve in programme that had been authorized by the Environment Agency which is Producer Compliance Scheme (PCS). The responsibility of the PCS is to provide fund for the treatment, recovery, recycling and any reliable method of disposal that will not affect the environment (Ongondo et al., 2011).

PCS receive the evidence regarding the amount of e-waste receive for treatment. The evidence provided by the approved authorised treatment facilities on handling and processing e-waste. PCS responsible for providing the information regarding e-waste and effect of illegal disposal to the environment. The distributor will not take charges on take-back discarded product from United Kingdom consumers. The distributor also supported the fund for collecting and transporting the collected e-waste (Ongondo et al., 2011).

Environment Agency also enforces the UK WEEE Regulation on England and Wales. Any of the producers that do not oblige the regulation can be prosecuted for an offence under the UK WEEE Regulation and serve with enforcement (Ongondo et al., 2011).

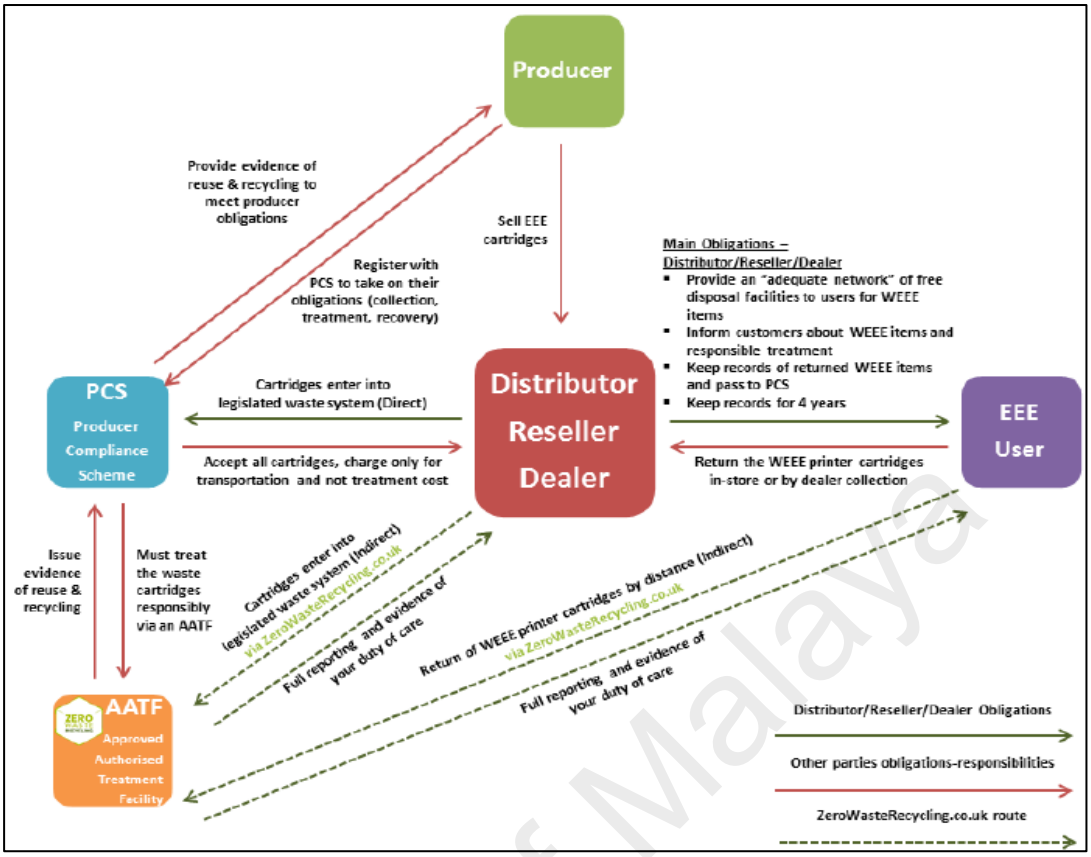

Figure 2.2: Flowchart of the E-Waste System in the United Kingdom

2.1.1.3 Switzerland

Switzerland is the prime developer country that develop e-waste management legislation. Swiss also the first to execute the most systematise e-waste management in collecting, transporting, recycling, treatment, and disposal (Ongondo et al., 2011).

Before the legislation was applied, the formal e-waste management started because of the voluntary initiative that was driven by the producer responsibility organisation. Then Swiss Federal office establishes the Ordinance on the Return, the Taking Back and the Disposal of Electrical and Electronic Equipment (ORDEE). The framework of the e-waste legal and operative system is establish from Extended Producer Responsibility (EPR) model (Ongondo et al., 2011).

Based on the EPR model, the management system assign the responsibility on handling the physical and financial for recycling and discarding the e-waste to the "manufacturer or producer and the exporters of the products" (Ongondo et al., 2011).

Manufactures and importers of electronic products are obliged to pay Advance Recycling Fee (ARF) to the recycling management system. The fee was "passed to the distributors, retailers and lastly to the consumers who pay the advance fee ARF" when consumers acquire electronic products (Streicher-Porte, 2006).

To prevent an unauthorized disposal of e-waste, consumers will be demand to pay the recycling fee. Consumers are more inclined to pay a small number of money for e-waste recycling fee than pay for the disposal. This practice also to ensure the needed funding for the e-waste management system as the consumers pay the fees in advance (Ongondo et al., 2011).

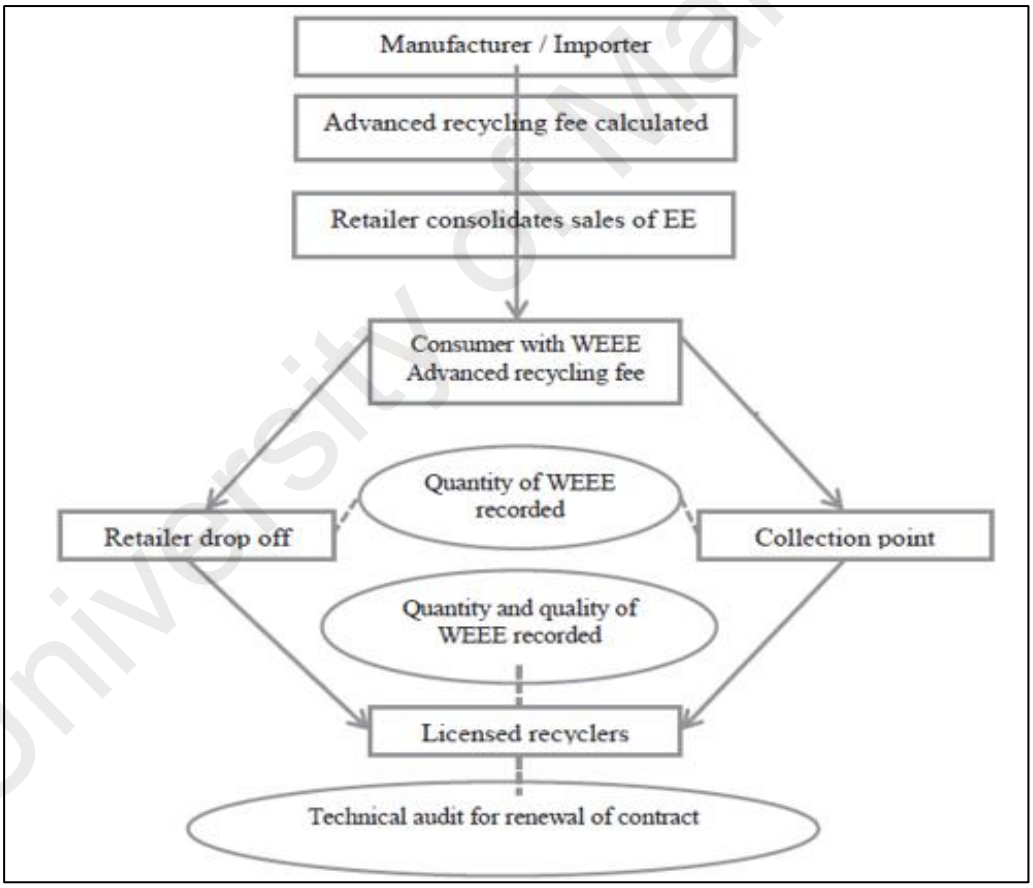

Figure 2.3: Flowchart of the E-Waste System in Switzerland

2.1.2 Asian Countries

2.1.2.1 Japan

Japan implemented Home Appliance Recycling Law to manage the e-waste that was produced by consumers (de Oliveira et al., 2012; Ongondo et al., 2011). This law is to

ensure proper treatment of e-waste. This law implements a ticket system for home appliance recycling. The system is to guarantee that manufacturers, retailers and consumer would comply with the law (de Oliveira et al., 2012).

The system requires consumers to pay for recycling and transporting to retailers. They also need to pay through a portal transfer for the recycling fees. After the collection of the e-waste at the retailers, producers or manufacturers are required to take-back the e-waste to disassemble and retrieve the components inside the product for reuse and recycle (Ongondo et al., 2011; Yoshida & Yoshida, 2014).

Manufactures or producers are put into joint recycling and divided into two groups. The purpose of the group is to establish a recycling plant and e-waste collection site (Ongondo et al., 2011).

The government and consumers can monitor the e-waste that discarded has been transported correctly. This checking system is to ensure the effectiveness of the law (Ongondo et al., 2011).

Japan E-waste management has reach balances in economic and technical by cost sharing between consumers and manufacturers. The e-waste law in Japan also has guideline regarding reuse and recycling and countermeasure illegal dumping (Yoshida & Yoshida, 2014).

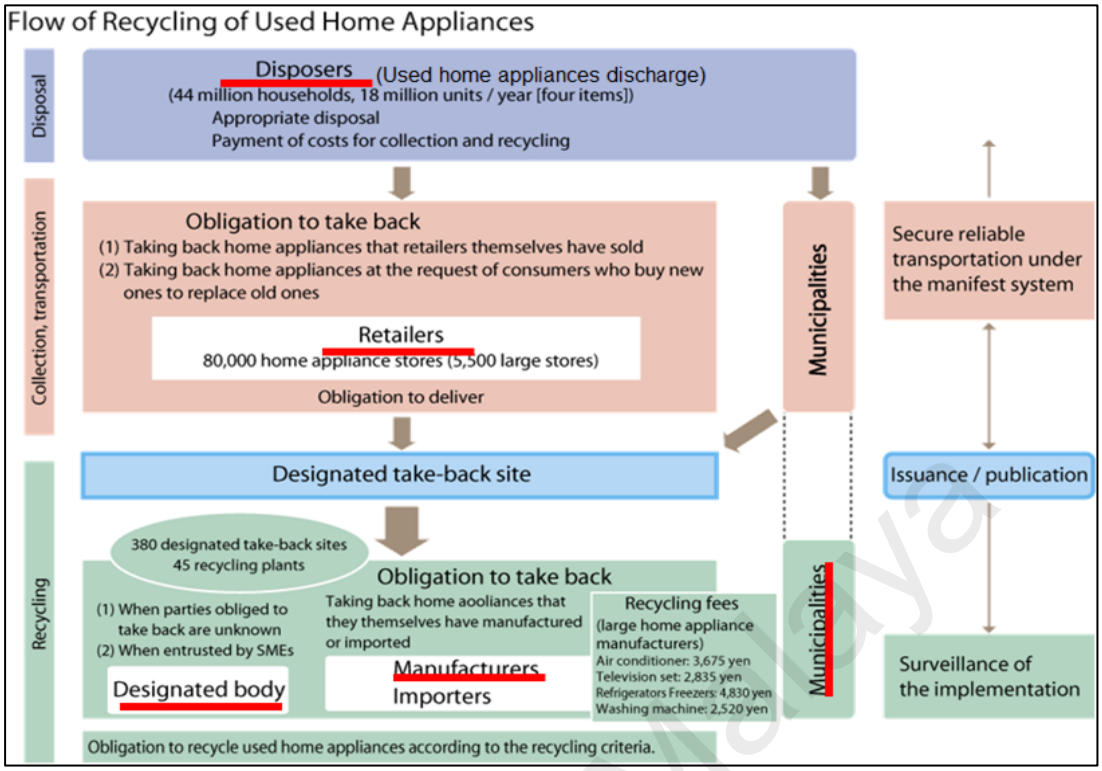

Figure 2.4: Flowchart of the E-Waste System in Japan

2.1.2.2 South Korea

In South Korea, the Ministry of Environment (MOE) has regulated an act to resolve the waste problem. The e-waste is often jumble with other municipal waste and resulting the e-waste to be disposed in a municipal landfill site and incinerators facilities. The knowledge and guidance on handling and disposing e-waste are limited and much unknown. Due to this problem, MOE has enforced a number of law on handling e-waste which was Extended Producer Responsibility Law (Hyunmyung & Yong-Chul, 2006).

South Korea applied Extended Producer Responsibility (ERP) in their e-waste management system, by implementing the ERP in their law and called Extended Producer Responsibility Law. According to the law, manufacturers and importers require to have a recycling rate that constructs every year by the government (de Oliveira et al., 2012).

Manufactures and importers are compulsory by the government to pay the recycling fees at the beginning of the years. At the end of the years, manufacturers or importers will receive partially refundable recycling fees according to the amount of e-waste they have

to recycle that year (de Oliveira et al., 2012). Manufactures that selling their electronic product must be in charge for collecting and recycling the assigned quantity based on certain quantity on the device they see. If the manufacturers do not follow the requirement, they must pay more than the recycling fee of the selling device (Hyunmyung & Yong-Chul, 2006).

Besides collecting fees from manufacturers, consumers will pay the fees for the recycling product. The fees depending on the condition and type of the product that consumers recycle. If the product that was received and determined to have value for reuse and recycle by the retailers, the recycling fees will not be charged to the consumer (Silveira & Chang, 2010).

This type of system is advance and original because it will stimulate the manufactures to improve and increase the recycling rates during the whole year as they can retrieve part of the recycling fees that have been paid at the beginning of the year (Silveira & Chang, 2010).

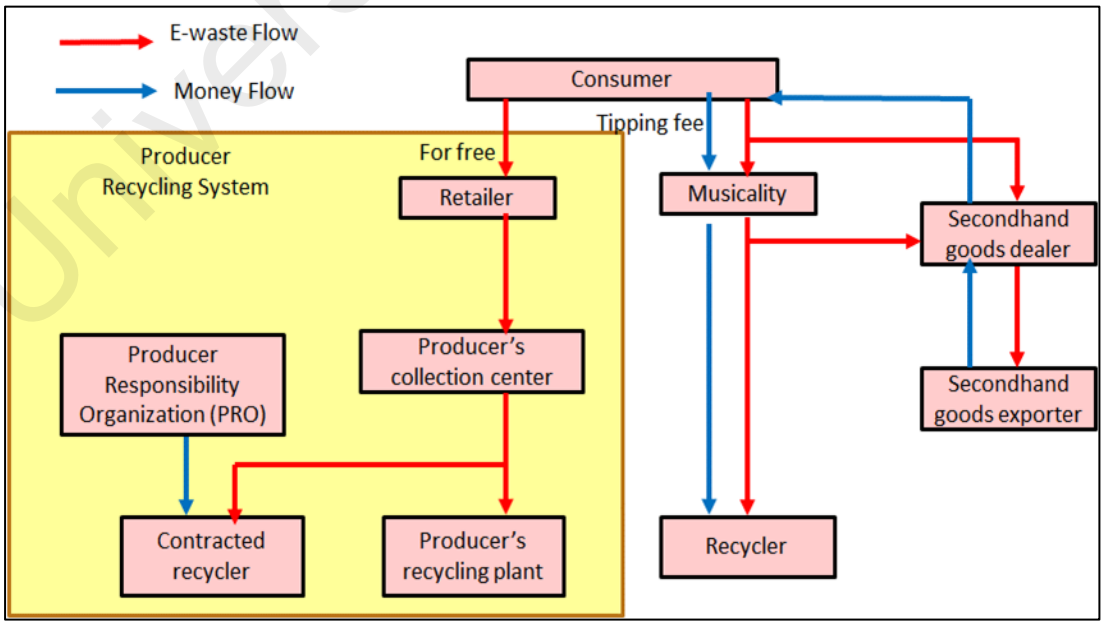

Figure 2.5: Flowchart of the E-Waste System in South Korea

2.1.3 Western Countries

2.1.3.1 United States of America

There is no federal law specifically for targeting e-waste management. There is only two federal regulation regarding e-waste such as The Resource Conservation and Recovery Act and CRT Rule. This legislation is tracking for hazardous waste. Most of the e-waste does not meet the specification (Kumar & Singh, 2013).

In the USA an agency that responsible for educating consumers regarding the importance to recycle and reuse the electronic is Environmental Protection Agency. While the agency informs the consumers and others, manufacturers, retailers, local and state government are providing the equipment for reuse and recycle e-waste. Manufactures and retailers also sponsor event regarding recycling e-waste and they also provide some type of take-back programme.(de Oliveira et al., 2012)

More than 23 states in the United States have execute a law regarding "collection, treatment and disposal of the e-waste". Most of the legislation is based on the EPR policy (de Oliveira et al., 2012; Kumar & Singh, 2013).

When consumers purchase a product, they need to pay a fee that goes to the state. The fee will be used to pay collectors and recyclers (de Oliveira et al., 2012).

2.1.3.2 Australia

A policy that manages the e-waste was launched and called a National Waste Policy in Australia. Under this policy, the e-waste management modelling from EPR were established (Morris & Metternicht, 2016). In this policy, householders that want to discard their equipment at allow to drop their product without needed to pay collection or recycling fees. The support from the government in term of collection and recycling is to

ensure that the consumer would comply with the same criteria as members of industries are voluntary participating (Ongondo et al., 2011).

The regulation provides a guideline on managing the life-cycle of electronic product. Importers and manufacturers are compulsory to subscribe to an Approve Co-Regulatory Arrangement (ACA) and responsible in financial of collection and recycling their e-waste products that discarded each year (Morris & Metternicht, 2016).

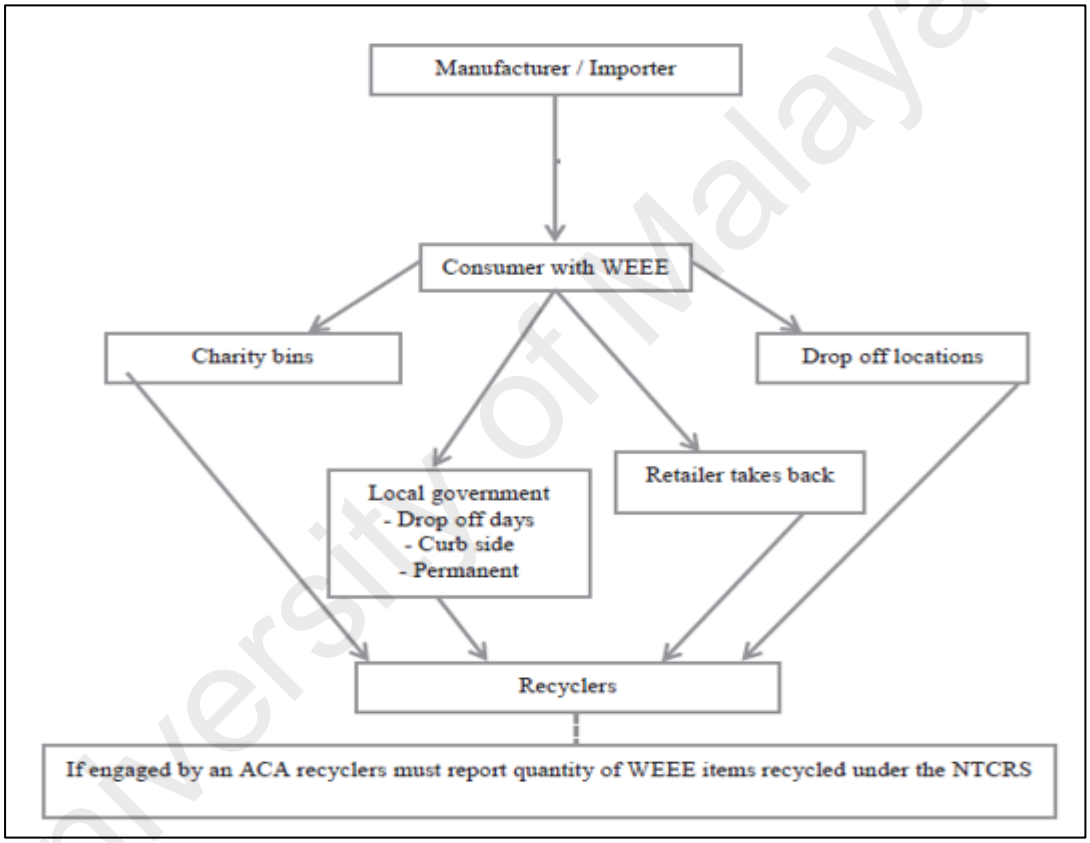

Figure 2.6: Flowchart of the E-Waste System in Australia.

Table 2.1: Legislation and Approach Apply To Developed Countries

Countries	Regulation/Policy	Approach
European Union Germany United Kingdom Switzerland	 ElectroG UK WEEE Regulation (July 2007)	 EPR EPR EPR
Asian Japan South Korea	 HARL EPR Law	 EPR, post-paid EPR
Others Countries United State of America Australia	 None at federal, 20 states have drafted a regulation	 EPR,ARF, Voluntary EPR, Voluntary

2.2 E-Waste Management System in Malaysia

To improve the environment quality due to the waste that was produced, Environmental Quality act was established to prevent and control the pollution in 1974. EQA give authorisation to the Director General of Department of Environment (DOE) to organise management regarding schedule waste for facilities that responsible for generating the waste, storing the waste, transporting, treats and disposes of waste. (Afroz et al., 2013)

There is a recognised group of contractors that licenced to manage the e-waste in term of collection, transportation, processing and disposal. DOE has categorised that whole unit of WEEE as e-waste, but this licenced contractor only collected the e-waste either disassemble components or complete unit from manufacturers or producers. This licensed contractor does not collect the e-waste produced from the business, institution or household. A non-licensed private contractor collected the e-waste from this sector. This private collector will collect the e-waste if the product does not send for repair (Afroz et al., 2013; Shumon, Ahmed, & Islam, 2014).

Due to this situation, Malaysia starts considering the EPR in regulation and policy. Unfortunately, the responsible organisation does not explain the EPR concept and the complete approach for a suitable e-waste management system in Malaysia (Afroz et al., 2013).

There is two legislation regarding waste produce which is solid waste and schedule waste. This two management have already permitted and empowered by the Department of Solid Waste Management (DSWM). These two key legislation make the Malaysia environmental policies progress backhanded. DOE and DSWM do not approve in assisting the regulation to enforce EPR in Malaysia (Afroz et al., 2013).

A policymaker in Malaysia is only focusing on solid and schedule waste management from the "collection, recovery to disposal of the waste". The EPR in Malaysia based on a voluntary initiative from multinational companies. This companies already initiate the related EPR activities as part of their "global corporate environmental policies". Take-back program is one of the activities in their policies (Afroz et al., 2013).

The generation of e-waste from the household sent through three different systems which are "partial and full recovery facilities" and informal recycling. Industrial e-waste which generates large numbers is sent directly to the "partial recovery facilities". This "partial and full recovery facilities" are formal for treating e-waste (Osman, 2016; Shumon et al., 2014).

Informal recycling do not have correct treatment for e-waste, and consequently execute unsuitable landfilling and incineration. Inappropriate mixing e-waste resulted in the contamination of water and soil and effect on human health (Shumon et al., 2014).

E-waste generated from household, still in an uncertain state due to various ways to disposing of their e-waste. Majority of the household favour to discard their e-waste by

selling on second-hand market or simply throw with ordinary garbage (Osman, 2016; Suja, Abdul Rahman, Yusof, & Masdar, 2014).

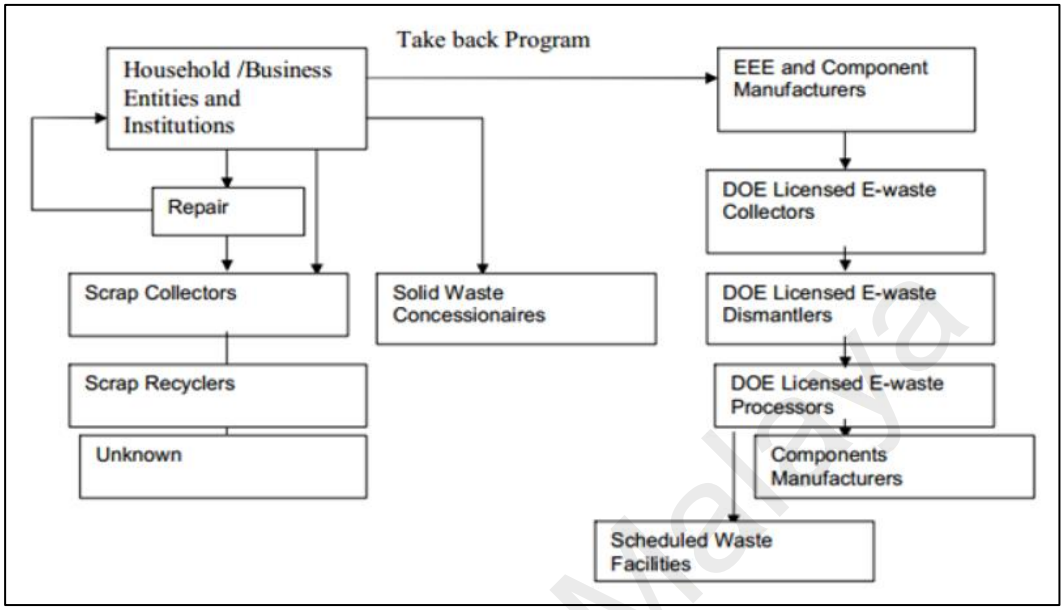

Figure 2.7: Flowchart of the E-Waste System in Malaysia.

2.3 Consumers Recycling Behaviors

Much research had done regarding consumer behaviour on how they treat and recycle their unused mobile phones. Researchers conduct many surveys on mobile phone consumers regarding their ways to discard and disposed of their unwanted, used mobile phones. Consumer behaviour divided into three parts which are consumers' frequent changing mobile phone, consumers' reasons for changing mobile phones and consumer treatment on unused mobile phones.

2.3.1 Consumers Frequency Replacing Mobile Phones

As technologies improved from day to day, changing the mobile phone to a new one is inevitable. The frequency of consumers changing mobile phone is divergent from each other due to different reasons. The previous study found that most of the consumers will replace their mobile phones every year (Li, Yang, Song, & Lu, 2012). It also proofed from others studies that consumers often change their mobile phones yearly (Ylä-Mella, Keiski, & Pongrácz, 2015).

Not all consumers will change their mobile phones every year. A small number of consumers changing their old mobile phones in the first two years and the most of the consumers changed their mobile phone in 2-3 years (Ylä-Mella et al., 2015). others study shows that majority of consumers will replace their mobile phones once every 2-3 years as it was estimated that mobile phone average lifetime used by consumers is 2 years (Li et al., 2012). All the survey that was conducted by the previous study shows that most of the consumers will change their phones once every 2-3 years due to the lifespan of mobile phone which range from 2-3 years with an average of 2.4 years (Jang & Kim, 2010).

As some consumers will either changing their mobile phones every year or once in every 2-3 years. General consumers usually used up their mobile phones to 3-4 years before the change to new mobile phones (Mohd Yusof, Shah, & Muslan, 2015).

2.3.2 Consumers Reason Changing Mobile Phones

There are many reasons why consumers are changing their mobile phones. This reasons will decide how frequent they are changing their mobile phones either once every year or once every 2-3 years. Mobile phones lifespan is one of the reasons why consumer is changing their mobile phones from old to the new one.

Common reason consumers changing their mobile phones is due to broken phones or damage (Li et al., 2012; Ongondo & Williams, 2011). Consumers phone broken in lifespan on three years or more.

Aside from the broken phones, consumers changed their old mobile phones because of the poor function or outdated. This reason also stated that half of the consumers changing their mobile phones due to their mobile phones function outdated, unfashionable style the latest mobile phones have an upgraded function compare to consumers mobile phones (Li et al., 2012; Ylä-Mella et al., 2015).

Beside damage or outdated style, telecommunication services also one of the reasons consumers changing their old mobile phones. The package deals offer by telecommunication service provider are one of the reasons why consumers attracted to replace their old mobile phones. Majority of United Kingdom universities students changing their mobile phones to a new one because their telecommunication network offers consumers to upgrade their mobile phones and network. This reason was chosen as the second largest reason after broken or damaged mobile phones by United Kingdom universities students (Ongondo & Williams, 2011).

Aside from major reason on changing mobile phone, the minor reasons consumer replace their mobile phones is due to the problem with the battery which majority of consumers at age 50 years above does not concern with the advanced technologies on the mobile phones feature. Consumers above 50 years only used mobile phones to make some communication with other people by calling or massaging. Therefore they are changing mobile phones because they desire to have a longer battery life. (Mohd Yusof et al., 2015). Having longer battery life is the third major reason consumers changing their mobile phones (Yin et al., 2014).

2.3.3 Consumers Treatment on Unused Mobile Phones

When consumers are changing their mobile phones from old to a new one, the treatment of the unused mobile phone is also contradictory for every consumer. Majority of consumers are stockpiling their unused mobile phones as their treatment. Countless study shows that consumers have a habit of keeping or stockpiling their mobile phones once they get new ones. This stockpiling action is a common habit shown by consumers.

Study of consumer's behaviour have shown that consumers always stockpile their unused mobile phones at their house and keeping it as spare phones (Li et al., 2012; Ongondo & Williams, 2011; Yin et al., 2014; Ylä-Mella et al., 2015). From this countless

study, it shows that most of the consumers will keep their unwanted mobile phones at their house after the mobile phones not functioning anymore.

As stockpiling the unwanted mobile phones at home by majority of the consumers, there are also several reasons why consumers are keeping their unwanted mobile phones. Most of the consumers that stockpile their unwanted mobile phones give reason that they do not know where to send their unused mobile phones for recycling (Yin et al., 2014). Consumers also do not know how to manage or treat their unwanted mobile phones (Li et al., 2012). These two reasons are second major reason chosen by most of the consumers on why they are keeping and stockpile their unwanted mobile phones at home (Mohd Yusof et al., 2015).

Other reasons why consumers stockpiling the mobile phones are that some consumers were scared of privacy revelation, used mobile phone as data storage equipment, think that unused mobile phone does not worth anything (Yin et al., 2014), feels that recycling is troublesome and do not have time to do the recycling (Li et al., 2012; Yin et al., 2014).

Besides stockpiling, consumers also give their unused mobile phones to relative. Small numbers of consumers choose to donate or give their unused mobile phones to someone either to their relative, children or friends if they not stockpile at home (Li et al., 2012; Yin et al., 2014; Ylä-Mella et al., 2015). Sometimes consumers also used their unused mobile phones as a gift to someone (Ongondo & Williams, 2011). Giving consumers' unused mobile phones to someone either their relative or as a gift is the second major reason why consumers do not send their mobile phones to recycle after stockpiling mobile phone at home.

Not all the consumers from countless previous studies stockpiling unused mobile phones at home or giving their mobile phone to people. There are also some of the

consumers recycle their mobile phones in various ways. Quite numbers of consumers are recycling their unused mobile phones through a recycling program (Yin et al., 2014). There are also consumers recycling their unused mobile phones by sending to a group that responsible for safe disposal (Ongondo & Williams, 2011).

While some consumers sell off their unused mobile phones to the paddlers or sold to company or individual, discarded their unused mobile phone in second-hand market, donated the unused mobile phone for recycling or trade-in to get some price deduction when buying new mobile phone (Ongondo & Williams, 2011; Yin et al., 2014). Even some consumers recycle or sold to the second-hand market. The number of consumers that choose this way is quite low (Li et al., 2012). Some of the consumers in Johor Bahru, Malaysia have low consumers in recycling their unused mobile phone compare with other consumers (Mohd Yusof et al., 2015).

The rest of consumers that do not stockpile, giving others people or recycle their unused mobile phone, consumers will throw away their mobile phones as ordinary garbage, mixing with municipal or general waste (Li et al., 2012; Yin et al., 2014). Although there are small numbers of consumers used this way to discard their unused mobile phones, it can give a bad impact on human well-being and environment as there are some hazardous materials inside the mobile phones.

2.4 Consumers Recycling Awareness

The awareness of consumers regarding recycling can consider four types of consumers, which are consumers aware the significant of recycling and participate with the recycling program. Aware about the significant of recycling but do not participate in any recycling program. Unaware about the significant of recycling and willing to take part in any recycling program and unaware about the significant of recycling and unwilling to take part in any recycling program.

Most of the mobile phone consumers are aware of the significant recycling unused mobile phones. Consumers also can list out several reasons why recycling is important such as material recovery from mobile phones, environmental protection and hazardous material inside the mobile phones (Ylä-Mella et al., 2015).

This majority consumer also aware about the existing of recycling program but only half of the consumers take part in the recycling program. The rest of the consumers regarded recycling as important (Ylä-Mella et al., 2015).

When consumers in Finland were asking about e-waste legislation in their country, half of the consumers respond that they are aware of the Government Decree concerning recycling. This shows that consumers are aware of the existing electronic waste recovery system, but only some of the consumers have taken part in the recycling program (Ylä-Mella et al., 2015). Beside general consumers, universities students from the United Kingdom also aware with recycling services provided by their government, but lack awareness about the services but an only small group of students uses services provided by the government (Ongondo & Williams, 2011). Even though consumers are aware about recycling program and the important of recycling in their respective countries, the consumer's attitudes when recycling their unwanted mobile phones are low (Ylä-Mella et al., 2015).

It is contrary to general consumers from Johor Bahru, Malaysia. They do not recycle their unused mobile phones because they unaware that unused mobile phones can be recycle. From this reason, it shows that some consumers are lack about the importance of recycling the unused mobile phone or e-waste. Consumers also unaware about recycling facilities or mobile phone recycling program and they find that recycling unused mobile phones are an inconvenience. They also do not know that unused mobile phones has some value (Mohd Yusof et al., 2015).

2.5 Consumers' Willingness in Participation of Recycling Waste Mobile Phone and Paying Recycling Fee

People recycle and throw their household solid waste properly because they have information regarding the effect of solid waste on human health or the waste produce smelly odour. It is contrary to e-waste as it does not produce any odour or most people think it will not affect the environment and human well-being. Due to these facts, the consumer does not treat their e-waste properly. Consumers usually kept the unwanted e-waste at home or threw through ordinary garbage. This has become a common habit among consumers. Due to this habit, the researcher study consumers' willingness in participating in recycling and willingness to pay recycling fee if the government will implement it.

Even consumers that are aware of about recycling, not all consumers are willing to take part. Only a minority of consumers are not willing to be involved in recycling their unwanted mobile phones through government take-back program. Some of the consumers are slightly willing to recycle but depend on what type of incentive scheme will be an offer to them. Consumers' willingness in participating recycling program depend on the type of incentive that will be offered. Different level of incentive will show a different level of willingness to recycle their waste mobile phones. Consumers are more cooperative to recycle their waste mobile phones if there is any monetary incentive offer when they recycle. The most effective incentive that was chosen by the consumers is cash or voucher (Li et al., 2012; Ongondo & Williams, 2011). Beside incentive, consumers' willingness to take part in the e-waste recycling program can be evoked by environmental policy and economic tools.

Besides providing an incentive to boost consumers' willingness in recycling, Point Reward System was suggested to use on consumers when consumers' recycle their e-

waste. This system will reward the consumers with reward point, and the consumer can change to a specific product or service with accumulated points. This suggestion shows that the majority of consumers are willing or very willing to take part in the e-waste recycling program with Recycling Reward System. The benefit of the system is that consumers can get a reasonable price to recover or environmental points. With this kind of system, it will increase consumers' willingness to take part in formal e-waste recycling (Zhong & Huang, 2016).

Majority of Mobile phones consumers in Macau are willing to pay and participate with recycling if their government implement the recycling fee on the recycling system. The rest of the consumers are not willing to pay if the system implemented (Song, Wang, & Li, 2012). Same desire also shows from consumers in India where the majority of consumers are willing to take part in recycling program, and the rest are not willing to take art (Dwivedy & Mittal, 2013). half of the consumers in Kuala Lumpur, Malaysia are willing to pay for recycling fees (Afroz & Masud, 2011).

There are reasons why the rest of the consumers are not willing to take part in paying the recycling fee. Consumers state their reasons, which consumer prefer to disposed their e-waste by selling the product to earn some money rather than paying the fee (Afroz et al., 2013; Islam et al., 2016), lack of extra money or lower income to pay the recycling fee (Afroz et al., 2013; Song et al., 2012), feared that the cost of living will increase (Dwivedy & Mittal, 2013; Song et al., 2012), consider the fee need to be pay by people who contribute to polluting the environment. Consumers do not believe with this kind of e-waste management program, thinking recycling not important (Afroz & Masud, 2011), and consumers also think that the recycling fee are not their duty but government responsibility (Dwivedy & Mittal, 2013; Islam et al., 2016; Song et al., 2012).

There are four main factors that contribute consumers' willingness to participate such as "environmental attitudes and norms", "recycling needs and motivation", "recycling circumstances and recycling condition" (Zhong & Huang, 2016). Recycling habit plays the most significant role in consumer's e-waste recycling behaviour. Economic benefits when recycling the e-waste also play an important role in consumers' willingness to recycle. Consumers usually sell off their e-waste so they will receive a certain reward rather than recycling through the formal system. If consumers get some incentive when they recycle their e-waste, it will increase their willingness.

CHAPTER 3: METHODOLOGY

3.1 Flowchart of the Research Project

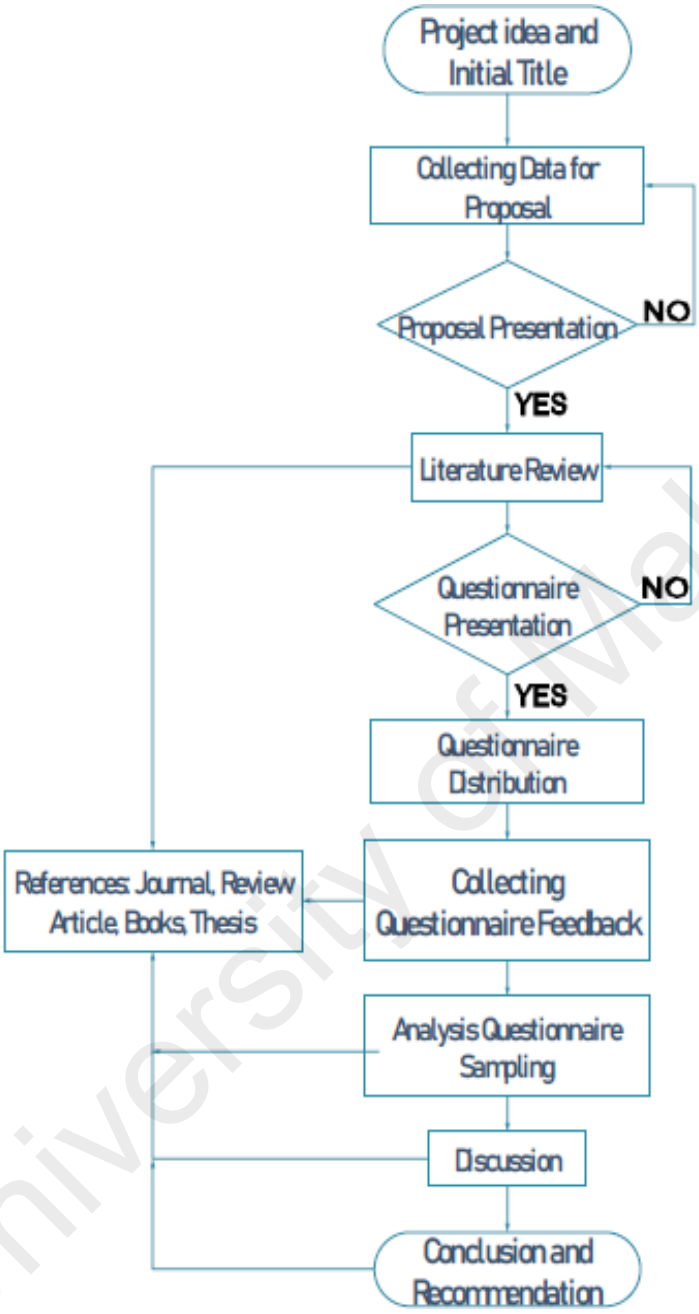

Figure 3.1: Flowchart of Research Project

3.2 Study Design and Sampling

The study of this research are about e-waste management. As the scope of the e-waste is large and consist of variety of electronic and electric device either large or small. The consumers' attitude on recycling e-waste also different between small or large devices. The large e-waste devices such as television, freezer or washing machine are taking

consumers' space if they stockpiling or keeping the device at home while smaller device such as mobile phones or tablet does not taking consumers space at their house. Due to this attitude, majority of consumers keeping their smaller e-waste at home.

The design of this research project is to concentrate on mobile phones or tablet waste as this two type of device are similar and have same function and design.

The research was conducted by using questionnaire to study mobile phone consumers regarding their habit, attitude or behaviour regarding unused mobile phones waste. The sampling for the questionnaire are mobile phones consumers from the range of age 15 years old to 60 years old and above. This selected range is due to the fact that all generation will have one mobile phones with them and they have an ability to think and make decision regarding recycling unused mobile phones.

The questionnaire was distributed to 100-150 mobile phones consumers. The questionnaire were distributed through by hand or by using online such as Google Form by Google. The using of Google Form is due to the fact that the feedback are faster than by using hand.

3.3 Tool-Questionnaire

The questionnaire that was distributed to the mobile phone consumers consists of 26 questions and was divided into three parts.

First part of the questionnaire consist of 6 questions. This questions is to study consumers' behaviours regarding frequent and reasons changing the mobile phones and consumers' treatment of unused mobile phones.

The second part of the questionnaire consist of 9 questions which are about consumers' awareness regarding the importance of recycling unused mobile phones and consumers actions regarding recycling mobile phones.

The third part of the questionnaire consist of 11 questions which are about consumers' willingness to participate the recycling activity and consumers' willingness to pay for recycling fee if it will be implement by government.

3.4 Statistical Analysis

All the questionnaire answer data were entered into Excel. The questionnaire was analysed and reported by using SPSS Statistical Software in order to determine the consumers' recycling behaviours, consumers' recycling awareness and consumers' willingness to participate in recycling.

CHAPTER 4: RESULTS

4.1 Consumers Recycling Behaviors

This topic is to discuss the behaviours of mobile phones consumers on how often they are changing their mobile phones as a new mobile phone with better specification and design was produced by mobile phones manufactures.

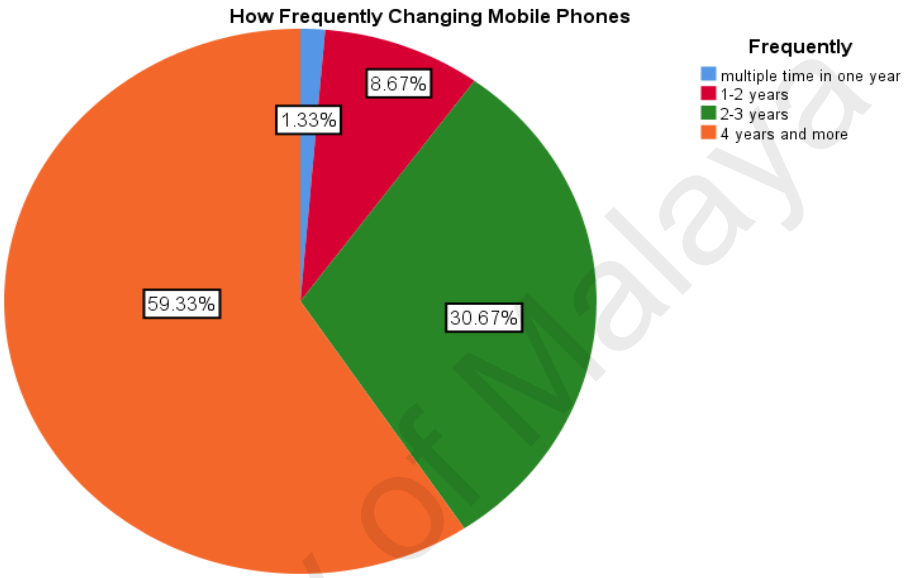

Figure 4.1: Percentage of Respondent Frequently Changing Their Mobile Phones

Figure 4.1 shows that majority of respondents which is 59.33% changing their mobile phone four years and more. The second frequently changing their mobile phones is 2-3 years and 8.67% in 1-2 years. Only a small number of respondents (1.33%) choose to change their mobile phones multiple times per year.

From the analysis above, it shows that respondents taking four years and more to changing their old mobile phones to new mobile phones.

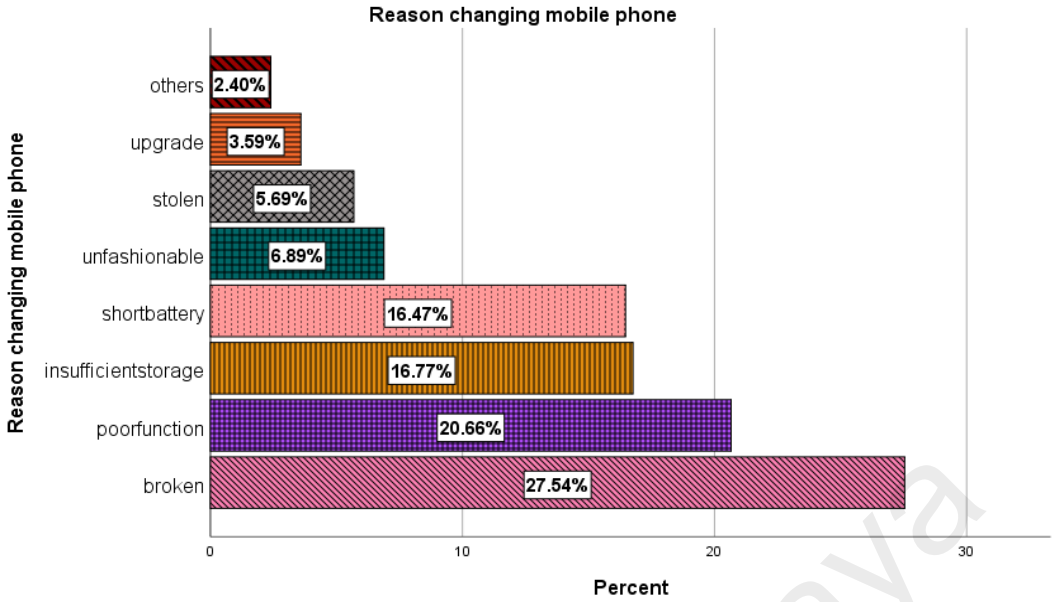

Figure 4.2: Percentage of Reasons Respondents Changing Their Mobile Phones

Figure 4.2 shows the reasons why respondents are changing their mobile phones. The highest percentage of reasons for changing the mobile phone is 27.54% which is mobile phone broken. The second highest is a poor function on a mobile phone which is 20.66%, while short battery life and insufficient mobile phone storage have nearly the same percentage which is 16.47% and 16.77%. Others reasons have the lowest percentage of the reasons why they are changing their mobile phones.

As shown in the result above, it can be concluded that the main reason why most of the respondents changing their mobile phones is due to the broken mobile phone. Beside broken, poor function in mobile phones are also one of the reason. As new technology was developed, the function of the mobile phone also upgrades. This new upgraded function makes the old mobile phone are incomparable with new mobile phones.

As technology advance, old mobile phone with low storage capacity cannot function properly when too many application running in the mobile phone system. This reason causes respondents changing their mobile phone. When too many application running in the mobile phone storage, it will consume the mobile phones battery faster. Larger battery life will have the longest hours when using a mobile phone. This four reason that has the

highest percentage among other reasons shows that it is the main reasons why respondents are changing their mobile phones.

There are other reasons besides the main four reasons such as old style or unfashionable mobile phones as new phones have a slick and sophisticated design which attract consumers. Sometimes when their mobile phone was stolen, they need to buy new mobile phones. Respondents also choose to upgrade from telecommunication service as one of the reasons they changing mobile phones which is 3.59%.

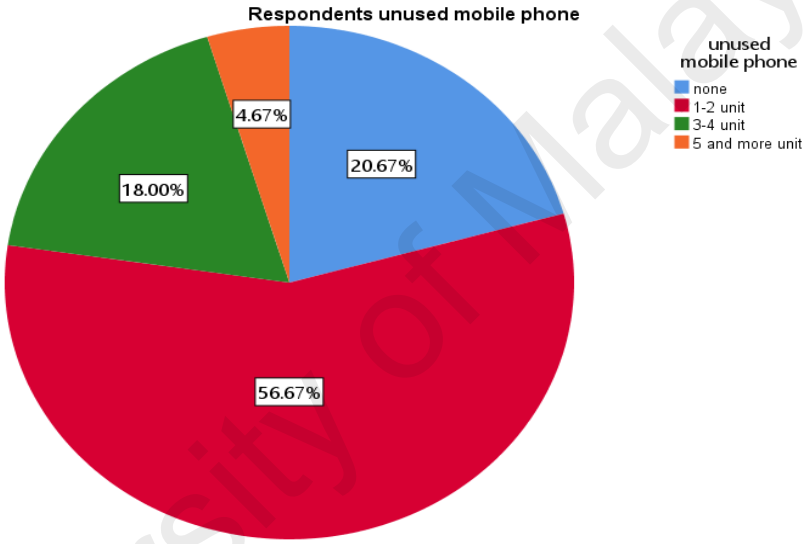

Figure 4.3: Percentage of Respondents Unused Mobile Phones

Figure 4.3 shows the percentage of respondents' unused mobile phones. The highest percentage of unused mobile phones that respondents have with them is 56.67% which is more than half of the respondents' 1-2 units of unused mobile phones with them. The lowest percentage of unused mobile phones is 4.67% which is 5 and more unit.

The result shows that majority of the respondents have 1-2 units of unused mobile phones with them when changing their old mobile phones. This result shows that most of the respondent keeping their unused mobile phones. Several respondents have 5 and more units of mobile phones with them.

Aside from having unused mobile phones, 20.67% of respondents have zero units of unused mobile phones with them. This shows that 20.67% of respondents treat their unused mobile phones besides keeping mobile phones.

There are several reasons what respondents do with their unused mobile phone units. Figure 4.4 below shows the percentage of respondents' action when dealing with their unused mobile phones.

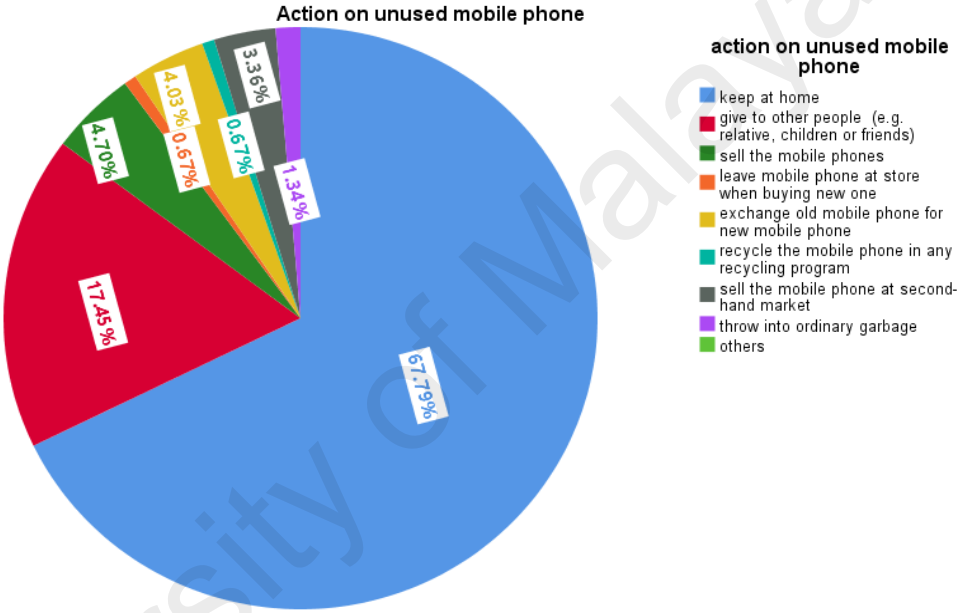

Figure 4.4: Percentage of Respondents' Action on Unused Mobile Phones

A large number of respondents (67.79%) keeping their unused mobile phones at home. Due to this action, most of the respondents have several units of unused mobile phones in their places. Second largest reasons chosen by the respondents are giving their unused mobile phones to other people such as a relative, children or friend.

Beside keeping at home and give it to other people, respondents also sell the unused mobile phone (4.70%) to get some money, exchange old mobile phone to new mobile phone (4.03) which can reduce the price of new mobile phones and sell the mobile phone to second-hand market (3.36%). This three action, respondents can get extra money by selling and exchange unused mobile phones.

Surprisingly, respondents' action where respondents throw unused mobile phones into ordinary garbage (1.34%) is more than recycling the unused mobile phone in any recycling program (0.67%). This result shows that respondents treat their e-waste as ordinary garbage throwing it.

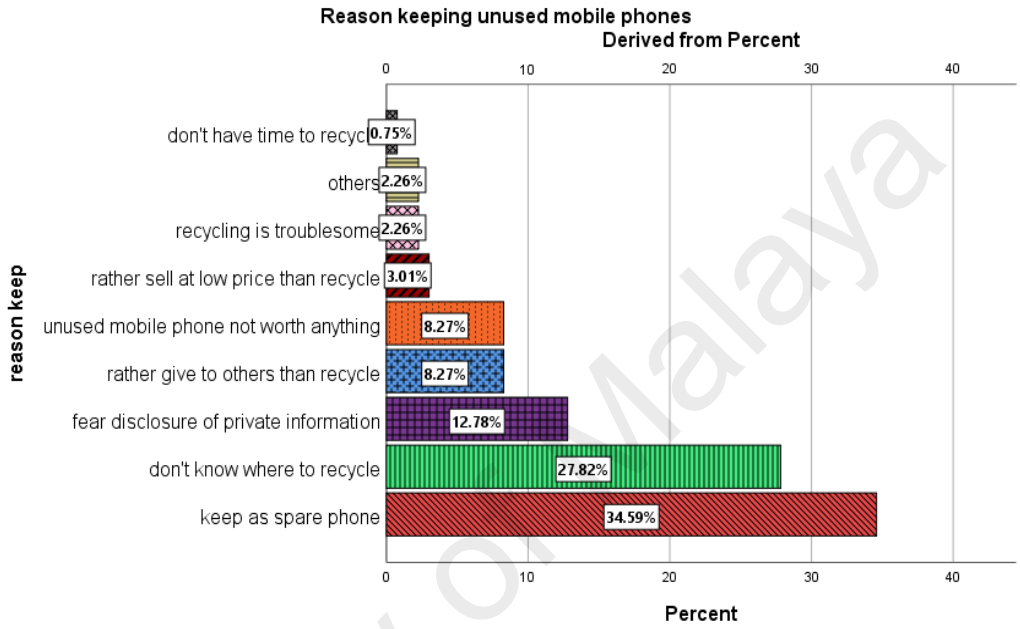

Figure 4.5: Percentage of Respondents Reasons Keeping Unused Mobile Phones

Every action that was taken is due to certain reasons. When the majority of the respondents' choose to keep their unused mobile phones at home, it is dues to several reasons. Figure 4.5 shows the result of respondents' reasons for keeping their unused mobile phones at home.

Figure 4.5 shows that majority of respondents keeping their unused mobile phones at home, and the reason is they keep the unused mobile phone as a spare phone. Keeping as the spare phone is the highest percentage among other reasons with 35.59%. Most of the respondents keeping their unused mobile phone as a spare phone or backup phone in case something happens to their main mobile phone.

Respondents also stated that they do not know where to recycle their unused mobile phone (27.82%) as the reason why they are keeping their unused mobile phones at home. From these results, it shows that quite several respondents do not know how and where to recycle their mobile phone e-waste.

Fear of disclosure of private information (12.78%) is one of the reason respondents keeping their unused mobile phones. Nowadays consumers used mobile phones as something important as it can keep many things such as phone numbers, account numbers, private or work email, picture or video. The fear people get this kind of information if consumers recycle their unused mobile phone, make consumers taking action keeping at their home. With nowadays advance technologies, nothing is impossible to get the information from the unused mobile phone. Consumers do not get any guaranty that the information will be deleted and cannot disclose if they recycle their unused mobile phone.

After buying a mobile phone, the mobile phone value will drop. After used several years, most of the consumers will keep their unused mobile phone because they think that unused mobile phones not worth anything. Figure 4.5 above show the results that 8.27% of respondents think that their mobile phone e-waste does not worth. Rather than recycling or discarded their unused mobile phone, 8.27% of respondents rather give to others than recycle it. They also rather sell at a low price than recycle their unused mobile phone (3.01%).

When talking about recycling the unused mobile phone, 2.26% of respondents think that recycling is troublesome and 0.75% of respondents do not have time to recycle their unused mobile phone.

4.2 Consumers Awareness in Recycling

When unused mobile phone produces by consumers increases as the number of new mobile phone with new technology, new design and better feature increases. As mobile phone e-waste was produced by consumers, this project is conducted to assess consumers' awareness regarding recycling program of e-waste, the effect of e-waste to the environment and human health, and the hazardous and recyclable material inside the mobile phones. As consumers buying new mobile phones and keeping or discarding old mobile phone, a question was asked towards respondents' f they have heard any recycling program regarding unused mobile phones. Figure 4.6 below show the results of the question.

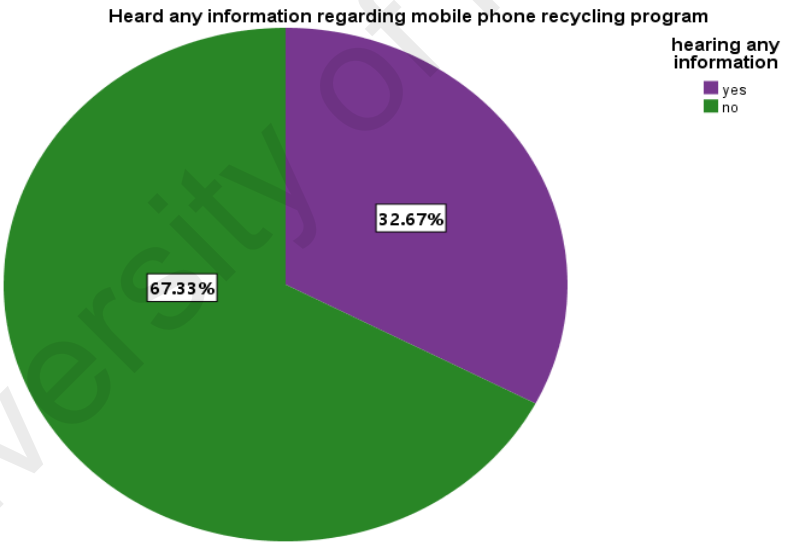

Figure 4.6: Percentage of Respondents Hearing Any Information about Unused Mobile Phone Recycling

More than half of the respondents about 67.33% said that they never heard any information regarding the recycling program of unused mobile phones. While only 32.67% have heard about the recycling program, this percentage shows that most of the respondents do not know any information about mobile phone e-waste. This shows the lack of knowledge about e-waste or mobile phone e-waste.

The respondents that have heard any information about the recycling program were asked where they have heard the information. Figure 4.7 shows the platform where they get this information.

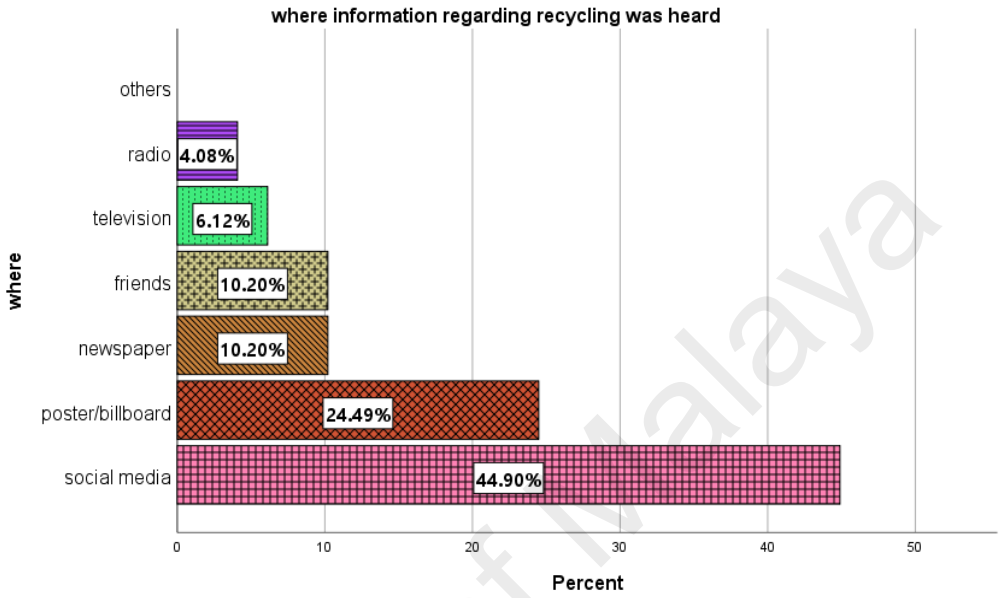

Figure 4.7: Percentage of Where the Information Was Get

Respondents heard or got any information regarding recycling unused mobile phones from media social such as Twitter, Instagram or Facebook. This type of platform are usually places where people share and spread any information. Even though this platform had many users, only a small amount of user has heard the information. As a result, it shows only a small number of respondents have heard compared to a large number of respondents that do not hear anything.

Others respondents also stated that they heard the information from poster or billboard (24.49%), newspaper and friends (10.20%), television (6.12) and radio (4.08%). The percentage shows that the information provided and spread for others through all platform, but only small numbers of consumers are aware of this information.

Figure 4.8 shows the results of what respondents think about the reasons low rate in recycling unused mobile phone among consumers.

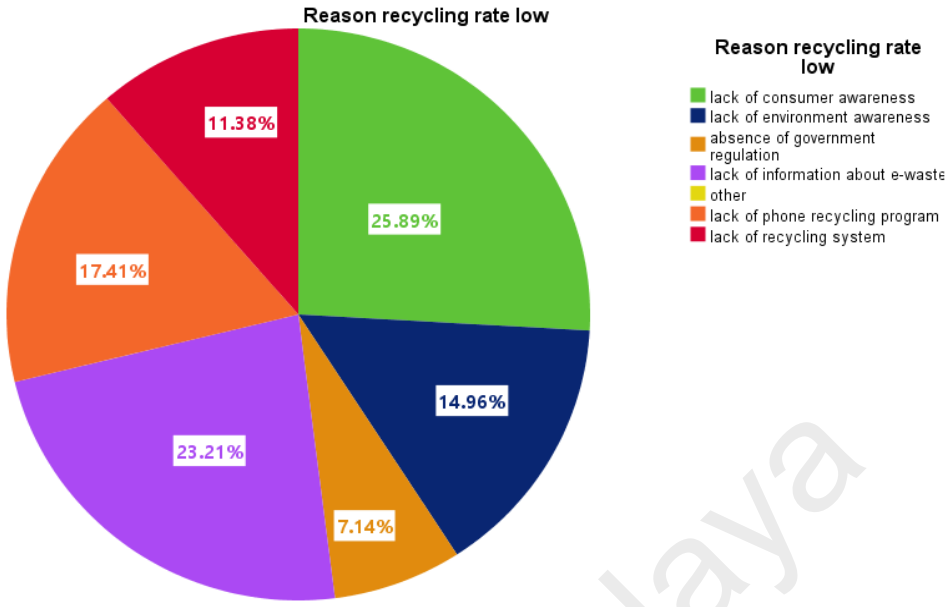

Figure 4.8: Percentage of Reasons Recycling Rate Low

Most of the respondents think that the reason is the lack of consumers' awareness (25.89%) and lack of information regarding e-waste (23.21%). These two major reasons were chosen by most of the respondents. They think that the information regarding e-waste are lacking and no awareness among consumers regarding recycling e-waste

They also stated that the lack of recycling program (17.41%) is one of the reasons the rate of recycling is low. When the recycling program is lacking, consumers do not know where to recycle their unused mobile phones.

Respondents also think that lack of environmental awareness (14.96%) as one of the reason. When consumers do not care about the effect on the environment, they will not care to recycle their waste. Absence of government regulation (7.14%) and lack of recycling system (11.38%) are also some of the reasons consumers do not recycle. When there is no regulation or any system of recycling, consumers do not like to voluntary recycling their mobile phone e-waste.

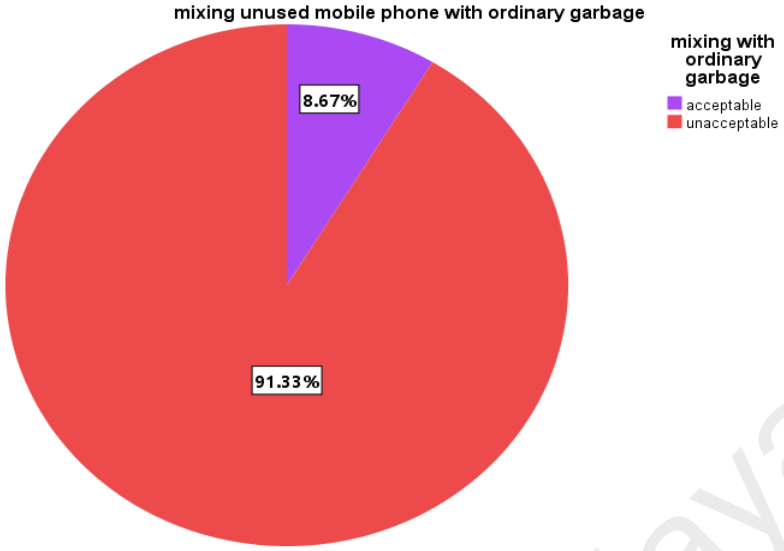

Figure 4.9: Percentage of Respondents on Mixing With Ordinary Garbage

Several questions were asked to the respondents' about their knowledge regarding the effects of unused mobile phone, hazardous and recyclable materials inside the mobile phones. As the unused mobile phone is e-waste, respondents were asked about their knowledge about mixing e-waste with municipal waste.

Figure 4.9 shows the result that almost all the respondents (91.33%) think that mixing e-waste with municipal waste is unacceptable while 8.67% of respondents think that it is acceptable. Even though it is a small number of respondents, it shows that there are also people that throw their e-waste with municipal waste as they think it does not have any effects.

Municipal waste will be sent to incinerator facilities to recycle the waste. As the facilities recycle the waste, they will expose to water, soil and air when e-waste mixing with municipal waste, the hazardous materials inside the mobile phones will affect the water, soil and air. This mixing of hazardous material with water, soil and air will spread and affected the environment and human health. E-waste that end-up in municipal landfill was describe as toxic time bomb. Components such as batteries, heavy metals may reach the land, water and may reach humans, animals and environment. It also will affect the

natural resources such as river and streams and disturb the ecosystem (Sivaramanan, 2013).

Respondent was asked whether they know the effect when e-waste was mixing with the municipal waste. Figure 4.10 below shows the result of respondent knowledge.

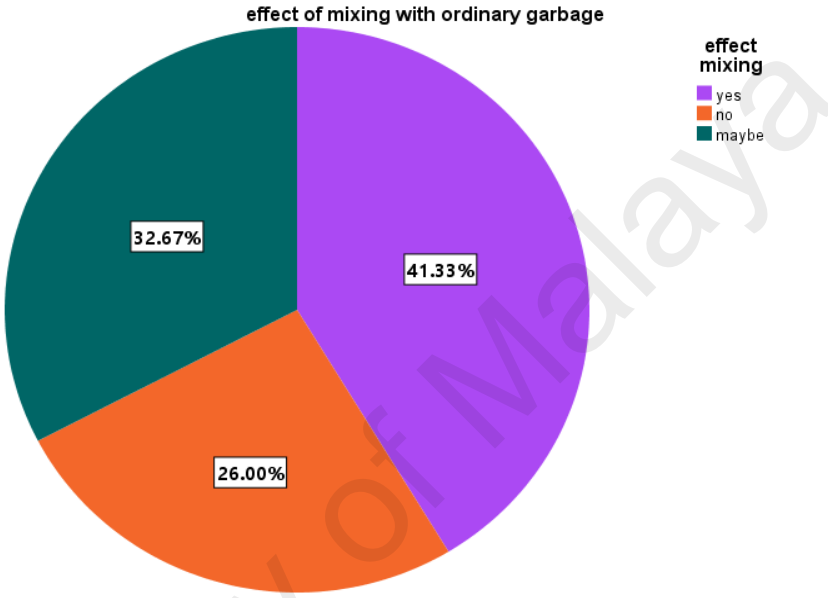

Figure 4.10: Percentage of Respondents' Knowledge about the Effect of Mixing With Ordinary Garbage

Figure 4.10 shows that almost half of the respondents know the effect when e-waste mixing with municipal waste. The result shows that this group of respondents have enough knowledge about the cons of e-waste with municipal waste.

Although the majority of respondents' are aware of the effect, quite several respondents are uncertain with the effect of mixing as 32.67% of respondents answer maybe. This show that they do not have enough knowledge about the effect that will produce when mixing with municipal waste.

Another 26.00% of respondents answer that they do not know the effect of e-waste with municipal waste. It is quite a large number of respondents that do not know the effect that will produce by e-waste.

A mobile phone is a unit that was assembled with different kind of components. In these components, there are material that can recyclable, and there are also material hazardous to human and environments. An article mention that lead, zinc and arsenic inside the mobile phone will pollute the surrounding soil and water. Besides give harms to environment and humans, there are also materials that can be recycle such as gold, silver and lead from circuit board (Pirolini, 2014).

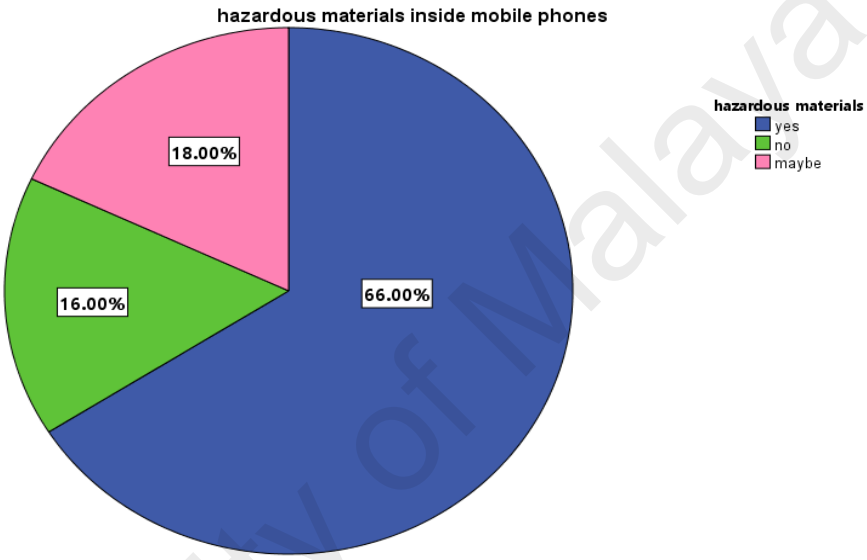

Figure 4.11: Percentage of Respondents Know There Is Hazardous Material inside Mobile Phones

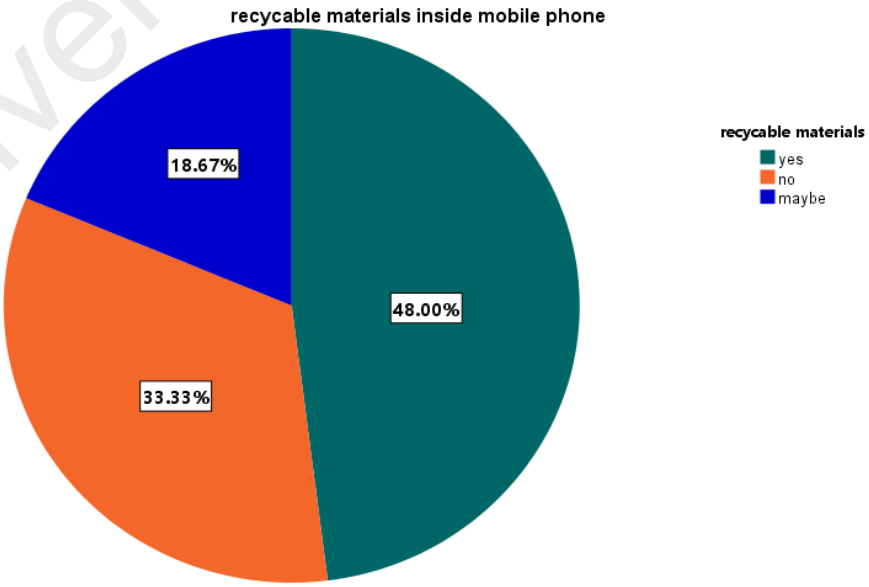

Figure 4.12: Percentage of Respondents Know There Is Recyclable Material inside the Mobile Phone

The percentage of respondents knew about the hazardous materials (66.00%) inside the mobile phone is more than several respondents that knew about recyclable materials (48.00%). This result shows that respondents are aware of hazardous and recyclable material inside the mobile phones, but they do not want to recycle their unused mobile phones through the correct system. Respondents have enough knowledge about the materials inside the mobile phones which is hazardous to human and environment and material that can be useful and recyclable.

The number of respondents that not quite certain about both material is quite the same with 18.00% for hazardous material and 18.67% for recyclable material.

Respondents that do not know about recyclable material inside the mobile phone (33.33%) is more than the number of respondents that do not know about hazardous material (16.00%). It shows that some people do not know the mobile phone contains some material that can be recyclable for other uses compares with hazardous materials.

As the generation of the e-waste increase, to tackle the e-waste problem, a regulation regarding e-waste generation, collection and recycle was established. Respondents were asked whether they are aware of the regulation from the government. Figure 4.13 below shows the results of respondents' awareness about the regulation.

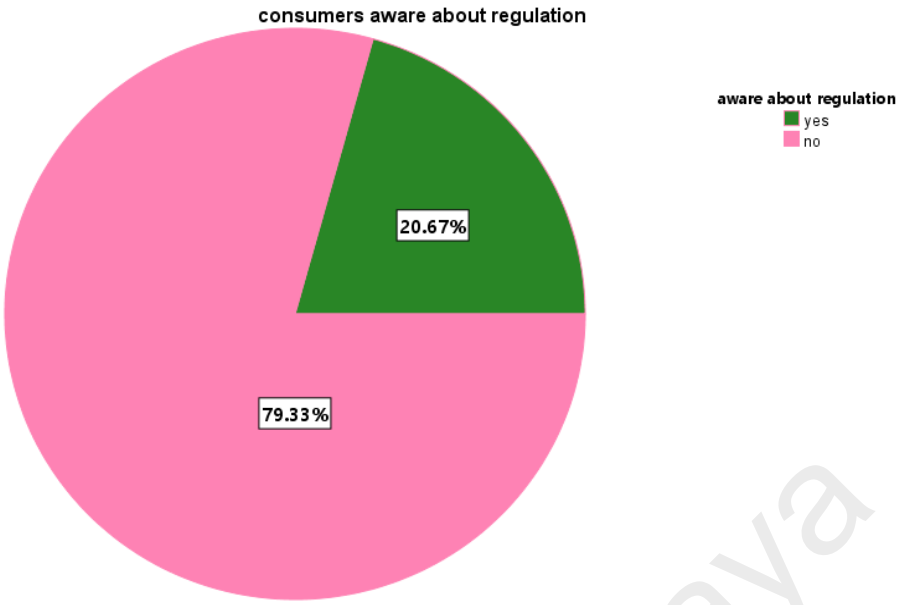

Figure 4.13: Percentage of Respondents' Awareness about the Regulation

From Figure 4.13, it shows that majority of the respondents are not aware of the regulation of e-waste (79.33%). As the regulation only concentrates on the industry, consumers who used and generated the e-waste do not know about the regulation.

From the analysis above, it can conclude that most of the respondents do not know or heard any information regarding the e-waste and how to recycle the e-waste. It shows the lack of information from the responsible sides such as government, manufacturers, or retailers. Respondents also are not aware of e-waste regulation.

However, respondents are aware that unused mobile phone cannot throw with ordinary garbage, aware of the effect when e-waste mixing with municipal waste, aware that mobile phones have components that hazardous and recyclable. It shows that they have enough knowledge about mobile phone e-waste.

4.3 Consumers' Willingness to Participate and Pay for Recycling Fee

As consumers are a major shareholder in generating e-waste such as mobile phone waste, the willingness to participate in recycling the waste from consumers is very important. If there is no contribution from consumers, the e-waste generation will increase

every year. Several questions were asked whether to study their willingness in recycling unused mobile phone.

Government collaborating with telecommunication services to solve the unused mobile phone waste by producing “Mobile E-waste Collection Box”. Respondents were asked whether they have seen the collection box. Figure 4.14 below shows the results of respondents answer.

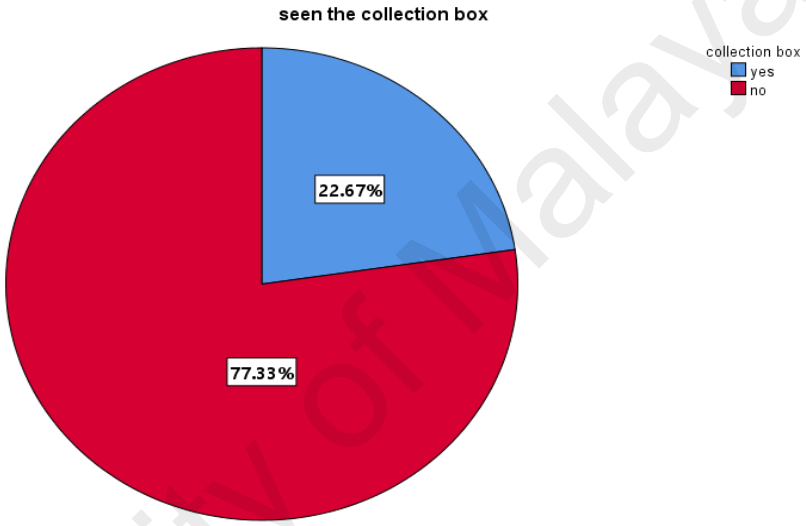

Figure 4.14: Percentage of Respondents Have Seen the Collection Box

As can be seen, the results show that majority of the respondents does not see the collection box (77.33%) compare with respondents that have seen the collection box (22.67%). Then respondents were asked whether they are willing to use the collection box if they see the box.

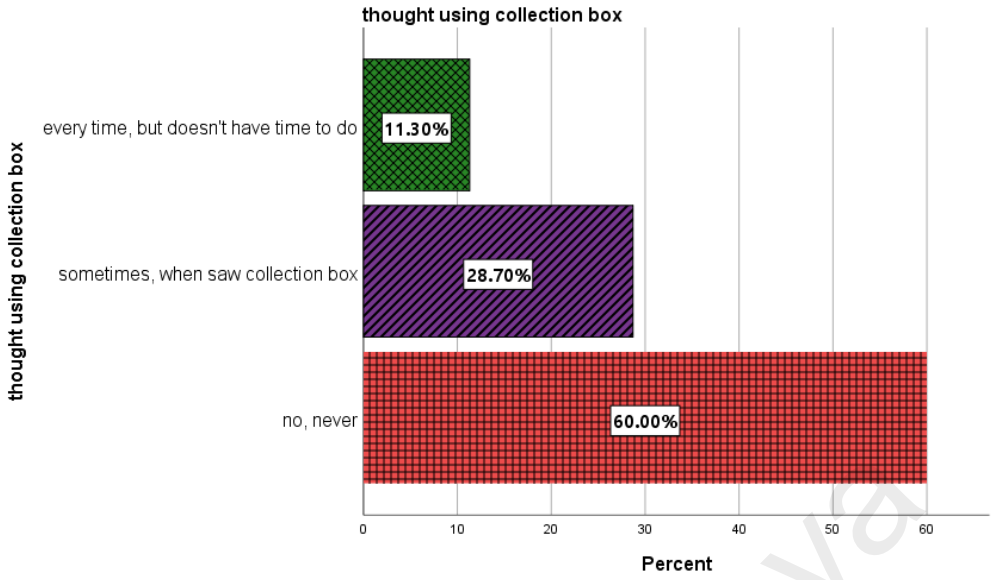

Figure 4.15: Percentage of Respondents Thought Using the Collection Box

The result above shows that willingness respondents to use the collection box if they see one. 60.00% of respondents said that they will never use the collection box to recycle their unused mobile phones. There are also a group of respondents that are willing to use the collection box, but cannot do because they do not have time to recycle their unused mobile phone (11.30%). One of the respondents claimed that they are too busy to do important things in their daily life and have not gotten around to recycle their unused mobile phones. There are also a group of respondents that want to use it when they saw the collection box (28.70%).

Other questions were asked to study respondents' willingness to recycling. Figure 4.16 and Figure 4.17 below show the results of the questions.

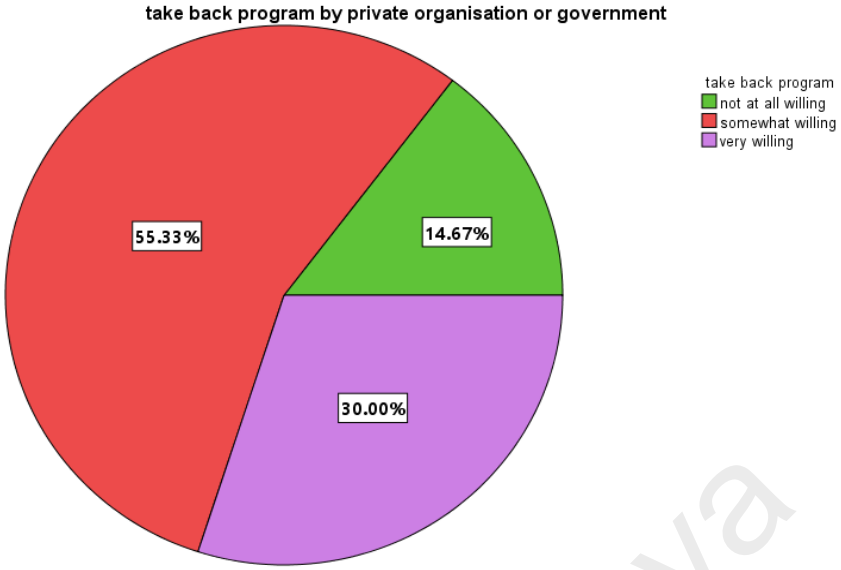

Figure 4.16: Percentage of Respondents' Willingness on the Take-back Program

The results show that more than half of the respondents somewhat willingness (55.33%) to participate in the take-back program by a private organisation or by government. Respondents are uncertain whether to participate or not with the take back-program. Their uncertain willingness is depending on certain condition if it gives benefit to them, for example if consumers get some cash payment when recycle their unused mobile phone. Only 30.00% of respondents are very willing to participate in the take-back program while 14.67% of respondents are not willing.

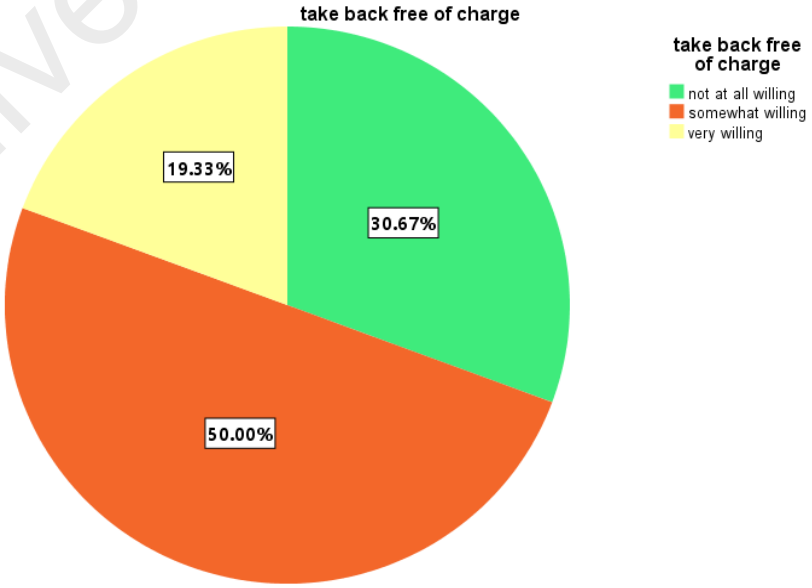

Figure 4.17: Percentage of Respondents' Willingness in the Take-back Program Free of Charge

Then respondents were asked whether they are willing to participate in the take-back program if it is free of charge for respondents without giving anything back to them. The result shows that half of the respondents still somewhat willing (50.00%) to participate in the recycling program. This shows that uncertain respondents will become willing or not depend on certain reasons or condition. On the other hand, there is an increase of respondents that are very willing to participate in the recycling (19.33%). This is because no charging fee needs to be pay by consumers. There are also slightly increase in the group of respondents that are not willing to participate (30.67%) which almost equally with result in Figure 4.16.

Then respondents were asked again in government applied the paying fee in the recycling system, would they participate in the recycling program or not. If they are somewhat willing or very willing, respondents were asked how much that they can pay for the fee while respondents that are not willing to pay were asked the reasons why they are not willing to pay.

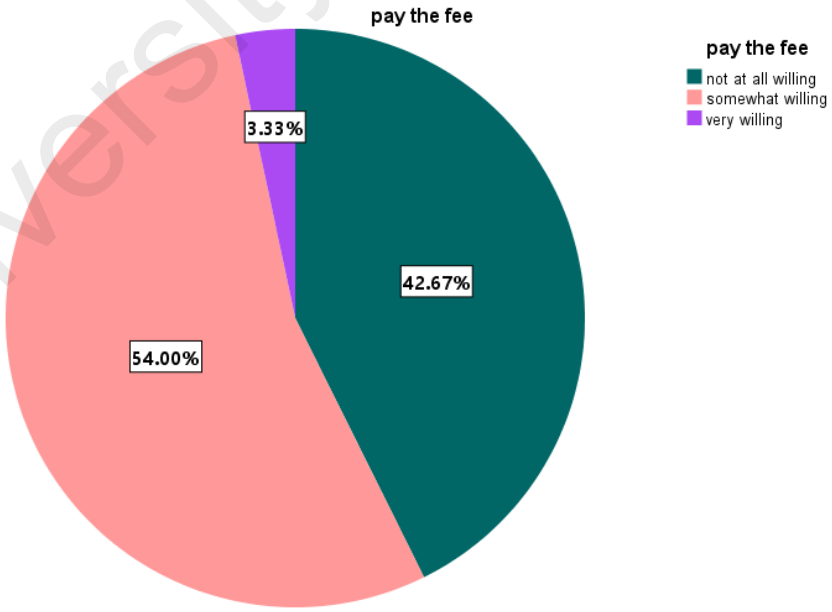

Figure 4.18: Percentage of Respondents Willing To Pay the Recycling Fee

The results in Figure 4.18 show that the percentage of somewhat willingness is almost the same as the results in Figure 4.16 and Figure 4.17. This still shows that respondents consider depending on the amount that they need to pay. However, the percentage of a group of respondents that very willing drop to 3.33% and a group of not willing respondents increase to 42.67%. This result shows that the number of people that very willing become not willing to participate in the recycling program if they need to pay the recycling fee.

The group of somewhat willing respondents and a group of very willing respondents stated the amount that they willing to pay.

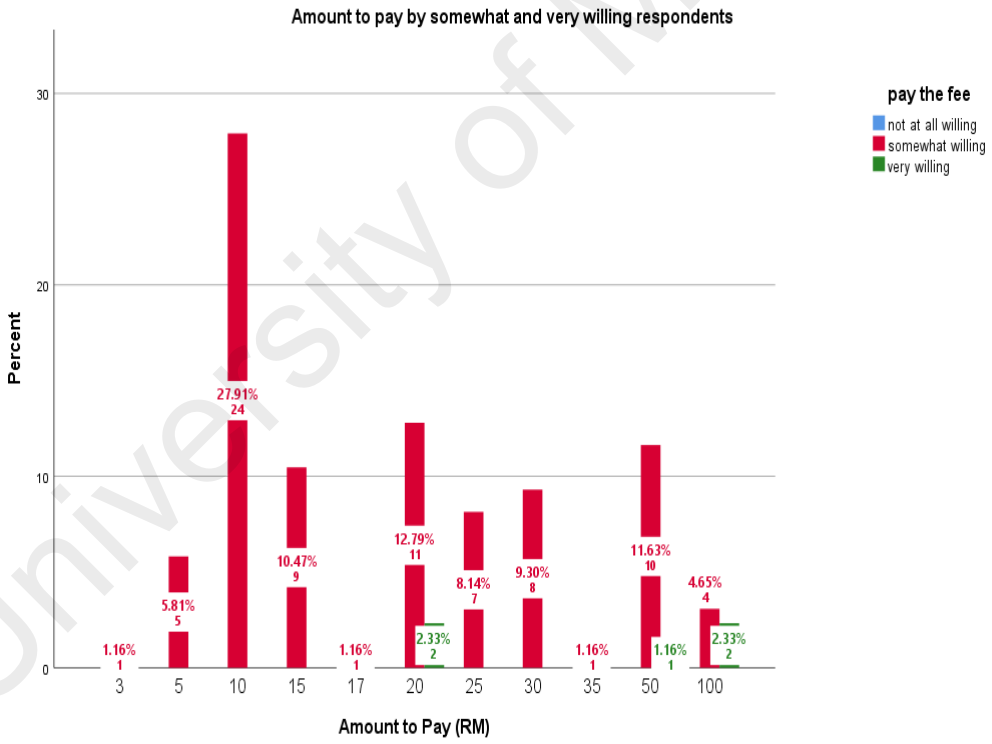

Figure 4.19: Percentage of the Amount That the Respondent Is Willing To Pay

Figure 4.19 above shows that respondents that very willing to participate (3.33) stated that they could pay for RM100 (2.33%), RM50 (1.16%) and RM20 (2.33%). The highest amount is RM100 while the lowest amount is RM20.

While the group of somewhat willing respondents' majority can pay if the amount of fee is RM10 (27.91%) which is highest among the somewhat willing group, the rest of the amount is slightly same with RM20 (12.7%), RM50 (11.67%), RM15 (10.47%), RM30 (9.37%), RM25 (8.14%), RM5 (5.81%), and RM35, RM17, RM3 (1.16%). The highest amount that they can pay is the same with a very willing group which is RM100, and the lowest amount is RM3. This shows that they can consider if the amount that they need to pay does not burden the consumers. If the amount that they need to pay is higher than they expect, the probability for consumers to change their mind from somewhat willing to not at all willing is higher.

The group of respondents not at all willing stated their reasons why they will not participate if they need to pay the recycling system. The reason stated that they have already committed to many payment and burden to pay extra recycling fee, does not have income and not enough income. They also stated that the mobile phone was bought with a high price and they do not believe with this kind of system as the appointed person will be doing business with the material inside the mobile phone and respondents stated that responsible party would make money from it. Respondents also stated that consumers should get pay with some cash when they recycle their unused mobile phone, getting paid for material inside the mobile phone for refurbishing purpose are better than recycling the unused mobile phone. Respondents also stated that this is still a voluntary program unless the law is amended for such notice.

Most of the consumer wants something that they can get if they recycle their unused mobile phone. Therefore to attract consumers to participate in a recycling program, an incentive was proposed to respondents. Several types of incentive were proposed and what kind of incentive that usually consumers want in exchange for their participation in the recycling program.

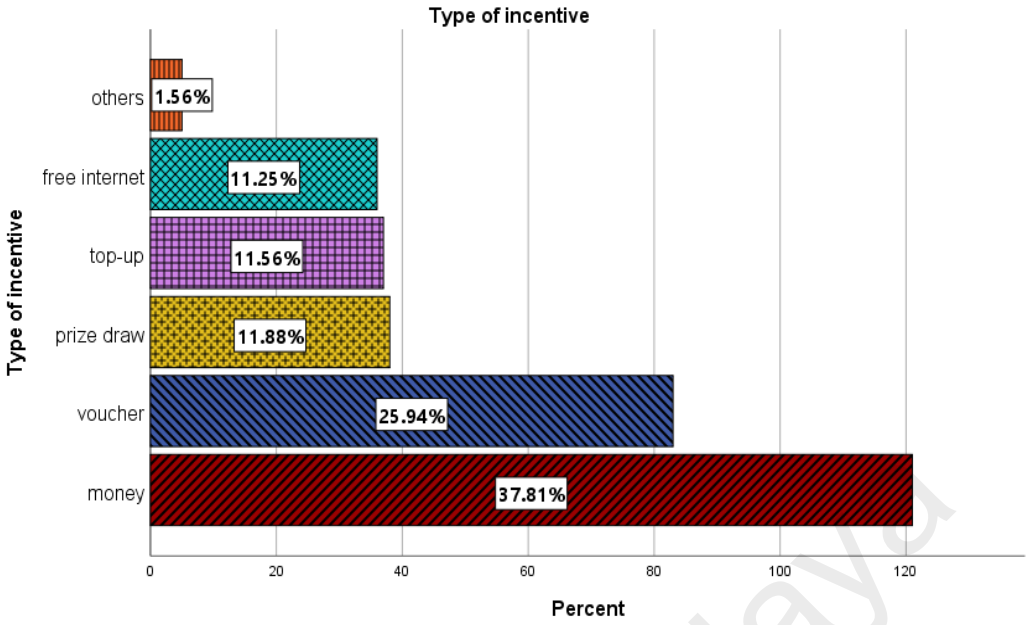

Figure 4.20: Percentage of Type of Incentive

Figure 4.20 shows the result which type of incentive that was preferred by the respondents. Majority of respondents want something that has a value such as money or voucher which shown from the results above that this incentive was selected more by respondents with the percentage of 37.81% for money and 25.94% for the voucher. This is because respondents can use the money or voucher to buy something else. Another type of incentive also prefers by respondents such as mobile phone credit top-up (11.56%), free internet data usage (11.25%), prize draw (11.88%) but not as much as money and voucher incentive.

In summary, government and telecommunication services provide "Mobile E-waste Collection Box", many are not aware of this collection box. When asked whether respondents will use this collection box for their unused mobile phone, more than half of the respondents' are not willing to use the collection box while other groups of respondents are willing but do not have enough time to recycle.

When respondents were asked if there is a take-back program of unused mobile phone, the majority of the consumers are somewhat willing. This result shows that respondents'

willingness are divided between willing and not willing. When proposed about consumers need to pay for the recycling fee, the majority of respondents also somewhat willing to participate. Most respondents stated that the amount is in a range that they can pay.

The group of unwilling respondents stated that paying fee will be a burden to their income as they have another important thing to pay. They also stated that they do not believe with this kind of system as both parties will take profit from this business.

To attract consumers to participate in the recycling program, most of the respondents want the type of incentives such as money and voucher. This is because they buy their unused mobile phone at a high price, and they want some money or voucher when they recycle mobile phone. This shows that they are willing to participate in recycling, but they want something back to as compensation.

4.4 Responsible Shareholder in Recycling Unused Mobile Phones

Recycling waste needs the cooperation of all shareholder from top to consumers. Respondents were asked which shareholder should take responsibility for recycling mobile phone waste.

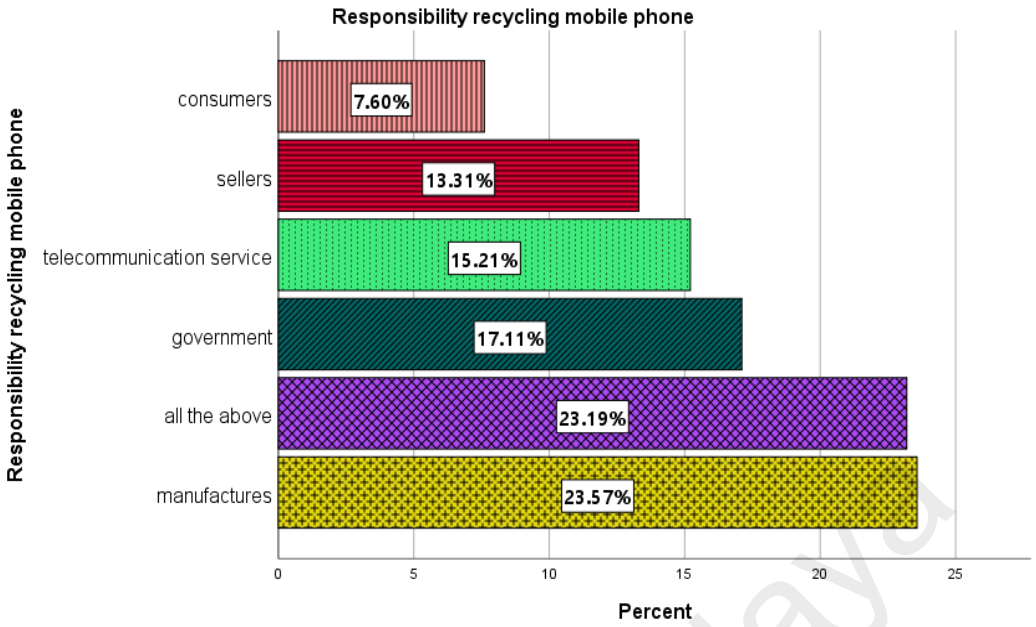

Figure 4.21: Percentage of Responsibility Shareholder in Recycling Waste Mobile Phone

The result from Figure 4.21 shows that most of the respondents think manufactures of producer (23.57%) are responsible for their waste mobile phone products as they produce mobile phones. A group of respondents also think all the above which are telecommunication service, manufacturers or producers, sellers, government and consumers (23.19%) are responsible for recycling waste mobile phone. This group of respondents think that all shareholder is responsible for a recycling program for success.

There is also a group of respondents that think that government, telecommunication service and seller are responsible for the recycling. This is due to the facts that if the government do not amend any law regarding recycling e-waste, the cooperation of all shareholder will not happen. They also think that telecommunication services and seller are responsible because they sell mobile phones to consumers.

Result also shows that most of the respondents' do not think that consumers should take responsibility for recycling the unused mobile phone. Only 7.60% of respondents think that consumers should take responsibility with unused mobile phone recycling.

Mobile phone consumers do not recycle their old mobile phones and always stockpile their mobile phone at home. It shows that the recycling rate is low among mobile phone consumers. When asked, respondents stated that lack of e-waste awareness among consumers is one of the reasons why the rate is low. Respondents were asked whether they think that government, manufacturers or producer, retailers or sellers and telecommunication services should provide information regarding e-waste to consumers. Figure 4.22 shows the result of respondents' answer.

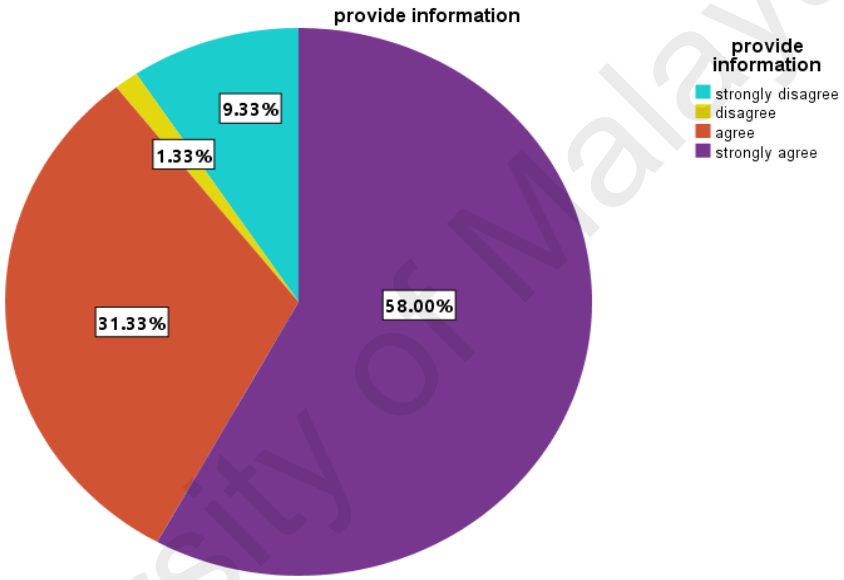

Figure 4.22: Percentage Should Government, Manufacturers, Sellers And Telecommunication Service Should Provide Information.

A majority of total 89.33% of respondents from group of strongly agree (58.00%) and group of agree (31.33%) think that government, manufacturers or producers, sellers or retailers and telecommunication services should provide information regarding mobile phone e-waste such as pros and cons of unused mobile phone, how to recycling the old mobile phone to consumers as they are shareholder that produce and sell the mobile phones.

While a total of 10.66% of respondents from a group of strongly disagree (9.33%) and a group of disagree (1.33%) do not think that government, manufacturers or producer,

sellers or retailers and telecommunication services are responsible in providing information regarding mobile phone waste to consumers.

CHAPTER 5: DISCUSSION

5.1 Consumers Behaviors on Recycling

Nowadays with rapid and advance development of technology, the mobile phone was also upgraded with advanced technology. Therefore mobile phones are called a normal "up-to-date" invention by (Cox, Griffith, Giorgi, & King, 2013). When the mobile phones were equipped with advanced technology, mobile phones have a short-lived service and will be discard before the end of the service life. With this new upgraded feature, consumers usually changing their mobile phones due to the desire for upgrade function. According to the data from the questionnaire, the respondent's mobile phones service life is normally less than four years which is less than the design service life that was investigated by Consumer Technology Association (CTA). According to the CTA CE Product Life Cycle study explore that "mobile phones have a life expectancy at 4.7 years" (Ely, 2014).

According to the respondents, they stated that the old mobile phones were broken or have stopped working properly. However when respondents claimed that they have 1-2 units unused mobile phones at their home. They claimed that this stockpile unused mobile phones were kept as a spare phone rather recycling them when acquire a new mobile phone. This reason indicated that the unused mobile phones were still working which is contradictory from respondents' claim where they stated that they are changing the old mobile phones because it stopped working properly.

Another commonly reason respondents claimed is that they fear disclosed of private information inside the mobile phone. The information can be deleted permanently from the mobile phone. It can be argued that respondents chose this reason to indicating their lack of recycling waste mobile phone.

This both reasons indicate that respondents have personal attachments to the device, so they keep the mobile phones at home. Many mobile phones consumers personalized their mobile phone and there for the personalized mobile phones become the description of style and personality (Cui, Chipchase, & Ichikawa, 2007; Vanden Abeele, Antheunis, & Schouten, 2014), and it will take some time to reduce the attachment and owner willing to part with their mobile phones (Ylä-Mella et al., 2015). During the time for attachment to subside, the owner might not remember about their old mobile phones. Due to the fast advancement in technologies, the spare mobile phones that were kept by the consumers are highly unlikely will be ever used again as the mobile phones are "up-to-date" products. Therefore there are immense resource and energy potential were stored at consumers home, waiting for the unused mobile phones time to end (Bouvier & Wagner, 2011; Polák & Drápalová, 2012; Saphores, Nixon, Ogunseitan, & Shapiro, 2009; Toppila, 2011).

This kind of behaviours needs to be correct. However, beyond correcting this behaviour, it is essential to persuade and advice mobile phone consumers to gather and to recycle their unused mobile phones from their home. The government should make consumers well informed the value of the unused mobile phone that can be retrieve through refurbishment, re-use, material and resource recovery. The government also should compensate the consumers as a motivation for their recycling action.

Another common reason was mention by the respondents are, they clueless where to send the unused mobile phone for recycling. These show that inadequate e-waste recycling information and e-waste recycling collection are the cause they keep mobile phones. The government should provide and apprise consumers the right way of e-waste recycling and provide more recycling place for mobile phone or e-waste.

5.2 Consumers Recycling Awareness

This research revealed that majority of the respondents unaware any information regarding waste mobile phone recycling. Respondents also think that the common reason the low rate in recycling is due to lack of consumers' awareness and lack of information about waste mobile phone recycling. Increased knowledge regarding e-waste and environmental consciousness has been verify to improve general citizen or mobile phone consumers participation in recycling (do Valle, Reis, Menezes, & Rebelo, 2004; Ramayah, Lee, & Lim, 2012; Saphores, Ogunseitan, & Shapiro, 2012; Thomas & Sharp, 2013). In this situation, it is impossible for mobile phone consumers to proper recycling and handling their waste mobile phone.

The research revealed that respondents have a certain degree of awareness regarding the dangerous and hazardous materials, and valuable materials inside mobile phones. It shows that consumers are more informed about the common knowledge of components in mobile phones but less knowledge about waste mobile phone recycling.

As information is essential in enhancing consumers' participation of recycling, the government should provide more information regarding e-waste in a short-term time scale to increase consumers understanding especially about the laws, regulation, and recycling management system guideline. The primary steps to improve consumers recycling awareness is by increasing the education of all public citizen (Song et al., 2012). Since education proves to play a major role in environmental awareness, e-waste management learning should be a prime concern in the e-waste management policy plan.

5.3 Consumers' Willingness to Pay and Participate In Recycling

As most of the respondents lack about e-waste recycling knowledge, their willingness to recycle unused mobile phones are uncertain. The questionnaire result shows that most of the respondents are somewhat willing to take part in the take-back program if it was

organized. This shows that mobile phones consumers have less knowledge regarding the pros when recycling their unused mobile phones. Consumers need some incentive or compensation as motivation for recycling action.

In this study, respondents were asked if they would like to pay for the recycling fee. Only approximately 3.33% of respondents are very willing to pay a recycling fee. Respondents were asked reason to the respondents that are not willing to pay the fee (42.67%). Respondents stated that they bought the mobile phone at a high price. Respondents also stated it is the government duty to provide the waste mobile phone recycling. Some of the respondents also stated it would be a burden on their income as they have a more important thing to pay. Respondents also stated that they are willing to sell their unused mobile phone to the second-hand market at a low price. Others studies also found that some of the respondents that are not willing to pay are willing to sell their unused mobile phone for low price rather pay for mobile phone recycling and treatment (Kalana, 2010; Liu, Li, Zuo, Zhang, & Wang, 2009). The rest of the respondents (54.00%) are somewhat willing to pay the recycling fee if it is in reasonable fee range and it will not burden their disposable income.

Respondents claimed that they want something back when they recycle their unused mobile phone. This is as compensation for their recycling action. Majority of respondents want cash payment of voucher as an incentive for their recycling action. This is expected as respondents would like some of the monetary return as a condition for them to part with their unwanted mobile phones since they can get some money if they sell their unused mobile phones.

Prize draw, free internet usage, and mobile phone credit top-up ranked lowest among the incentives .this kind of incentive is not enough attractive proposition. Money and voucher incentive ranked the top two position respectively. A total of 63.75% of the

respondents prefer this incentive. Previous study also shows that cash payment or voucher is more preferred by consumers rather than any other types of incentives (Ongondo & Williams, 2011).

In developed countries, they applied Extended Producer Responsibility (EPR) in their e-waste management system. The concept of EPR is shared the responsibility of all stakeholder which include collaboration and coordination (Yin et al., 2014). According to developed countries experience, a stable and complete waste mobile phone recycling system require the cooperation of all shareholder including government, manufacturers, retailers, telecommunication services and consumers.

In this study, 23.19% of respondents think it is the responsibility of all shareholder such as government, manufacturers, retailers, telecommunication service and consumers. This show that almost one quarter of respondents are aware that to make the recycling effective, all shareholder are responsible. Almost 8% of respondents think it fully their responsibility. Therefore 30.79% of the respondents are supportive of the recycling program. 69.21% of the respondents thinks it's not their responsibility. This is what we should advice.

5.4 Recommendations That Can Be Implement To Improve Consumers Awareness and Willingness in Recycling

E-waste management detailed process should be taken by the government and some personal levels to avoid some potential problem arise on current waste management in Malaysia. Some improvement is needed to improve the e-waste management system.

Table 5.1: Adaptation that Suitable for Malaysia

Country	Adaptation (suitable for Malaysia)	Possibility Implementation
European Union	EU WEEE Directive: "manufacturers and importers responsible developing e-waste collection and recycling system"	High Cost
Germany	Producers or manufacturers responsible to financially their product waste from consumers	High Cost
United Kingdom, Japan	Establish financial capability to best treatment technology	High Cost
South Korea	Government should prepare a plan for e-waste collection and recycling when there is incremental in product characterization	Moderate Cost
Japan	Establish collection point when recycle the e-waste to reduce probability mixing with ordinary garbage	Moderate Cost
	Establish the facilities near towards consumers to increase consumers' willingness recycle the e-waste	Moderate Cost
Spain	Include the knowledge of e-waste in their primary and secondary education	Intermediate Cost
China	Spread the information about e-waste recycling through all medium such as social media, advertisement, TV, newspaper and radio.	Intermediate Cost

5.4.1 Law and Regulation

The proposed suggestion regarding e-waste regulation should be approached immediately to manage e-waste generated from an individual or household consumers, from business organization and institution. International regulation from developed countries such as EU WEEE Directive and EPR can be applied and alter into national regulation regarding e-waste management system. In the proposed regulation or law, the responsibility and role of stakeholder need to clarify especially the responsibility of product manufacturers and importers. Besides that, the experience from developed countries about their e-waste management system can be learned. Analysing their policy and technical proficiency by analysing the regulation critically. The proposed regulation should state that manufacturers and importers are responsible for developing e-waste

collection and recycling management system. The e-waste management system should be established from financial capability to best available technology like in the United Kingdom or Japan. As personal electronic device such as mobile phones, tablet, laptop are increasing parallel with technology advancement, the scheme for the waste collection and recycling should be prepared by the government like in South Korea where they have regulation for incremental product characterization.

5.4.2 Development of Infrastructural

Recycling facilities are a place where consumers can recycle their e-waste. The convenient collection points should be established for consumers. The e-waste collection point will reduce the probability of e-waste were thrown with ordinary garbage. If the e-waste collection point is near towards consumers, the willingness for consumers to recycle their e-waste is also increased (Sun, Yang, Huisingh, Wang, & Wang, 2015). The collection points may be initiated at the place where consumers usually go such as shopping mall, office area, schools, universities, and hypermarket. The recycling facilities enough supply of e-waste so that the financial flow of the facilities ensures and sufficient (Islam et al., 2016).

5.4.3 Education and Information

As electronic consumers and the general public lack about e-waste information, the government can provide information about proper e-waste recycling to their citizen. The government can organize some campaign, workshop, seminars or project to increase general public knowledge and their level of awareness regarding e-waste recycling. The government can add education regarding e-waste for students from primary level to university level. Therefore it can enhance students' knowledge and environmental awareness. A country like Spain includes the knowledge of e-waste in their primary and secondary education where students are occupied with a small collection, and results

show that recycling and collection rate in Spain was improved remarkably (Solé, Watson, Puig, & Fullana-i-Palmer, 2012; Sun et al., 2015). Spread the information through all medium such as newspaper article, short video advertisement, TV advertisement, and social media can help to create and increase public awareness about e-waste. Previous research shows that residents in China, receive information about Chinese environmental labelling from advertisement, TV, and newspaper (Huang, Zhang, & Deng, 2006).

CHAPTER 6: CONCLUSION

6.1 Conclusion

In conclusion, this research shows that respondents have behaviour to treat their unused mobile phone by stockpile at their home. Respondents have 1-2 units of an unused mobile phone where they keep a spare phone. This is contrary to their reason for changing an old mobile phone to a new mobile phone where respondents claimed that the old mobile phone stopped working properly. This reason indicates that respondents have personal attachments with the daily use electronic device.

Respondents also claimed that they do not have any idea where is the collection point or recycling facilities for e-waste. Lack of collection points in the reason consumers keeping their unused mobile phone at home. Respondents also scared that their information inside the old mobile phone will be disclosed when they recycle their mobile phone. Besides correcting consumers' behaviour, it is important to plan a way to motivate consumers to recycle their stockpiling unused mobile phones and return the mobile phone for recycling.

Research shows that respondents have general knowledge about components and material inside the mobile phone, but they lack knowledge about waste mobile phones recycling. They also realize that the rate of waste in mobile phones recycling is low in Malaysia. Lack of knowledge among electronic consumers will create an impossible situation for proper waste mobile phone recycling and handling.

Information and knowledge are important to enhance and increase consumers' participation in recycling waste mobile phone. The government should provide more information regarding waste mobile phone through all platform of advertising. Education regarding e-waste should become a prime reason for planning the policy.

Respondents are uncertain about participating in the recycling activities as they lack information about the proper treatment of e-waste. However, respondents are somewhat willing to participate in recycling activities. This shows that they are willing to participate if there are some incentive or compensation as a motivation for their recycling action.

Respondents are somewhat willing to pay the recycling fee if the government apply the fee in the e-waste management system. Respondents can pay the fee if it does not affect their current disposable income. Some of the respondents think governments are responsible for providing the recycling system.

Almost half of the respondents do not feel willing to pay the recycling fee and they rather selling their unused mobile phone to second-hand market or informal collector for a low price. Respondents would like some cash payment more than any incentive when they sent their unused mobile phones to recycling.

To make the waste mobile phone recycling success, the collaboration and coordination of all shareholder are important. Developed countries prove that for stable recycling system, government, manufacturers, retailers, telecommunication service and consumers are require to cooperate.

6.2 Future Work

The questionnaire was distributed to respondents to analyse their behaviours on mobile phone treatment and recycling, their awareness regarding recycling unused mobile phone and their willingness to participate. Due to some limitation in resources such as money and time, the questionnaire was distributed through two channel which is face-to-face with respondents and by using an online questionnaire form. Both methods enable to collect a sample containing typical example of all types, but the quality of the collected data was not good. For future research, use a face-to-face interview with respondents and

investigate their willingness in recycling for a different group of respondents. This method will produce high-quality data to be analyse.

Also, use the statistical method and tools in describing the investigate factor more quantitatively. Adding more region and increase the number of the sample so that the data are more quality and valuable to analyse.

REFERENCES

Afroz, R., & Masud, M. M. (2011). Using a contingent valuation approach for improved solid waste management facility: Evidence from Kuala Lumpur, Malaysia. *Waste Management, 31*(4), 800-808. doi: https://doi.org/10.1016/j.wasman.2010.10.028

Afroz, R., Masud, M. M., Akhtar, R., & Duasa, J. B. (2013). Survey and analysis of public knowledge, awareness and willingness to pay in Kuala Lumpur, Malaysia – a case study on household WEEE management. *Journal of Cleaner Production, 52*, 185-193. doi: https://doi.org/10.1016/j.jclepro.2013.02.004

Borthakur, A., & Govind, M. (2017). Emerging trends in consumers' E-waste disposal behaviour and awareness: A worldwide overview with special focus on India. *Resources, Conservation and recycling, 117*, 102-113. doi: https://doi.org/10.1016/j.resconrec.2016.11.011

Bouvier, R., & Wagner, T. (2011). The influence of collection facility attributes on household collection rates of electronic waste: The case of televisions and computer monitors. *Resources, Conservation and recycling, 55*(11), 1051-1059. doi: https://doi.org/10.1016/j.resconrec.2011.05.019

Cox, J., Griffith, S., Giorgi, S., & King, G. (2013). Consumer understanding of product lifetimes. *Resources, Conservation and recycling, 79*, 21-29. doi: https://doi.org/10.1016/j.resconrec.2013.05.003

Cui, Y., Chipchase, J., & Ichikawa, F. (2007). *A Cross Culture Study on Phone Carrying and Physical Personalization*, Berlin, Heidelberg.

de Oliveira, C. R., Bernardes, A. M., & Gerbase, A. E. (2012). Collection and recycling of electronic scrap: A worldwide overview and comparison with the Brazilian situation. *Waste Management, 32*(8), 1592-1610.

do Valle, P. O., Reis, E., Menezes, J., & Rebelo, E. (2004). Behavioral Determinants of Household Recycling Participation:The Portuguese Case. *Environment and Behavior, 36*(4), 505-540. doi: 10.1177/0013916503260892

Dwivedy, M., & Mittal, R. K. (2013). Willingness of residents to participate in e-waste recycling in India. *Environmental Development, 6*, 48-68. doi: https://doi.org/10.1016/j.envdev.2013.03.001

Ely, C. (2014). The Life Expectancy of Electronics. from https://www.cta.tech/News/Blog/Articles/2014/September/The-Life-Expectancy-of-Electronics.aspx

Huang, P., Zhang, X., & Deng, X. (2006). Survey and analysis of public environmental awareness and performance in Ningbo, China: a case study on household electrical and electronic equipment. *Journal of Cleaner Production, 14*(18), 1635-1643. doi: https://doi.org/10.1016/j.jclepro.2006.02.006

Hyunmyung, Y., & Yong-Chul, J. (2006, 8-11 May 2006). *The Practice and Challenges of Electronic Waste Recycling in Korea with Emphasis on Extended Producer*

Responsibility (EPR). Paper presented at the Proceedings of the 2006 IEEE International Symposium on Electronics and the Environment, 2006.

Islam, M. T., Abdullah, A. B., Shahir, S. A., Kalam, M. A., Masjuki, H. H., Shumon, R., & Rashid, M. H. (2016). A public survey on knowledge, awareness, attitude and willingness to pay for WEEE management: Case study in Bangladesh. *Journal of Cleaner Production, 137*, 728-740. doi: https://doi.org/10.1016/j.jclepro.2016.07.111

Jang, Y.-C., & Kim, M. (2010). Management of used & end-of-life mobile phones in Korea: A review. *Resources, Conservation and recycling, 55*(1), 11-19. doi: https://doi.org/10.1016/j.resconrec.2010.07.003

Kalana, J. A. (2010). Electrical and electronic waste management practice by households in Shah Alam, Selangor, Malaysia. *International Journal of Environmental Sciences, 1*(2), 132-144.

Kumar, U., & Singh, D. (2013). E-waste management through regulations. *International Journal of Engineering Inventions, 3*(2), 6-14.

Li, B., Yang, J., Song, X., & Lu, B. (2012). Survey on disposal behaviour and awareness of mobile phones in Chinese university students. *Procedia Environmental Sciences, 16*, 469-476.

Liu, Q., Li, H.-m., Zuo, X.-l., Zhang, F.-f., & Wang, L. (2009). A survey and analysis on public awareness and performance for promoting circular economy in China: A case study from Tianjin. *Journal of Cleaner Production, 17*(2), 265-270. doi: https://doi.org/10.1016/j.jclepro.2008.06.003

Mohd Yusof, M. B., Shah, G., & Muslan, Z. (2015). *Consumers E-Waste Management in Malaysia- A Case Study of Mobile Phone*.

Morris, A., & Metternicht, G. (2016). Assessing effectiveness of WEEE management policy in Australia. *Journal of Environmental Management, 181*, 218-230.

Ongondo, F. O., & Williams, I. D. (2011). Greening academia: Use and disposal of mobile phones among university students. *Waste Management, 31*(7), 1617-1634. doi: https://doi.org/10.1016/j.wasman.2011.01.031

Ongondo, F. O., Williams, I. D., & Cherrett, T. J. (2011). How are WEEE doing? A global review of the management of electrical and electronic wastes. *Waste Management, 31*(4), 714-730. doi: https://doi.org/10.1016/j.wasman.2010.10.023

Osman, N. (2016). *Handling E-Waste in Malaysia: Management, Policies and Strategies*.

Pirolini, A. (2014). The Recycling of Cell Phones. from https://www.azom.com/article.aspx?ArticleID=8012

Polák, M., & Drápalová, L. (2012). Estimation of end of life mobile phones generation: The case study of the Czech Republic. *Waste Management, 32*(8), 1583-1591. doi: https://doi.org/10.1016/j.wasman.2012.03.028

Ramayah, T., Lee, J. W. C., & Lim, S. (2012). Sustaining the environment through recycling: An empirical study. *Journal of Environmental Management, 102*, 141-147. doi: https://doi.org/10.1016/j.jenvman.2012.02.025

Rotter, V. S., Chancerel, P., & Schill, W. P. (2009). *Implementing individual producer responsibility (IPR) under the European WEEE directive-Experiences in Germany.* Paper presented at the 2009 IEEE International Symposium on Sustainable Systems and Technology.

Saphores, J.-D. M., Nixon, H., Ogunseitan, O. A., & Shapiro, A. A. (2009). How much e-waste is there in US basements and attics? Results from a national survey. *Journal of Environmental Management, 90*(11), 3322-3331. doi: https://doi.org/10.1016/j.jenvman.2009.05.008

Saphores, J.-D. M., Ogunseitan, O. A., & Shapiro, A. A. (2012). Willingness to engage in a pro-environmental behavior: An analysis of e-waste recycling based on a national survey of U.S. households. *Resources, Conservation and recycling, 60*, 49-63. doi: https://doi.org/10.1016/j.resconrec.2011.12.003

Shumon, M. R. H., Ahmed, S., & Islam, M. T. (2014). Electronic waste: present status and future perspectives of sustainable management practices in Malaysia. *Environmental earth sciences, 72*(7), 2239-2249.

Silveira, G. T. R., & Chang, S.-Y. (2010). Cell phone recycling experiences in the United States and potential recycling options in Brazil. *Waste Management, 30*(11), 2278-2291. doi: https://doi.org/10.1016/j.wasman.2010.05.011

Sivaramanan, S. (2013). *E-Waste Management, Disposal and Its Impacts on the Environment* (Vol. 2).

Solé, M., Watson, J., Puig, R., & Fullana-i-Palmer, P. (2012). Proposal of a new model to improve the collection of small WEEE: a pilot project for the recovery and recycling of toys. *Waste Management & Research, 30*(11), 1208-1212. doi: 10.1177/0734242x11434563

Song, Q., Wang, Z., & Li, J. (2012). Residents' behaviors, attitudes, and willingness to pay for recycling e-waste in Macau. *Journal of Environmental Management, 106*, 8-16. doi: https://doi.org/10.1016/j.jenvman.2012.03.036

Streicher-Porte, M. (2006, 8-11 May 2006). *SWICO/S.EN.S, the Swiss WEEE recycling systems and best practices from other European systems.* Paper presented at the Proceedings of the 2006 IEEE International Symposium on Electronics and the Environment, 2006.

Suja, F., Abdul Rahman, R., Yusof, A., & Masdar, M. (2014). *e-Waste Management Scenarios in Malaysia* (Vol. 2014).

Sun, M., Yang, X., Huisingh, D., Wang, R., & Wang, Y. (2015). Consumer behavior and perspectives concerning spent household battery collection and recycling in China: a case study. *Journal of Cleaner Production, 107*, 775-785.

Thomas, C., & Sharp, V. (2013). Understanding the normalisation of recycling behaviour and its implications for other pro-environmental behaviours: A review of social norms and recycling. *Resources, Conservation and recycling, 79*, 11-20. doi: https://doi.org/10.1016/j.resconrec.2013.04.010

Toppila, A. (2011). *Waste Flows in Finnish Producer Responsibility System-Case WEEE and Portable Batteries and Accumulators.* Master's Thesis (in Finnish), University of Jyväskylä.

Vanden Abeele, M., Antheunis, M. L., & Schouten, A. P. (2014). Me, myself and my mobile: A segmentation of youths based on their attitudes towards the mobile phone as a status instrument. *Telematics and Informatics, 31*(2), 194-208. doi: https://doi.org/10.1016/j.tele.2013.04.004

Xu, C., Zhang, W., He, W., Li, G., & Huang, J. (2016). The situation of waste mobile phone management in developed countries and development status in China. *Waste Management, 58*(Supplement C), 341-347. doi: https://doi.org/10.1016/j.wasman.2016.08.037

Yin, J., Gao, Y., & Xu, H. (2014). Survey and analysis of consumers' behaviour of waste mobile phone recycling in China. *Journal of Cleaner Production, 65*, 517-525. doi: https://doi.org/10.1016/j.jclepro.2013.10.006

Ylä-Mella, J., Keiski, R. L., & Pongrácz, E. (2015). Electronic waste recovery in Finland: Consumers' perceptions towards recycling and re-use of mobile phones. *Waste Management, 45*(Supplement C), 374-384. doi: https://doi.org/10.1016/j.wasman.2015.02.031

Yoshida, F., & Yoshida, H. (2014). *E-Waste Management in Japan: A Focus on Appliance Recycling* (Vol. 878).

Zhong, H., & Huang, L. (2016). The Empirical Research on the Consumers' Willingness to Participate in E-waste Recycling with a Points Reward System. *Energy Procedia*, *104*, 475-480. doi: https://doi.org/10.1016/j.egypro.2016.12.080