

E-WASTE MANAGEMENT: UUM STUDENTS AWARENESS OF SMARTPHONE RECYLING

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ABSTRACT

Millions of smartphones reach the end of their lives each year, making their responsible management an urgent environmental goal. Cell phone waste will continue to be growing problem as more devices are produced roughly 1.5 billion cell phones were sold worldwide in 2011 alone. The fastest growing segment of this market is smartphones, which grew 62.7% from 2010 to 2011 and now account for nearly a third (32%) of all handsets (IDC2012; Canalys 2012). This study will focused on the ways of UUM students dispose their old smartphone. They are some effect will occur when students not dispose their smartphone in correct manner. These device are tremendous waste challenge because smartphone users replace handsets after an average of only 2 years (Entner 2011; Singhal 2005; Google 2012) and they contain toxic materials. Besides that, the awareness of proper waste management of smartphone will realize the students about the important to dispose their smartphone in the right way without give bad effect to environment and human. From this study also, we are able to know the methods for proper treatment like recycling. This methods is help to reduce the negative effect to environment and human.

Keywords: e-waste management, waste of smartphone, awareness, recycling.

INTRODUCTION

This study begins by providing a background of the study about e-waste management: UUM students awareness of smartphone recycling. Every year new smartphone models come out and people rush to buy it. This situation created a short lifecycle for many consumer electronics and leads to a lot of older models entering the e-waste recycling system.

Millions of smartphone reach the end of their lives each year, making their responsible management an urgent environmental goal. Cell phone waste will continue to be growing problem as more devices are produced roughly 1.5 billion cell phones were sold worldwide in 2011 alone. The fastest growing segment of this market is smartphone, which grew 62.7% from 2010 to 2011 and now account for nearly a third (32%) of all handsets (IDC 2012; Canalys 2012).

This device are tremendous waste challenge because smartphone users replace handsets after an average of only 2 years (Entner2011;Singhal2005;Google2012) and they contain toxic materials such as copper, chromium, and flameretardants (Oiva et al.2000; Lindholm 2003; Huisman 2004). In 2012, only 15% of handsets were projected to be responsibly disposed;

(the vast 2009). However, the versatility of smartphone opens up a variety of creative end-of-life (EoL) strategies that have not been previously exploited.

The changes in technology reflect the development over the hundred years. The changes from landline telephone to smartphone and especially the internet has been a greater advantages for users. Sectors are taking more advantages of the goodness of technological innovation in order to progress in sustainability (Souter,D,2012). In order to increase awareness on environment and human health, recycling of smartphone must be practice by users.

PROBLEM STATEMENT

With many of new brand of smartphone being sold, are users disposing their older smartphone properly. Based to U.S Environmental Protection Agency (EPA) data, estimately 2,440,000 tons electronics such as smartphone were disposed in 2010. This research is being carried out to identify the waste management of smartphone among UUM students. This research will focused on the ways of UUM students diposing their old smartphone. They are some negative effect will occur when student not dispose their smartphone in correct manner. For example, it can give bad effect to environment and to human health. The awareness among UUM students is important to makesure their dispose smartphone correctly. The method of recycling can be practice by students to makesure material of waste smartphone can be reuse.

OBJECTIVE

The aim of this study is to investigate UUM students awareness of smartphone recycling
The objectives are :

- 1) To identify the waste management of smartphone among UUM students.
- 2) To investigate the effect waste of smartphone to environment and human health.
- 3) To recommend UUM students about the awareness of smartphone recyling.

LITERATURE REVIEW

Definition of e-Waste

In terms of popular and informal, electronic waste (e-waste) is loosely refers to any white goods, consumer electronics, and business and information technology hardware are available at the end of its useful life. In particular, Puckett et al define e-waste as "diverse and expanding electronic devices from home appliances such as refrigerators, air conditions, cell phones, personal stereos, and consumer electronics to computers that have been discarded by their users." According to Sinha-Khetriwal, "e-waste can be classified as any electrical appliance authorities have reached end-of-life".

Besides that, the amount of WEEE increase every year and is to be the most critical e-waste issue. United Nation University predict that 20 to 50 tons of e-waste disposal being generated per year (UNEP, 2005). The most e-Waste problem is short lifespan of electronics product. For examples the lifespan of smartphone and computers is less than two years (W.J. Denga, 2006). International Association of Electronics Recyclers reported that with the current growth of many consumer electronics, three bilion units would be dispose by 2010 and average 400 milion units per year.

E-Waste management

Over the past two decades, the global market for electrical and electronic equipment (EEE) continues to increase rapidly, while the shelf life of products become less. Therefore, the waste management business as well as employees face new problems, and e-waste recycling or waste electrical and electronic equipment (WEEE) is receiving a great amount of attention from policy makers. As expected, the number of electrical devices will continue to growth on a global scale, and the microprocessor will be used in increasing numbers in everyday objects (Hilty, 2005).

In 2003, United States has sold less than 80 million communication devices and the amount estimately increase 152 million in 2008 (UNEP, 2009), a growth of over 90 percent in 5 years. Besides that, more 34 million TVs are appear in market, and 24 million of PCs and for portable communication devices is 139 million (Consumer Electronics Association, 2008). In 2009, the total units of electronic devices in European Union (EU) is 3.8 billion units with 265 million computers, estimately 245 million for home consumer electronics and for consumer appliances is 197 million (Euromonitor, 2010). For China, estimately 20 million refrigerators, and approximately 48 million TVs were sold in 2001. For PC, they are 40 million have sold in 2009 (Watts, 2009) and the rate continue to growth. (He, Li, Ma, et al, 2006).

The effect of e-waste management

Comparison with conventional municipal waste, many electronic products contain toxic chemicals that effect human health and environment (Woodell, 2008). As example, television and computer monitors typically contain dangerous materials such as lead, mercury, and cadmium, nickel, beryllium, and zinc that located at circuit board. Because of this thing, recycling and disposal become important issue of electronics waste. Many people in society, not realize the bad effect because of the increase of monitors, computers, and smartphone.

When these products are put into landfills, it can cause problems to human health because of the harzadous materials. Environment also will polluted because of wrong e-waste management of electronics product. The increase of e-waste placed in landfills, exposure to environmental toxins is expected to rise, can cause to a high risk of cancer and neurological disorders.

Health Impacts

Electronic devices have many dangerous substances included lead, cadium, beryllium and brominated flame-retardants. The 60% of the materials is including iron, aluminium, gold, copper. 30% is plastics materials and harzadous materials is 2.70%. (Widmer, 2004). Lead is the most used in electronic devices and very dangerous to environment and human health. Lead can effect human heath through water, soil, air, and food (Jang YC,2003). Lead enters body systems via food, water, air, and soil. Children is most easily affected by lead poisoning because they absorb more lead than adult that can give problem to blood and nervous system.

According to UNEP, 2009 electronic devices such as smartphone contain more than 40 hazardous components. E-waste is more dangerous compare to others waste because it contain lots of harzadous elements such as antimony, cadmium, mercury, lead beryllium and lead. This elements can effect human heath such as kidney, nervous system, bones, and reproductive systems.

Women who are pregnant and living in the area of recycling will develop health problems than women who live far away recycling site. Such is the impact on women will be affected by neurotoxicants fetuses exposed in soil, water, and air. For example, if the water they drink comes from contaminated sources, it will affect those who consume it, including pregnant women.

Neurodevelopmental deficits are an important concern when analyse exposure to e-waste toxicants because children living in e-waste recycling society may have been effect to high-levels of toxicant mixtures in their life. In addition, the toxicant body-load can be more with infants and young children because they have relatively low body weight (Pronczuk de Garbino 2004). Growth of fetuses and small children are at critical windows of neuronal growth, differentiation, migration, and myelination, which can increase the harmful effects of exposure. Problems in fine-tuned processes in human neurodevelopment can have detrimental effects (Dietrich 2010).

Recycling of e-waste

When it comes to e-waste, recycling faces several difficulty, including those pertaining to hazardous materials such as CRT glass and find a market for flame-retardant plastic. In additions, none of technology now appear to recycle certain EEE with efficiently. In the United States, the US EPA estimates three-quarters of the computers sold in storage in garages and closets. When disposed, they either through it in landfills or exported to Asia.

More than 2 million tons of e-waste was manage in the United States alone (US EPA), but only 17 to 18 per cent of that product have been collected for recycling. The others, more than 80 percent, have been disposed, especially in the local landfill. Hazardous chemicals in e-waste can leach out of land and into groundwater and rivers, and if plastic substances are burned, dioxins emitted to air. Next, it is estimated that 50-80 percent of e-waste taken for recycling in the United States actually for exported, even though it is not legal for many country to accept it. Most of this waste will be traded illegally informal recycling sector in the countries of Asia and West Africa, where it is disposed of using old and toxic technologies. Cost also is another major issue for e-waste management. The logistic and trasport cost is very high that must faced of recycled.

Smartphone recycling

Smartphone waste is very dangerous to environment and human health because it contain toxic. A research has shown that smartphone can effect human to get cancer. The hazardous substances in smartphone can pollute air, land, and water. Hence, it its important to decrease pollution that comes from smartphone waste. The major problems in the smartphone waste management are redesign of smartphone and accessories to reuse it, recycling and reduce harzadous chemical in the devices (Nnorom and Osibanjo 2008). Development of awareness that keep used smartphone out of the waste stream and collecting and recycling (Kim, Hwang et al. 2009). Waste management of smartphone need to be proper manner to reduce environmental effect and human heath. If the waste management is not proper, it will release toxic to environment (Bigum, 2012).

METHODOLOGY

To complete the study, quantitative techniques are used. Questionnaires were used to respondent. Furthermore, another method is to have a reference in the library. For examples sources of books, journals, newspapers and internet. At the beginning discusses the design of

the study, followed by sampling and sampling techniques. The second part discusses flow chart, followed by the method and procedures for data collection. Next, the data will be analyzed and a summary is made about it.

Design Review

The study design can be divided into two. First is a design study used a qualitative approach. Second is the design of the study using a quantitative approach. While the data is divided into two, that is primary data and secondary data. In this study, quantitative approach used to prepare a questionnaire to the respondents. According to (Mojahed, 2005) descriptive data collected through various ways such as through questionnaires, interviews or observations. In this study, primary data and secondary data were used. For part of the primary data, it be done by giving online questionnaires to the respondents. It aims to obtain information on students awareness of e-waste management of smartphone recycling. The questionnaire can specify different information from respondents.

In addition, a questionnaire was used to assess the medium of study. The questionnaire is an indirect way to collect data over the respondents. In the questionnaire, respondents were given the time to think before they answer and can reveal his identity or keeping it secret. According to (Altschuld, 1995) questionnaire is an easy way to get information about a research. The questionnaire was designed to meet the information required by the study. It can provide important information such as analysis, evaluation tool that measures the outlook for each respondent

The advantage of using questionnaires in collecting data:

- Respondents were able to choose their own answers because the answers have a scale such as strongly agree, agree, moderate or strongly disagree.
- The questionnaire is quite fast because it uses language that is easily understood by respondents and respondents did not need a long time to complete it.
- Questionnaires are generally low validity because they do not explore questions in any detail or depth.
- Researchers can contact the respondent them quickly and widely because the questionnaires have been identified the target groups in the research.
- Complex issues which require a respondent to explain their reasons for believing something are difficult to explore using this method.
- Closed questions are used the respondent is restricted to answering questions using the categories provided by the researcher. There is little or no scope for the respondent to qualify the meaning of their answers.

Research Population

This study was conducted to identify the UUM students awareness on recycling smartphone. Based on the scope of the project, the population of this study consisted of diverse students studying in UUM. For example, undergraduate student are randomly choose to become respondents in this research.

Research samples and sampling techniques

Research subjects discussed in detail the UUM students awareness on smartphone recycling. The respondents were undergraduate students of UUM from various semesters. A total of 65 respondents were randomly selected and given questionnaires to collect data. Base on Lindner, Murphy and Briers (2001), a proposal to ensure that the number of late respondents

are large enough to be practical and meaningful statistics, the minimum number of respondents through to is 50 respondents.

LIMITATION OF STUDY

They are some limitation to face during to complete this project research:

- **Time constraint**
To make a good research paper, we must have enough time to gather information on that research. The researcher are given within 3 month to complete the research. This duration make researcher have limits time to complete the research.
- **Limited references in UUM library**
UUM library do not have enough references. Thats make researcher to find other resources to gain more informations. Reseacher need to explore more in the other library such as University Sains Malaysia Library.
- **Commitment of respondents**
To complete this research, some total of respondents must be gather. Respondents are given a online questionnaire for data collection. The respondent are from UUM students, but some of students not give feedback on this survey.

FINDINGS

Ways UUM students manage their old smartphone

	STRONGLY DISAGREE	DISAGREE	MODERATE	AGREE	STRONGLY AGREE	Total	Weighted Average
I will recycle my old smartphone	1.54% 1	29.23% 19	33.85% 22	29.23% 19	6.15% 4	65	3.09
I will returned it to smartphone company	13.85% 9	38.46% 25	23.08% 15	21.54% 14	3.08% 2	65	2.62
I will sell it to someone other than family or friends	7.69% 5	20.00% 13	29.23% 19	32.31% 21	10.77% 7	65	3.18
I will store my old smartphone	7.81% 5	7.81% 5	23.44% 15	31.25% 20	29.69% 19	64	3.67
I will give my old smartphone to a friend or relative	6.25% 4	28.13% 18	25.00% 16	28.13% 18	12.50% 8	64	3.13
I will donate my old smartphone	12.31% 8	32.31% 21	30.77% 20	16.92% 11	7.69% 5	65	2.75
I will repairs my old smartphone	4.62% 3	16.92% 11	27.69% 18	33.85% 22	16.92% 11	65	3.42
I will through it into garbage	29.23% 19	36.92% 24	18.46% 12	13.85% 9	1.54% 1	65	2.22

Impact of smartphone disposal

	STRONGLY DISAGREE	DISAGREE	MODERATE	AGREE	STRONGLY AGREE	Total	Weighted Average
I know that some components of electronic devices contain toxic/hazardous materials	1.54% 1	10.77% 7	16.92% 11	49.23% 32	21.54% 14	65	3.78
I know these materials can pollute the air and contaminate soil and drinking water	3.08% 2	12.31% 8	21.54% 14	46.15% 30	16.92% 11	65	3.62
I know that mobile phone coatings are normally made of lead, a toxic chemical that can cause adverse health effects when exposed to it at high levels	4.62% 3	9.23% 6	24.62% 16	36.92% 24	24.62% 16	65	3.68
I know smartphones and accessories contain concentrations of toxic heavy metals or other metals	1.56% 1	14.06% 9	20.31% 13	48.44% 31	15.63% 10	64	3.63
I know chemicals in smartphone are associated with a range of adverse human health effects	3.08% 2	7.69% 5	26.15% 17	43.08% 28	20.00% 13	65	3.69
Dumping mobile phones creates long term pollution risk to the environment	0.00% 0	9.23% 6	24.62% 16	50.77% 33	15.38% 10	65	3.72
I know that making new cell phones to replace these old ones is carbon-intensive	0.00% 0	9.52% 6	39.68% 25	42.86% 27	7.94% 5	63	3.49
I know that material in smartphone can cause cancer	6.15% 4	7.69% 5	24.62% 16	41.54% 27	20.00% 13	65	3.62

Awareness of smartphone recycling

	STRONGLY DISAGREE	DISAGREE	MODERATE	AGREE	STRONGLY AGREE	Total	Weighted Average
I concerned about my environment	3.08% 2	4.62% 3	12.31% 8	50.77% 33	29.23% 19	65	3.98
I aware that mobile phones contain precious metals and plastics that can be recycled to save energy and resources	1.54% 1	9.23% 6	21.54% 14	46.15% 30	21.54% 14	65	3.77
I aware of any government regulation on e-waste management	4.62% 3	7.69% 5	30.77% 20	40.00% 26	16.92% 11	65	3.57
I will support smartphone recycling programs	3.13% 2	4.69% 3	21.88% 14	40.63% 26	29.69% 19	64	3.89
I will encourage everyone to take the social responsibility in making recycling a benefit for everyone	3.08% 2	6.15% 4	20.00% 13	44.62% 29	26.15% 17	65	3.85
I will slow down and use my smartphone for longer	3.08% 2	9.23% 6	18.46% 12	52.31% 34	16.92% 11	65	3.71
I will support e-Waste legislation stated by government	3.08% 2	6.15% 4	20.00% 13	50.77% 33	20.00% 13	65	3.78
I will keep the environment in mind when disposing of mobile devices	1.54% 1	7.69% 5	18.46% 12	53.85% 35	18.46% 12	65	3.80

SUGGESTION FOR FURTHER STUDY

In the present research, the researcher conducted their study on the student of UUM STML. For improving the awareness should be modified according to strategy and various campaign, workshop should be arranged in a regular interval and also arranged the campaign. Further study could be extended in term of area and number samples of the study.

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