KNOWLEDGE LEVEL AND ATTITUDE OF MOBILE PHONE RECYCLING PRACTICE AMONG UPM STUDENTS

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ABSTRACT

On average, mobile phone users change their mobile phones every eighteen months. The management of electronic waste has become an environmental concern in many developing countries as urbanization continues to take place. As a consequence, there is an increase in the waste associated to this product, and many alternatives to the disposal of the mobile phones are being studied, such as recycling. Due to this scenario, this study was conducted in University Putra Malaysia (UPM), Serdang, Selangor. The main purpose of this study is to measure the knowledge level and attitude of mobile phone recycling and how its influence mobile phone recycling practice among UPM students. The sample consisted of 120 undergraduates from 3 chosen faculties in UPM which were chosen by using systematic random method. Then, respondents were randomly chosen from the 3 chosen faculties. Information on knowledge level and attitude towards mobile phone recycling and also mobile phone disposal practice was collected using structured questionnaires. From this study, significant relationship was found only between gender and attitude towards mobile phone recycling ($t = 0.757$, $p < 0.05$) where females were more likely to have positive attitude towards mobile phone recycling. But there was no significant relationship between gender and knowledge level in mobile phone recycling. Results also showed that there were no significant relationship between faculties and knowledge level in mobile phone recycling; between faculties and attitude towards mobile phone recycling; between students' knowledge level and mobile phone recycling practice; between students' attitude and mobile phone recycling practice. The collection and recycling of mobile phones is still at an early stage in Malaysia. The methods and infrastructure for collection and recycling process for mobile phone recycling have not yet been established. Government should put more effort in promoting mobile phone recycling, adding more collection points and take back centers where consumers can drop off their unwanted mobile phones. Producers, consumers, mobile telecommunication companies, and government should work together cause to succeed mobile phone recycling practice in Malaysia.

Keywords: *Knowledge Level, Attitude, Recycling, Mobile Phone Waste*

ABSTRAK

Secara purata, pengguna telefon bimbit menukar telefon bimbit mereka setiap

keprihatinan di kebanyakan negara-negara membangun di mana negara-neagara ini sedang mengalami pembandaran yang pesat. Sebagai akibatnya, peningkatan sisa telefon bimbit telah meningkat dan banyak alternatif pembuangan telefon bimbit telah diteliti, seperti kitar semula telefon bimbit. Berikutan inilah kajian ini dijalankan di Universiti Putra Malaysia (UPM), Serdang, Selangor. Tujuan utama kajian ini adalah untuk mengukur tahap pengetahuan dan sikap kitar semula telefon bimbit dalam kalangan pelajar UPM dan bagaimana tahap pengetahuan dan sikap mempengaruhi amalan kitar semula telefon bimbit dalam kalangan pelajar UPM. Sampel kajian terdiri daripada 120 mahasiswa dan mahasiswi dari tiga fakulti yang dipilih secara rawak sistematik dalam UPM. Seterusnya, responden dipilih secara rawak daripada tiga fakulti yang dipilih. Maklumat tentang tahap pengetahuan dan sikap terhadap kitar semula telefon bimbit dan juga amalan pembuangan telefon bimbit telah dikumpulkan dengan menggunakan borang soal selidik. Daripada kajian ini, hasil kajian menunjukkan terdapat hubungan yang signifikan di antara jantina dan sikap pengguna terhadap kitar semula telefon bimbit ($t = 0.757$, $p < 0.05$) di mana wanita lebih cenderung mempunyai sikap yang positif terhadap kitar semula telefon bimbit tetapi tidak terdapat hubungan signifikan di antara jantina dan tahap pengetahuan kitar semula telefon bimbit. Hasil kajian juga menunjukkan tidak terdapat hubungan signifikan di antara fakulti dan tahap pengetahuan kitar semula telefon bimbit; di antara fakulti dan sikap pengguna terhadap kitar semula telefon bimbit; di antara tahap pengetahuan pelajar dan amalan kitar semula telefon bimbit; di antara sikap pelajar dan amalan kitar semula telefon bimbit. Pengumpulan dan kitar semula telefon bimbit di Malaysia masih berada pada peringkat awal. Kaedah dan infrastruktur pengumpulan dan proses kitar semula telefon bimbit didapati masih lagi belum begitu berkembang. Oleh itu, kerajaan harus bersungguh-sungguh dalam mempromosi kitar semula telefon bimbit, menambah lebih banyak lokasi pengumpulan dan menyediakan pusat pengumpulan tertentu di mana pengguna dapat membuang telefon bimbit yang tidak diingini mereka. Diharapkan pengeluar, pengguna, syarikat telekomunikasi selular dan kerajaan perlu bekerjasama untuk menjayakan amalan kitar semula telefon bimbit di Malaysia.

Kata Kunci: *Tahap Pengetahuan, Sikap, Kitar Semula, Sisa Telefon Bimbit*

INTRODUCTION

Along with globalization, sustainability has become a popular term from local to global. Sustainability is the ability to be maintained at a certain rate or level (Oxford English Dictionary, 2011). Sustainable development which means development that meets the needs of the present without compromising the ability of future generations to meet their own needs was introduced in Brundtland Report 1987

by United Nations. Sustainable development and recycling are closely related and cannot be separated. Recycling involves processing used materials (waste) into new products to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution and water pollution by reducing the need for conventional waste disposal, and lower greenhouse gas emissions as compared to virgin production. Commonly recyclable materials include many kinds of glass, paper, metal, plastic, textiles and electronics. Although these are common recyclable materials but some of them cannot be recycled. Example for glass criteria, beverages bottles and food jars can be recycled but window glass and light bulbs cannot be recycled. Another example is paper criteria, newspaper and office paper can be recycled but waxed paper and tissue paper cannot be recycled. Materials to be recycled are collected from a collections centre or picked up from the curbside, then sorted, cleaned and reprocessed into new materials bound for manufacturing.

According to the Malaysian Department of Environment (DOE, 2010), e-waste is defined as waste from the assembly of electrical or electronic appliances that consist of components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl.

A mobile phone (also called mobile, cellular phone, cell phone or hand phone) is an electronic device which allows its user to make and receive telephone calls. The first generation of mobile phone was demonstrated by Martin Cooper of Motorola in 1973, using a handset weighing in two kilos. Nowadays, mobile phone is typically weigh handy and has become an important part of daily lives in the general population because it is a very efficient tool for in communication. At the same time, advancement in mobile phones have developed rapidly to satisfy a variety of users' requirements such as taking pictures, as a radio, gaming and other additional functions. The use of mobile phones has grown exponentially from the first few users in the 1970s to 4.6 billion in 2007 (ITU, 2009).

The first generation mobile phone was large and heavy; they contained lead acid batteries and weighed over 4kg. However, mobile phones are smaller and lighter since 1980s. Today mobile phone is typically weigh more or less 100g (without battery), and are powered by a small battery (average weight of 23g). A mobile phone contains 500 – 1000 components and most of them are toxic and hazardous if the mobile phones at their end-of-life are inappropriately managed. For example, it has been reported that the amount of cadmium from one mobile phone battery is sufficient to pollute 600,000 liters of water (Nnorom, Ohakwe & Osibanjo, 2009).

Proper disposal of mobile phones is a major issue due to the fact that millions of people produce mountains of mobile phone waste. Mobile phones components contain many toxic chemicals that can seep into ground and contaminate both the soil and water sources. Mobile phones often contain mercury, which can be very harmful to the environment when thrown away. In addition, mobile phones and their components are usually made of non-biodegradable elements that will take up previous landfill space forever. According to Department of Environment (DOE, 2010), the importance of mobile phone recycling is to extend life duration of dumpsite, reduce demand for natural resources, and to give opportunity for new industries. Recycling e-waste is not only good for the environment but also for the manufacturing industry. It helps industry reduce the need to create or mine raw materials for new products, which also reduces manufacturing costs. There are currently a few ways in which we can dispose of mobile phones. The first would be to donate the unwanted mobile phone. It would be donated to them who need a mobile phone. The second option would be to sell the unwanted mobile phone at one of the many mobile recycling sites or mobile phone recycling centers which will pay users an amount of money for recycling their mobile phones. Many people prefer the second option as they can get paid for their actions and they could spend the money on purchasing a new mobile phone. But, still there are many of us keeping unwanted mobile phone in drawer or just throw it into rubbish bin which ended up in the landfills.

Extended Producer Responsibility (EPR) was implemented in Europe widely. EPR is defined as an environmental protection strategy that makes the manufacturer of the product responsible for the entire life cycle of the product and especially for the take back, recycling and final disposal of the product (Lindhqvist, 2000). Sometimes known as manufacturer take back or product stewardship (Lifset, 1993), the EPR movement began in Europe.

Today the electronic waste recycling business is in all areas of the developed world a large and rapidly consolidating business. Electronic waste processing systems have matured in recent years, following increased regulatory, public, and commercial scrutiny, and a commensurate increase in entrepreneurial interest. For most of us, that unwanted mobile phone kept in house is definitely worthless. But to an electronic recycler, it is quite literally as precious as gold. There is gold inside mobile phones, as well as other electronics. Being an excellent conductor of electricity and also resistant to corrosion, the metal is commonly used in communication equipment such as mobile phones.

In Malaysia, there is an e-waste recycling plant in Seberang Prai, Penang - TES-AMM (Malaysia) Sdn. Bhd. There are a few steps to go through

for recycling mobile phone. The first step of recycling e-waste is collecting the waste. Next is weighing and separating. Then, dismantling where the separated items are stripped down to even smaller components and categorizing them into a "waste stream" consisting of plastic, ferrous metal, electronic scraps and so on. The fourth step is crushing, electronic parts that contain traces of precious metals are crushed into powder form. And then is the most important part of the entire recycling process - chemical process where gold is extracted from the waste. The final process is gold smelting which is making the gold bar process.

TES-AMM (Malaysia) Sdn. Bhd. deputy managing director John Ashok[1] told that the circuit boards had a small amount of gold along with other metals like silver, copper, palladium, and platinum. However, it takes between 50,000 and 60,000 mobile phones or about three tones of mobile phone PCBs to make 1kg of 99.99% pure gold, which are sold to industrial buyers. He also said that mobile phones accounted for only a small percentage of surplus and obsolete electronics processed at the factory. He said Malaysians were less savvy in electronics recycling compared to developed countries like Japan and Korea.

[1]The Star, 29 September 2010. Recycle is the key word. Retrieved on 14, August 2010 from http://thestar.com.my/metro/story.asp?file=/2010/9/29/north/7121177&sec=north

LITERATURE REVIEW

Mobile Phone Recycling

In Malaysia, Nokia has launched a recycling initiative by placing kiosks in busy shopping malls. The kiosks both collect old phones to be recycled and act as a convenient, automated facility for customers to drop-in their old mobile phones.

Besides that, Department of Environment (DOE) has been conducting the recycling of mobile phone batteries since 2002. Although some users understand the importance of recycling of used mobile phones but at the same time most of them don't know how they should do. Under the above understanding, Sony is planning to provide more information on the recycling of mobile phones to users through Web and press advertising because awareness-raising are important to implement mobile phone recycling effectively.

About 16% (by weight) of a typical mobile phone is considered 'high value' materials. For example, 1 tone of electronic circuit boards yields about the same amount of gold as 110 tons of gold ore. Industry-led take-back schemes have existed in Asia-Pacific, Europe and the USA since the late 1990s and predate legislative requirements. There are now provisions for the collection of used phones

in more than 80 countries around the world. In countries without a strong tradition of recycling, the number of intact phones returned is likely to be small unless there is substantial investment in awareness raising and infrastructure. A survey done in 2008 which consists of 6,500 people in 13 countries reported that 44% kept their old phone, 25% gave it to friends or family, 16% sold their used phone, 4% are thrown into landfill and only 3% are recycled.

According to Mobile's Green Manifesto (2009), when it comes to mobile phone take-back, refurbishment and reuse, which extend the life of the product, are clearly preferential to recycling. On average, more than 70% of collected handsets from developed countries could be refurbished. However, take-back rates are low as research shows that old mobile phones are typically kept by users or dumped in landfills sites.

Knowledge Level

The review carried out by Thomas (2001) found that *'recyclers were generally found to be more aware of publicity and more knowledgeable about recycling with non-recyclers more concerned about incentives to recycle and convenience'.*

Most of research concerning battery disposal were survey research. For instance, Robinson & Read (2005) had surveyed household waste disposal behavior in London, England, and found that waste disposal behavior in between year 2003 to 2004 were below local targets, due to insufficient public knowledge and understanding of waste disposal.

Maycox (2003), as cited in Rawshan *et al.* (2009) demonstrated that understanding behavior is critical to minimizing municipal solid waste, but there are very significant barriers, such as a lack of knowledge among the general public as well as social norms that adversely affect waste practices. The complex link between environmental attitudes and environmental actions is emphasized. As a result, a conceptual framework was produced with three predictors of behavior which are environmental values, situational characteristics and psychological factors (Barr *et al.*, 2001 as cited in Rawshan et al., 2009). The research showed that recycling behavior is influenced by convenience, knowledge and access to a curbside scheme, whereas waste minimization behavior is driven more by a concern about environmental issues. While results from attitude and behavioral factors in waste management in the construction industry of Malaysia showed that contractor attitudes towards waste management are more positive if a contractor's employees have a higher level of construction-related education.

According to Nnorom, Ohakwe & Osibanjo (2009), less knowledge of the toxicity of e-waste and the dangers of inappropriate recycling techniques is considered the primary barriers in e-waste recycling.

A contextual psychological model for proper disposal of used batteries by identifying key variables of behaviors of used batteries disposal, i.e. knowledge on proper disposal of batteries, attitude toward ecological waste disposal, rationale for involvement in battery disposal, and individual methods of battery disposal –e.g. a special place for storage of used batteries at home. From the tested model, revealed that respondents' specific knowledge on proper disposal of used batteries correlates positively with proper disposal of used batteries is created (Hansmann *et al.*, 2006). Hansmann et al., 2006 also discussed that specific knowledge and rationale for battery disposal have a more closely correlated relationship to battery disposal behaviors compared with general psychological variables.

Results of the research done by Oraphin *et al.* (2009) which compared safe mobile phone usage behaviors and intent on proper mobile-phone battery disposal among sample groups of different biosocial characteristics mostly supported hypothesis #1: non-student mobile phone users have more proper mobile phone usage behaviors and more intention on proper mobile phone battery disposal than those mobile phone users who are students. The characteristics of sample groups were that of the non-student mobile phone users group, most are highly educated –bachelor degree or higher, and most are civil service or state-enterprise officers. This is possibly due to the fact that individuals with higher education tend to possess higher knowledge and understanding of proper and safe mobile phone-battery usage, as well as knowledge of proper mobile phone-battery disposal, than students with less knowledge and understanding of such matters. This research result also supported hypothesis #2: higher-age mobile phone users have higher proper mobile phone usage behaviors and intention on proper mobile phone-battery disposal. Non-students are also of higher average ages than students. And from additional analysis by the researchers, it was found that the higher-age group has more knowledge of mobile phone usage than the lower-age group; resulting in a higher level of proper mobile phone usage and more intention on proper mobile phone-battery disposal.

Survey done by Junaidah (2010) showed that 57% of the respondents are knowledgeable about e-waste and the rest have no idea on what e-waste entails (43%). Most of the respondents do not know the proper ways of disposing their e-waste. This explains why they tend to store e-waste in their houses or premises and to throw away the waste with other general wastes. It has also been determined that most of the respondents in Malaysia kept their e-waste because there is no information on how to dispose of the e-waste appropriately.

Previous research showed that there is a recycling knowledge gap among the segments of the University community on what to recycle, where to recycle and how to recycle (Kaplowitz *et al.*, 2009; Kelly *et al.*, 2006; McDonald and Oates, 2003 as cited in Zhang et al., 2011)

Attitude

Relevant specific attitudes have consistently been found to correlate with recycling behavior. Research findings regarding the relationship between attitudes and recycling behaviors had been generally consistent with attitude-behavior theories (Schultz *et al.*, 1995).

Darby & Obara (2005) found that people were still lacking awareness on disposal of small appliances, unconcerned, disregarded and discounted this matter; and considered it easy to dispose small appliances, unable to identify specific small-appliance disposal methods. Unlike the disposal of large or major appliances, on which people were more concerned and able to identify specific disposal methods.

Hansmann et al. (2006) proposed a contextual psychological model for proper disposal of used batteries by identifying critical variables of behaviors of used batteries disposal, i.e. knowledge on proper disposal of batteries, attitude toward ecological waste disposal, rationale for involvement in battery disposal, and individual methods of battery disposal –e.g. a special place for storage of used batteries at home. Of psychological variables, attitude toward ecological waste disposal may have indirect influence on battery disposal behaviors.

Pro-recycling attitude is the main contributor to recycling behavior (Tonglet *et al.*, 2004 as cited in Martin, Williams & Clerk, 2006).

One of the general conclusion from Vicente & Reis (2008) is that households participate in recycling because: (a) of their conviction that recycling is the personal responsibility of each person – 'I feel an obligation to recycle', 'I feel bad if I do not recycle', and (b) of their positive attitudes towards recycling – 'recycling is a major way of reducing pollution', 'recycling is a major way of preserving natural resources'. When there is a strong conviction both about the benefits of recycling and the responsibility of cooperating, incentives are of minor importance, especially those of a material or moral nature.

Oraphin et *al.*, (2009) revealed the group that discarding their mobile phone batteries along with other garbage had low intention on proper mobile-phone battery disposal, low attitude toward proper mobile-phone battery disposal, low mobile phone-battery knowledge, but high external motivation on mobile phone battery disposal.

Attitudes toward waste reduction are one of the causes for difficulties in waste management in the construction industry. Contractors who follow source reduction measures or practices tend to have more positive attitudes toward

waste management. Contractors who follow reuse and recycling practices have more positive attitudes toward waste management as compared to whom they do not (Teo & Loosemore, 2001 as cited in Rawshan *et al.*, 2009). Findings also showed that contractors that have positive attitudes toward waste management also have satisfactory behaviors, supporting Ajzen's theory of planned behavior (Ajzen, 1991). However, this study showed that contractor attitudes toward waste management significantly affect contractor behaviors regarding waste management.

Attitudes may influence behavior and in turn, be influenced by it. It is thought that attitudes are concealed and not directly observable in themselves, but they cause actions and behaviors that are observable and so prompt pro-environmental behavior (Lawrence et al., 2009).

Gender

Schultz et al. (1995) reported that women appear more likely to recycle, but Gamba & Oskamp (1994) and Werner & Makela (1998) detected no relationship between gender and recycling. The other studies that studied the relationship between gender and recycling were unanimous in finding no significant relationship (Webster, 1975; Vining & Ebreo, 1990; Hopper & Nielson, 1991). Thus, men and women are equally likely to recycle.

Darby & Obara (2005) indicated that men are more likely to visit civic amenity (CA) sites than women (10% more of the male respondents stated this than women). But, this trend changes for those women that recycle regularly that are as likely as men to visit CA sites. This difference could be linked to the fact that women who recycle regularly are more aware of the recycling provision at CA sites and so consequently they are more likely to visit CA sites for this purpose. Those women who do not recycle regularly may be unaware of the recycling facilities at CA sites as they do not require them, and so do not have a need to visit such sites.

Besides that, (Kelly *et al.*, 2006) also found that there was no significant relationship between on-campus recycling behavior and gender while studying university community responses to on-campus resource recycling.

Oraphin et *al.* (2009) pointed out that research results that not fully supported hypothesis of differences between male and female, about which this research found difference only on safe mobile phone usage behaviors: the non-student female group has higher safe mobile phone usage behaviors than male. In other groups, no differences between genders were found. This showed that only

working women are more careful about safe mobile phone usage than working men; but among male and female students, mobile phone usage behaviors are similar, and intention on proper mobile phone-battery disposal are alike.

Recycling Practice

Several empirical studies showed that recycling behavior is influenced by the attitudes of individuals towards recycling. Attitudes on the importance of recycling and the belief about the convenience of recycling practice were also studied and identified as determinants of recycling participation (Vining & Ebreo, 1990; McCarty & Shrum, 2001 as cited in Vicente & Reis, 2008).

Any effort at achieving a sustainable resource and waste management practice will also require a more responsible behavior by producers and consumers (Nnorom *et al.*, 2009).

OBJECTIVES

The aim of this study is to measure the knowledge level and attitude of mobile phone recycling and how its influence mobile phone recycling practice among UPM students.

This can be achieved by the following specific objectives:

1. To identify the difference between students' socio-demographic (gender and faculty) and knowledge level in mobile phone recycling.
2. To identify the difference between students' socio-demographic (gender and faculty) and attitude towards mobile phone recycling.
3. To measure students' knowledge level in mobile phone recycling.
4. To measure students' attitude towards mobile phone recycling.
5. To examine the correlation of students' knowledge level and attitude towards mobile phone recycling practice.

Hypothesis

H01: There is no significant difference between gender and knowledge level in mobile phone recycling.

H02: There is no significant difference between gender and attitude towards mobile phone recycling.

H03: There is no significant difference between faculties and knowledge level in mobile phone recycling.

H04: There is no significant difference between faculties and attitude towards mobile phone recycling.

H05: There is no significant correlation between students' knowledge level and mobile phone recycling practice.

H06: There is no significant correlation between students' attitude and mobile phone recycling practice.

INSTRUMENT

A structured questionnaire survey was used to collect data by asking targeted respondents who was willing to answer the questionnaire. The survey questionnaire was given to 40 respondents from each chosen faculty (FEM, FSKTM and FBSB). This survey questionnaire has four main sections:

I. Respondent's background
II. Respondent's knowledge level of mobile phone recycling
III. Respondent's attitude towards mobile phone recycling
IV. Respondent's mobile phone recycling practice

Section I had 10 questions which collected respondents' general information such as gender, race, and faculty and other basic information. In section II, there were 9 questions which gathered the respondents' knowledge level of mobile phone recycling data using 2 options which was Yes or No. In section III, there were 11 questions which gathered information about respondents' attitude towards mobile phone recycling by using 5-point Likert Scale. 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree. In section IV, there were 10 questions which accessed the information about respondents' mobile phone recycling practice by giving them 3 options to choose which were 1 = Never, 2 = Once and 3 = More than once.

Data Analysis

Data analysis was performed by using Statistical Package for Social Science (SPSS) Version 16.0 application program. T-test was used to analyze the difference between gender's knowledge level and mobile phone recycling. T-test was also used to analyze the difference between gender's attitude and mobile phone recycling. One-way ANOVA was used to analyze the difference between faculties and knowledge level in mobile phone recycling. One-way ANOVA was also used to analyze the difference between faculties and attitude towards mobile phone recycling. Pearson Correlation was used to analyze the correlation between students' knowledge level and mobile phone recycling. Pearson Correlation was also used to analyze the correlation between students' attitude and mobile phone recycling practice.

RESULTS AND DISCUSSION

H01: There is no significant difference between gender and knowledge level in mobile phone recycling

Table 1: Difference Between Gender And Knowledge Level In Mobile Phone Recycling (n=120)

Variables	n	Mean	Standard Deviation	t	p
				0.332	0.370
Gender :					
Female	60	6.8667	1.35880		
Male	60	7.0833	1.27946		

Note: $p > 0.05$

Table 1 showed the result of independent samples t-test which analyzed the difference between gender and knowledge level in mobile phone recycling. Mean for female and male is 6.8667 and 7.0833; standard deviation for female and male is 1.35880 and 1.27946. From the table, $t = 0.332$ and $p = 0.370$. When $p > 0.05$, the variance for two groups are the same.

As a conclusion from this analysis, independent samples t-test was used to compare the mean for two groups of subjects. Result showed that there is no significant difference between gender and knowledge level in mobile phone recycling as ($t = 0.332$, $p = 0.370$ where $p > 0.05$). Therefore, H01 is not successfully rejected. This also showed that there is no significant difference in knowledge level and mobile phone recycling for female and male.

H02: There is no significant difference between gender and attitude towards mobile phone recycling.

Table 2: Difference Between Gender And Attitude Towards Mobile Phone Recycling (n=120)

Variables	n	Mean	Standard Deviation	t	p
				0.757	0.002
Gender :					
Female	60	40.7833	6.99174		
Male	60	36.7333	6.72931		

Note: $p < 0.05$

Table 2 showed the result of independent samples t-test which analyzed the difference between gender and attitude towards mobile phone recycling. Mean for female and male is 40.7833 and 36.7333; standard deviation for female and male is 6.99174 and 6.72931. From the table, $t = 0.757$ and $p = 0.002$. When $p < 0.05$, this showed that there is a significant difference in the mean scores for each of the two groups.

As a conclusion from this analysis, independent samples t-test was used to compare the mean scores for two groups of subjects. Result showed that there is significant difference between gender and attitude towards mobile phone recycling practice as ($t = 0.757$, $p = 0.002$ where $p < 0.05$). Therefore, H02 is successfully rejected. This also showed that there is significant difference in attitude and mobile phone recycling practice for female and male. The result of study showed that female have more positive attitude towards mobile phone recycling. This result supported by Schultz et al. (1995) who reported that women appear more likely to recycle.

H03: There is no significant difference between faculties and knowledge level in mobile phone recycling.

Table 3: Difference Between Faculties And Knowledge Level In Mobile Phone Recycling (n=120)

Variables	Mean	Standard Deviation	F	P
			0.057	0.945
Faculty :				
FEM	6.9250	1.38467		
FSKTM	7.0250	1.25038		
FBSB	6.9750	1.34903		

Note: $p > 0.05$

Table 3 showed the result of one-way ANOVA test which analyzed difference between faculties and knowledge level in mobile phone recycling. FSKTM get the highest mean (7.0250) with standard deviation 1.25038. Mean for FEM and FBSB is 6.9250 with standard deviation 1.38476 and 6.9750 with standard deviation 1.34903 respectively.

As a conclusion from this analysis, one-way ANOVA test was used to compare the mean scores for three or more groups of subjects. Result showed that there is no significant difference between faculties and knowledge level in mobile phone recycling as ($F = 0.057$, $p = 0.945$ where $p > 0.05$). Therefore, H03 is not successfully rejected. This also showed that there is no significant difference

H04: There is no significant difference between faculties and attitude towards mobile phone recycling.

Table 4: Difference Between Faculties And Attitude Towards Mobile Phone Recycling (n=120)

Variables	Mean	Standard Deviation	F	P
			1.664	0.194
Faculty :				
FEM	39.8750	6.71465		
FSKTM	39.2750	7.04923		
FBSB	37.1250	7.48396		

Note: $p > 0.05$

Table 4 showed the result of one-way ANOVA test which analyzed difference between faculties and attitude towards mobile phone recycling. FEM get the highest mean (39.8750) with standard deviation 6.71465 follow by FSKTM which have mean (39.2750) with standard deviation 7.04923. For FBSB, mean is 37.1250 and standard deviation is 7.48396.

Based on this analysis, result showed that there is no significant difference between faculties and attitude towards mobile phone recycling as ($F = 1.664$, $p = 0.194$ where $p > 0.05$). Therefore, H04 is not successfully rejected. This also showed that there is no significant difference between faculties and attitude towards mobile phone recycling.

H05: There is no significant correlation between students' knowledge level and mobile phone recycling practice

Table 5: Correlation Between Students' Knowledge Level And Mobile Phone Recycling Practice (n=120)

Variables	Pearson Correlation (r)	P
Knowledge Level	0.089	0.333

Note: $p > 0.05$

Table 5 showed the result of Pearson Correlation which analyzed correlation between students' knowledge level and mobile phone recycling practice. From the Table, $r = 0.089$ which means there is a positive correlation between knowledge level and practice. Student who had high knowledge level in mobile phone recycling, bring to high involvement in mobile phone recycling. P value (Significant 2-tailed) for correlation between students' knowledge level

and mobile phone recycling practice is 0.333 ($p = 0.333$) while significant level is $p < 0.05$. This showed that there is no significant correlation between students' knowledge level and mobile phone recycling practice. Therefore, H05 is not successfully rejected. The result of study not supporting the research done by Robinson & Read (2008) and Nnorom *et al.* (2009) which claimed that insufficient public knowledge and understanding of waste disposal causes inappropriate e-waste disposal practice.

H06: There is no significant correlation between students' attitude and mobile phone recycling practice

Table 6: Correlation Between Students' Attitude And Mobile Phone Recycling Practice (n=120)

Variables	Pearson Correlation (r)	P
Attitude	- 0.013	0.886

Note: $p > 0.05$

Table 6 showed the result of Pearson Correlation which analyzed correlation between students' attitude and mobile phone recycling practice. From the Table, $r = - 0.013$ which means there is a negative correlation between attitude and practice. Student who had positive attitude in mobile phone recycling, do not bring to high involvement in mobile phone recycling. P value (Significant 2-tailed) for correlation between students' attitude and mobile phone recycling practice is 0.886 ($p = 0.886$) while significant level is $p < 0.05$. This showed that there is no significant correlation between students' attitude and mobile phone recycling practice. Therefore, H06 is not successfully rejected. The result of study not supporting the research done by Tonglet et al. (2004) which stated that pro-recycling attitude is the main contributor to recycling behavior. The other studies that studied the relationship between attitude and recycling were unanimous in finding significant relationship (Schultz *et al.*, 1995; Hansmann *et al.*, 2006; Vicente & Reis, 2008; Oraphin *et al.*, 2009).

CONCLUSION

This study presents an overview of knowledge level and attitude towards mobile phone recycling practice among UPM students. The behavior of UPM students (as representatives of young people and consumers in Malaysia) with regard to their knowledge level in mobile phone recycling, attitude towards mobile phone recycling and disposal of mobile phone has been evaluated. Mobile phone recycling represents one attempt to reduce the amount of mobile phone trash

sampling method was used. From the listed 15 faculties in UPM, every 5th faculty was chosen. The 3 chosen faculties were Faculty of Human Ecology (FEM), Faculty of Computer Science and Information Technology (FSKTM), Faculty of Biotechnology and Biomolecular Sciences (FBSB) respectively. A structured questionnaire survey was used to collect data by asking targeted respondents who was willing to answer the questionnaire. Data analysis (T-test, ANOVA and Pearson Correlation) was performed by using Statistical Package for Social Science (SPSS) Version 16.0 application program.

From this study, result showed that there is no significant difference between gender and knowledge level in mobile phone recycling as ($t = 0.332$, $p = 0.370$ where $p > 0.05$). Result also showed that there is no significant difference between faculties and knowledge level in mobile phone recycling as ($F = 0.057$, $p = 0.945$ where $p > 0.05$). So, there is no significant difference between students' socio-demographic (gender and faculty) and knowledge level in mobile phone recycling.

Result showed that there is significant difference between gender and attitude towards mobile phone recycling practice as ($t = 0.757$, $p = 0.002$ where $p < 0.05$). The result of study showed that female have more positive attitude towards mobile phone recycling. This result is supported by Schultz *et al.* (1995) who reported that women appear more likely to recycle. Result showed that there is no significant difference between faculties and attitude towards mobile phone recycling as ($F = 1.664$, $p = 0.194$ where $p > 0.05$). So, there is significant difference between gender and attitude towards mobile phone recycling but there is no significant difference between faculty and attitude towards mobile phone recycling.

Only 1 respondent was low in knowledge level of mobile phone recycling. Most respondents, 101 of them had moderate knowledge level of mobile phone recycling. The remaining 18 respondents had high knowledge level of mobile phone recycling. This showed that UPM students mostly had knowledge and information about mobile phone recycling but not high enough.

There were only 1 respondent had positive attitude towards mobile phone recycling but 2 respondents had negative attitude towards mobile phone recycling. 117 respondents had moderate attitude towards mobile phone recycling. This showed that UPM students mostly do not have positive attitude towards mobile phone recycling and remain indifferent.

The result of study not supporting the research done by Robinson & Read (2005) and Nnorom *et al.* (2009) which claimed that insufficient

public knowledge and understanding of waste disposal causes inappropriate e-waste disposal practice. But result from this study showed that there is no significant correlation between students' knowledge level and mobile phone recycling practice.

The result of study not supporting the research done by Tonglet *et al.* (2004) which stated that pro-recycling attitude is the main contributor to recycling behavior. The other studies that studied the relationship between attitude and recycling were unanimous in finding significant relationship (Schultz *et al.*, 1995; Hansmann *et al.*, 2006; Vicente & Reis, 2008; Oraphin *et al.*, 2009). But result from this study showed that there is no significant correlation between students' attitude and mobile phone recycling practice.

Implication of the study, the collection and recycling of mobile phones is still at an early stage in Malaysia. The methods and infrastructure for collection and recycling process for mobile phone recycling have not yet been established. Government should put more effort in promoting mobile phone recycling, adding more collection points and take back centers where consumers can drop off their unwanted mobile phones. Producers, consumers, mobile telecommunication companies, and government should work together to promote mobile phone recycling in Malaysia.

REFERENCES

Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179 – 211.

Barr, S., Gilg, W. A. & Ford, N. J. 2001. Differences between household waste reduction, reuse and recycling behavior: A study of reported behaviors, intention and explanatory variables. *Journal Environmental and Waste Management,* 4(2),

Darby, L. & Obara, L. 2005. Household recycling behavior and attitudes towards the disposal of small electrical and electronic equipment. *Journal of Resources, Conservation and Recycling,* 44, 17 – 35.

Department of Environment. 2010. Recycling Campaign Mobile Phone. Retrieved on August, 14, 2010 from http://www.doe.gov.my/portal/education-awareness-on-environment%2%80%93public-and-industry/recycling-campaign-mobile-phone-english-ver/

Gamba, R., & Oskamp, S. 1994. Factors influencing community residents' participation in commingled curbside recycling programs. *Environment*

Hansmann, R., Bernasconi, P., Smieszek, T., Loukopoulos, P. & Scholz, R.W. 2006. Justification and self-organization as determinants of recycling behavior: The case of used batteries. *Journal of Resources, Conservation and Recycling,* 47, 133 – 159.

Hopper, J. & Nielson, J. M. 1991. Recycling as ahruistic behavior: normative and behavioral strategies to expand participation in a community recycling program. *Environment and Behavior,* 23,195 – 220.

International Telecommunication Union (ITU). Information and communication technology statistics 2009. Retrieved on August, 14, 2010 from http:// www.itu.int/itd-d/icteye/reporting/indicators.

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

Kaplowitz, M.D., Yeboah, F.K., Thorp, L. & Wilson, A.M., 2009. Garnering input for recycling communication strategies at a Big Ten University. Resources, Conservation and Recycling, 53 (11), 612–623.

Kelly, T.C., Mason, I.G., Leiss, M.W. & Ganesh, S. 2006. University community responses to on-campus resource recycling. *Journal of Resources, Conservation and Recycling,* 47, 42 – 55.

Lawrence, O.M., Jane, P., Paul, S.P. & Roy, F. 2009. Assessing public attitudes and behavior to household waste management in Cameroon to drive strategy development: A Q methodological approach. *Sustainability,* 1,556-572.

Lifset, R.J. 1993. Take it back: extended producer responsibility as a form of incentive-based environmental policy. *Journal of Resource Management and Technology,* 21(4), 163 – 172.

Lindhqvist, T. 2000. Extended Producer Responsibility in Cleaner Production. The International Institute for Industrial Environmental Economics. Lund University, Lund, Sweden.

Martin, M., Williams, I.D. & Clark, M. 2006. Social, cultural and structural influences on household waste recycling: A case study. *Journal of Resources, Conservation and Recycling,* 48, 357 – 395.

Maycox, A. 2003. The village initiative project: achieving household waste minimization in the rural locale. Chartered Institution of Wastes Management (CIWM): *Scientific and Technical Review,* 4, 10–7.

McCarty, J. A. & Shrum, L. J. 2001. The influence of individualism, collectivism and locus of control on environmental beliefs and behavior. *Journal of Public Policy and Marketing,* 20, 93.

Mobile's Green Manifesto. 2009. Retrieved on August, 14, 2010 from GSM World: http://www.gsmworld.com/documents/mobiles_green_manifesto_11_09.pdf

Nnorom, I.C. & Osibanjo, O. 2005. Overview of electronic waste (e-waste) management practices and legislation, and their poor applications in the developing countries. *Journal of Resources, Conservation and Recycling,* 52, 843 – 858.

Nnorom, I.C., Ohakwe, J. & Osibanjo, O. 2009. Survey of willingness of residents to participate in electronic waste recycling in Nigeria – A case study of mobile phone recycling. *Journal of Cleaner Production,* 17, 1629 – 1637.

Oraphin, C., Wiladlak, C., Ashara, S., Pannee, B., Manat, B. & Tasana, T. 2009. Survey of Thais' monile phone-battery usage and disposal. *The Journal of Behavioral Science,* 4(1), 28 – 43.

Oxford English Dictionary. 2011. Oxford University Press.

Rawshan, A.B., Chamhuri, S., Joy, J.P. & Abdul Hamid, J. 2009. Attitude and behavioral factors in waste management construction industry of Malaysia. *Journal of Resources, Conservation and Recycling,* 53, 321 – 328.

Robinson, G.M. & Read, A.D. 2005. Recycling behavior in a London Borough: Results from large-scale household surveys. *Journal of Resources, Conservation and Recycling,* 45, 70 – 83.

Schultz, P.W., Oskamp, S. & Mainieri, T. 1995. Who recycles and when? A review of personal and situational factors. *Journal of Environmental Psychology,* 15, 105-121.

Shaw, P.J. & Maynard, S.J. 2007. The potential of financial incentives to enhance householders' kerbside recycling behavior. *Waste Management,* 28, 1732 – 1741.

Thomas C. 2001. Public understanding and its effect on recycling performance in Hampshire and Milton Keynes. *Resource, Conservation & Recycling,* 32, 59 – 74.

Tonglet, Michele, Phillips, Paul S., Read & Adam D. 2004. Using the theory of planned behaviour to investigate the determinants of recycling behaviour: a case study from Brixworth, UK. *Resources, Conservation and Recycling,* 41, 191 – 214.

Vicente, P. & Reis, E. 2008. Factors influencing household's participation in recycling. *Waste management and research,* 26, 140 – 146.

Vining, J. & Ebreo, A. 1990. What make a recycler? A comparison of recyclers and nonrecyclers. *Environment and Behavior,* 22, 56 – 73.

Webster, F. 1975. Determining the characteristics of the socially conscious consumer. *Journal of Consumer Research,* 2, 188 – 196.

Werner, C., & Makela, E. 1998. Motivations and behaviors that support recycling, *Journal of Environmental Psychology,* 18(4), 373 – 386.

Zhang, N., Williams, I.D., Kemp, S. & Smith, N.F. 2011. Greening academia: Developing sustainable waste management at Higher Education Institutions. *Waste Management,* 31(7), 1606 – 1616.

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