DETERMINANTS OF MOBILE PHONE WASTE RECYCLING AND END-OF-LIFE MANAGEMENT IN JOHOR

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DEDICATION

To my beloved mother and father.

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ABSTRACT

Growing development in the telecommunications industry, along with frequent purchases, upgrading and increased ownership of mobile phones (MPs) have indirectly contributed to the global increase in e-waste generation, along with future pile-ups of used MP units and accessories. An improper end-of-life (EOL) management of MPs further exacerbated environmental degradation associated with their hazardous waste components. The increasing number of new MP purchases and service subscriptions, especially in Johor had made it relevant to study how the MP usage trend and its EOL management amongst consumers and sellers could affect future stockpiling and e-waste disposal. This study also analyzed the urban and non-urban respondents' willingness to pay (WTP) for a green MP or participate (WTPar) in a recycling program as well as their opinions on MP-related policy and recycling facilities. It involved a randomly selected sample of 1200 MP users and 110 sellers around urban Johor Bahru and non-urban areas (i.e., Muar and Kota Tinggi). Mean comparison or analysis of variance (ANOVA), bivariate analysis, and linear regression were used to determine associations between socio-economic background and purchasing activity as well as willingness-to-participate in a recycling program between the groups. Results indicated that on average, urban consumers chose price in making purchases, owned more MP units and kept them as spares, thus implying the stockpiling problem. Based on Kendall's tau coefficient, willingness to participate in a recycling program and pay more for a green MP differed according to socio-economic and locational factors (i.e., $p < 0.01$ or significant at 99% confident level). Majority, especially the non-urban respondents, were highly supportive of incentives and rebates, along with improved accessibilities and increased number of recycling facilities in promoting a more sustainable EOL management of MPs. The study provides a new insight in integrating locational and socio-economic factors, as well as MP usage, pricing, purchasing behavior, and convenience with current and future MP's EOL management system and policy framework.

ABSTRAK

Pertumbuhan industri telekomunikasi berserta kekerapan pembelian, penambahbaikan, dan peningkatan pemilikan telefon bimbit (MP) secara tidak langsung menyumbang kepada penambahan penjanaan e-sisa secara global serta pelonggokan MP dan aksesori terpakai. Pengurusan selepas jangka hayat (EOL) yang tidak mapan menambah pencemaran alam sekitar disebabkan kandungan komponen sisa berbahaya MP. Peningkatan jumlah pembelian MP baru dan pendaftaran servis, terutamanya di Johor menjadikan kajian mengenai bagaimana trend penggunaan MP dan pengurusan EOL di kalangan pengguna dan penjual menambah masalah pelonggokan dan pembuangan e-sisa di masa akan datang lebih relevan. Kajian ini turut menganalisa kesanggupan responden dari bandar dan luar bandar membeli (WTP) MP hijau dan melibatkan diri dalam program kitar semula (WTPar), serta pendapat mereka terhadap polisi berkaitan MP dan fasiliti kitar semula. Kajian melibatkan 1200 pengguna dan 110 penjual MP yang dipilih secara rawak. di sekitar bandar Johor Bahru, dan kawasan luar bandar (i.e., Muar dan Kota Tinggi). Kaedah analisa varian (ANOVA), *bivariate*, dan regresi linear digunakan untuk menentukan hubung kait antara latar belakang sosio-ekonomi kedua kumpulan responden dan aktiviti pembelian, serta kesediaan mereka untuk melibatkan diri dalam program kitar semula. Hasil kajian mendapati responden kawasan bandaraya mementingkan harga dalam pembelian dan memiliki lebih banyak unit MP yang menyebabkan masalah pelonggokan. Berdasarkan pekali Kendall tau, penglibatan dalam program kitar semula dan kesanggupan membayar lebih untuk MP 'hijau' berbeza mengikut faktor sosio-ekonomi dan lokasi responden (i.e., $p < 0.01$ atau signifikan pada tahap kepercayaan 99%). Majoriti di kalangan responden luar bandar menyokong pemberian insentif dan rebat serta kemudah sampaian dan penambahan fasiliti kitar semula dalam menggalakkan pengurusan EOL MP yang lebih mapan. Kajian ini memberikan wawasan baru dengan mengambil kira faktor lokasi, sosio-ekonomi, penggunaan MP, harga, dan tabiat pembelian serta keselesaan fasiliti dalam membentuk rangka polisi dan sistem pengurusan EOL MP sedia ada dan di masa hadapan.

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LIST OF ABBREVIATIONS

A	-	Agree
ABI	-	Allied Business Intelligence, Inc.
Ag	-	Argentum or silver
Al	-	Aluminium
AMTA	-	Australian Mobile Telecommunications Association
ANOVA	-	Analysis of variance
ASPs	-	Average selling prices
Asymp.	-	Asymptotic significance (2-tailed)
Au	-	Aurum or gold
BAN	-	Basel Action Network
BAT	-	Best available techniques
BATs	-	Best Available Technologies
Be	-	Beryllium
BEP	-	Best environmental practices
CBD	-	Central Business District
CCD	-	Charge-coupled device
CO_2	-	Carbon dioxide
CRT	-	Cathode Ray Tube
Cu	-	Cuprum or copper
CVM	-	Contingent Valuation Method
CWTA	-	Canadian Wireless Telecommunications Association
D	-	Disagree
DEFRA	-	Department for Environment, Food and Rural Affairs
DNSWM	-	Department of National Solid Waste Management
DO	-	Dining out or Drop off
DOE	-	Department of Environment

E	-	Electronics
Ed	-	Education
EE	-	Environmental education
EOL	-	End-Of-Life
EPA	-	Environmental Protection Agency (USA)
EPR	-	Extended producer responsibilities
ESRI	-	Economic and Social Research Social Research Institute
EU	-	European Union
FB	-	Facebook
Fe	-	Ferum or iron
FS	-	Family size
G	-	Gender
GPRS	-	General Packet Radio Service
HDPE	-	High-density polyethylene
IDC	-	International Data Corporation
iOS	-	iPhone operating system
IQR	-	Interquartile range
ISWA	-	International Solid Waste Association
ITC	-	Information and Communication Technology
ITU	-	International Telecommunication Union (ITU)
JB	-	Johor Bahru
JICA	-	Japan International Cooperation Agency
JPSPN	-	*Jabatan Pengurusan Sisa Pepejal Negara* (National Solid Waste Management Department)
LCA	-	Life Cycle Assessment
LCD	-	Liquid crystal display
LDPE	-	Low-density polyethylene
LF	-	Lack of recycling facilities
Li-Ion	-	Lithium-ion
LLC	-	Local Liaison Committee
KMO	-	Kaiser–Meyer–Olkin or Measure of Sampling Adequacy
KPKT	-	*Kementerian Perumahan dan Kerajaan Tempatan* or Ministry of Housing and Local Government
KT	-	Kota Tinggi

MCMC	-	Malaysian Communications and Multimedia Commission
MDKT	-	*Majlis Daerah Kota Tinggi* or Kota Tinggi District Council
MHLG	-	Ministry of Housing and Local Government
MMS	-	Multimedia Messaging Service
Mn	-	Manganese
MOeF	-	Ministry of Environment and Forests
MP	-	Mobile phone
MPM	-	*Majlis Perbandaran Muar (Muar City Council)*
Mt	-	Metric ton
MWW	-	Mann–Whitney–Wilcoxon (or Mann–Whitney U test)
N	-	Neutral
NBI	-	National Broadband Initiative
NGO	-	Non-governmental organization
Ni	-	Nickel
Ni-Cd	-	Nickel-cadmium
Ni-MH	-	Nickel-metal hydride
NSWMD	-	National Solid Waste Management Department
NZ	-	New Zealand
OECD	-	Organisation for Economic Co-operation and Development
OEWG	-	Open-Ended Working Group
PASW	-	Predictive Analytics Software
PAYT	-	Pay-as-you-throw
Pb	-	Plumbum or lead
PC	-	Personal computer
PCB		Printed circuit board
Pd	-	Palladium
PBT	-	*Pihak Berkuasa Tempatan* (Local Authority)
PET	--	Polyethylene terephthalate
PM	-	Particulate Matter
PPKAS	-	*Peraturan-Peraturan Kualiti Alam Sekitar*
ppm	-	Parts per million
PPSPA	-	Solid Waste Management and Public Cleansing
PVC	-	Poly (vinyl chloride),
Pvt. Ltd.	-	Private Limited

PWB	-	Printed Wiring Board
PWD	-	Printed wiring boards
RERA	-	Responsible Electronics Recycling Act of 2013
RIHED	-	Regional Institute of Higher Education and Development
RM	-	Ringgit Malaysia
RoHS	-	Restrictions on Hazardous Substances
RRR	-	Reuse, recycling and refurbishing
RS	-	Retail shop
S	-	*Setuju* or Agree
SA	-	Strongly agree
SC	-	Satisfactory campaign
SD	-	Strongly disagree or Standard deviation
SEM	-	Structural Equation Modelling
Sig.	-	Significant
SMS	-	Short messaging services
Sn	-	Selenium
SPSS	-	Statistical Packages for Social Sciences
SS	-	*Sangat setuju* or strongly agree
Std.	-	Standard
STS	-	*Sangat tidak setuju* or strongly disagree
SW	-	Scheduled waste
SWM	-	Southern Waste Management Environment Pvt. Ltd.
SWCorp	-	Solid Waste Corporation
TEC	-	Total Environment Center
TPB	-	Theory of Planned Behavior
UDA	-	Urban Development Authority
UNEP	-	United Nations Environment Programme
UK	-	United Kingdom
USA	-	The United States of America
USD	-	United States Dollar
W	-	Total daily residential waste (kg/household/day)
WEEE	-	Waste Electrical and Electronic Equipment
WTP	-	Willingness-to-pay
WTPar	=	Willingness to participate

LIST OF SYMBOLS

&	-	And
β	-	Beta
ai	-	constant that represent i value
$	-	Dollar
df	-	Degree of freedom
=	- -	Equals to
f	-	Frequency or function of
F	-	F-distribution is a particular parametrization of the beta prime distribution also called the beta distribution.
gm	-	gram
<	-	Less than
≤	-	Less or equal to
H_a	-	Alternative hypothesis
H_0	-	Null hypothesis
K	-	Number of items in scale
Kg	-	kilograms
n	-	Number of data items in sample
p	-	Level of significance
$\bar{x}$	-	Mean of all values in data sample
>	-	More than
μ	-	Mu
≠	-	Not equal to
N	-	Number of population
%	-	Percent
π	-	Pi
Q2	-	Second quarter

$\boldsymbol{R^2}$	-	Multiple correlation coefficient
$\sum$	-	Sigma or sum of
r	-	Correlation coefficient
3R	-	Reduce, reuse, and recycle
r_s or ρ	-	Spearman ‘s rho Correlation
σ	-	Standard deviation for variance,
Σx	-	Sum of all data items
t-test	-	Test of significance
U	-	Value for Mann-Whitney-Wilcoxon (or Mann–Whitney U test)
x	-	Each value in the data sample
x_i	-	Variable that represent the respondent frequency from i
S_i^2	-	Variance of item *i*
S_p^2	-	Variance of total score

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Prior to exploring a certain issue and problem, underlying determinant variables or contributing factors to identify scope, and methods to be used needs to be analyzed in the study. This chapter discusses the background of the problem, as well as aim and objectives of the study. It later discusses in general, the scope of study, methodology and the study's contribution to knowledge especially in the area of mobile phone-related e-waste. It is very relevant as currently there is a shortage of related data base; lack of attention on behavioral approach, as well as a lack of qualitative study on the topic.

The growing global development in telecommunication and advancement in mobile phone (MP) technology along with changing trends amongst consumers had consequently contributed to the global increase in e-waste, as well as environmental threats associated with the disposal of the units. Competition has made phone makers to produce latest and better phone models, as well introduced promotions for new units with better applications which triggered users to change or purchase a new mobile phone. Consumers nowadays insist on better technology to meet the current trends and needs. Shorter service life of mobile phones of one year or less than three years due to trend or fashion and the need or habit to upgrade to latest functions further exacerbate the problem (Yin, Gao and Xu (2013), Polák and Drápalová (2012); Ongondo and Williams (2011a); and Ha *et al.* (2008).

The wasted mobile phone parts, considered as Waste Electrical and Electronic Equipment or WEEE contain hazardous electrically-powered components. The technological development of mobile phones has been dynamic since the earlier Qwerty system to current smartphones. (Chen, 2015). This has led to an increase in the volume of potentially hazardous waste materials. Globally, it has been estimated that around 20-50 million tonnes of e-waste were generated annually, most of which originated Asian countries (Herat and Agamuthu, 2012). Within a thirty year period, 5 billion out of the total 7 billion people in the world used mobile phones. In the United States alone, 300,000 mobile phones were disposed daily in the trash (Leyla, 2013).

As far as the e-waste from mobile phones are concerned, Malaysia has also experienced the advancement in electronic communication industry, along with the increase in users, thus stock piles of old and unused units. Out of the 700,000 tonnes of e-waste generated by households, mobile phones contributed to the one of the largest proportion of the Waste Electrical and Electronic Equipment (WEEE) (Ho *et al.*, 2015). The continuous improvement in economic status, as well as the status symbol attached to up-scale and branded mobile phones have increased the WEEE generation. According to e-Marketer report in 2014, the number of smartphone users (excluding older models) in the world has reached 1.63 billion (Hiong, 2015) and the figure continues to increase.

According to a recent study, almost one hundred million mobile phones are replaced each year. Even in Malaysia, its usage has been increasing while landline telephone coverage is decreasing. The Malaysian Communications and Multimedia Commission (MCMC), an organization responsible with the monitoring of mobile phone registration, reported that the number of subscriptions in Malaysia (units purchased) increased four times to 43.3 million in 2014 (MCMC, 2015a) from 11.12 million in 2003 (Bernama, 2008). The figure was 30.3 million in 2010 (MCMC, 2010), with a penetration rate of about 144.2 per 100 inhabitants, due to multiple subscriptions. The study area of Johor State took up quite a large percentage of 156.7%. Majority (62.3%) of the Malaysian subscribers were urban, while 37.7% rural users. As for the service provider Maxis alone, i.e., a leading service provider in 2012, it had total of 13.8 million subscriptions (New Straits Times, 2012).

Proper mobile phones' waste management in developing countries was said to be lacking. According to Gartner (2015), only 3% of the consumers recycled their old phones. The same issue goes to Malaysians MP users. The recycling of unused mobile phone in Malaysia can be improved. According to Agamuthu and Tanaka (2014), only 20 percent of Malaysians were aware of the e-waste and mobile phone recycling. As far as mobile phone in the State of Johore is concerned, only three companies including Shan Poornam Pvt. Ltd. were involved in the take back scheme, making it necessary for a study to be done to improve the facilities (Department of Environment, 2016).

Since the inception of the recycling campaigns in late 2013, organized by the MCMC, only less than 3,000 units of the millions of mobile e-waste were collected for proper treatment indicating a very low level of proper e-waste disposal (the Star, 2016). Latest data shows that in Penang alone, less than 1800 tonnes of the countless mobile phone units available were collected in 2015 (Berita Harian, 2016). The developing nations, in general, need to develop effective policies and collection systems as well as recycling treatment infrastructures (Yu *et al.*, 2010, Polák and Drápalová, 2012; Li *et al.*, 2012; Song *et al.*, 2012).

Electronic wastes must be disposed correctly to avoid the negative effect on the environment and future generations. While the use of external nickel may cause allergic dermatitis (Zinwas and Molenda, 2009), other parts and components in mobile phone, if exposed to or ingested, could lead to cancer, kidney damage, lung, sight, hearing and nervous system disorders (Utusan Malaysia, 2012; *Buletin Umum*, 1996). The harmful contents include mercury, lead, cadmium, arsenic, bromine, and chlorine if leaked could cause an increase in concentration or bio-accumulation in the food chain. This phenomenon if occurred could be detrimental to the overall ecosystem and the environment including soil, vegetation, water, humans, and animals (Anthony, 2013).

As far as MP's end-of-life (EOL) is concerned, the impacts of the production phase are mainly attributable to the energy intensive manufacturing of printed wiring boards (PWB). Impacts on ecosystem quality are dominated by the EOL phase and the heavy the metal long term emissions, in particular, have negative effects on the ecosystem. Recycling of network materials in general leads to a twofold reduction of

environmental impacts: in the EOL phase itself as well as by means of the avoided primary production of materials recovered in the EOL phase. A significant reduction in the negative impacts on human health is achieved by improving the material quality of the secondary precious and rare materials (Scharnhorst, *et al.*, 2005).

The government had initiated campaigns and promotions to provide information and encourage awareness amongst the public regarding the importance of proper e-waste disposal. Fines will be imposed on companies, manufacturers and both government as well as private sectors if found guilty over indiscriminate or illegal disposal of e-waste. These electronic wastes must be gathered by licensed contractors to dispose them safely at licensed government-approved recovery facilities (Department of Environment, 2012a). Co-operations amongst parties are important to ensure the effectiveness of the policy.

The environmental and recycling awareness is still low amongst Malaysians. As reported by Zaim (2015) according to Solid Waste Corporation (SWCorp.), only 10.5 percent of the population recycled their waste compared to other developed countries, i.e., more than 40%. Time and money constraints were found to be the most common excuses by consumers for not doing so. Some of them do not know the importance of proper disposal and choose to throw the electronic wastes into normal trash bins and end up in our landfills. The consumer awareness and convenience, according to Bian, Hu, and Wang (2014), Nokia (2011b), Fiorillo (2011), Bernstad *et al*. (2010), Ongondo and Williams (2011a), as well as Mohd.Badruddin (2004), are the key determinants in waste recycling. Only 10 % or less have recycled their old mobile phones (Nokia, 2011b). This further emphasizes the need to look at awareness and knowledge on existing facilities as well as recycling programs as they were seen as obstacles for consumers.

1.2 Aim and Objectives of Study

The broad aim of the research is to analyze mobile phone usage trend amongst Johoreans, in general, and public consumers as well as mobile phone retailers in urban Johor Bahru and non-urban Muar, as well as Kota Tinggi, in specific. Consumers in the

study included the general public, while retailers included the sellers and employees of MP sellers.

The study would later be used to propose an end-of-life (EOL) management framework for the government to help improve in the overall e-waste policy. Due to the ever-changing trends of such a dynamic technology as mobile phones that such studies as this is crucial in providing a data base linking behavioural aspects in MP ownership to the overall policy improvement in its waste recycling. Based on the direct feedbacks and suggestions by the shop owners and the public, future policies could be made more people friendly and more effective as implemented in developed countries**.**

Studies as this is of utmost importance to analyze current e-waste recovery methods in the area, if not the whole country, as most developing countries, cared less on the effects on the environment during recycling process which further led to serious contamination. The components such as plumbum or lead (Pb) along with cyanide, mercury as well as other metals such Ni (Nickel), Beryllium (Be), as well as electrolytes from batteries, if incinerated without off-gas cleaning equipment, furans and dioxin would be released into the atmosphere (Hagelüken, 2007). The recycling of e-waste, printed-circuit boards, in particular, gold recovery, most often done in backyards of many developing countries' residential neighbourhoods, has brought about detrimental environmental degradation (Wong *et al*., 2007a; Liu *et al*., 2006*).*

The objectives of the study are as follows:

i. To study the mobile phone ownership and usage trends in affecting its EOL management amongst urban (Johor Bahru) and non-urban (Kota Tinggi and Muar) consumers.

ii. To analyze urban and non-urban consumers' willingness-to-pay (WTP) more for a 'green' mobile phones and willingness-to-participate (WTPar) in a recycling campaign through a standardized questionnaire survey.

iii. To analyze mobile phone's usage differences and recycling behavior, as well as EOL management between the public consumers as well as shop owners and sellers (retailers).

iv. To integrate the behavioural aspect and usage trend analyzed from the scientific, qualitative survey in mobile phones' EOL and management policy measures for Johor.

1.3 Scope of Study

A study aims to understand the underlying behavioural aspects of urban and non-urban users (WTP and WTPay) in helping to propose a better mobile phone waste recovery and more appropriate management framework for the government to help improve the overall e-waste policy**.** The study looked at the characteristics of users and mobile phone retailers within selected cities of Johor Bahru, Kota Tinggi and Muar, pattern of usage, reuse or recycle of phones, and disposal (End-of-Life (EOL) assessment) in helping to develop ways to encourage recycling or reduce the overall impact on the environment.

Primary data were derived from both the qualitative and quantitative survey through a standardized list of questionnaires used. By conducting a survey amongst the MP users to provide the primary data on the EOL management, the researcher would be able to develop an empirical formula in determining the attributes of recyclers, while helping to improve future policies. The primary data obtained from the survey included profiles of the urban and non-urban users, their mobile phone usage trend, and EOL management, as well as their willingness-to-pay (WTP) and participate (WTPar) in its recycling program.. The findings were used to meet the objectives of the study.

Other supplementary secondary data from the government agencies as well as published information from the Department of Environment (DOE) and multi-media service providers as well as MCMC could be used to further analyze the current management issues and help in suggesting improvement measures in the future. The

study looked into determining factors that may affect the effectiveness of regulations related to e-waste handling. This explanatory research involved both literature on the subject matter as well as quantitative data collection used to understand the EOL, stockpiling, and multiple ownership of mobile phone which contributes to the ever increasing electronic waste.

The main data collection involved a total sample of 1200 public respondents randomly selected (yet stratified based on the State's gender distribution) in the study areas, (400 from each location: Johor Bahru (JB), Kota Tinggi (KT) and Muar Municipalities) (i.e. based on a 95% confident level (or p <0.05) for a population of more than 100,000 (Singh and Masuku, 2014; Yamane, 1983), and 110 retailers (i.e., 50 per study area). The Johor Bahru and MPJBT areas of the study were chosen as, the number of repair shops were limited in numbers to treat MPJBT areas separately, as most repair shops were concentrated mainly in Johor Bahru city centers (KSL Mall, Danga Malls, etc.).

1.4 Significance of Study

The study is crucial due to the lack of similar studies in Malaysia. It could provide a promising area for further studies in the future. The results from the study would provide vital information to mobile phone makers regarding consumer preferences to produce a better phone to cater the consumer needs. The understanding of the behavior and EOL of unused mobile phones as well as current collection facilities, would help policy makers design a more effective ways of managing e-waste in the future, an area that still needs improvement in the country.

It is important to understand underlying problem and issues involving MP's usage behavior, EOL management among consumers, as well as facilities, and policy commitment with MP waste recovery. Since the implementation of 'Mobile E-waste Program' in 2015, only 3 companies (i.e., Sengheng, Meriahtek Pvt. Ltd.., and Shan Poornam Metals Pvt. Ltd.) were involved with the mobile phone e-waste recovery,

which further supported the low feedback from both industries and consumers (Department of Environment, 2016).

By using empirical method of assessing the potential impact of disposed mobile phones, batteries and chargers, the study could be used by the Department of Environment as well as waste managers such as Alam Flora Pvt. Ltd., and Southern Waste Management Environment Pvt. Ltd. (SWM) to improve on the overall e-waste management in Malaysia. Necessary information as far as the management of electronic waste mangement is concerned were provided to assist the improvement in the overall national e-waste management and services. resolved through this study and the data compiled.

1.5 Contribution to Existing Knowledge and Policy

The study contributes a great deal to the literature on mobile phone EOL and recycling behavior by addressing the need for a more sustainable and integrated e-waste management. The lack of attention on the consumer product and the studies related to its EOL management provided a promising future for the development of the literature on the subject matter.

Improvement measures can be suggested based on the responses from a large sample of both public consumers as well as retailers (MP sellers) regarding the weakness of current policies and guidelines on MP waste recovery (as successfully conducted by previous researchers in both developed and developing countries.

Among the stakeholders who would benefit from the study include:

i. The retailers and mobile phone manufacturers.
ii. The government and authorities related in e-waste management.
iii. The Malaysian Department of Environment.

iv. The SWCorp Pvt. Ltd.

v. The academics and resesarchers through publications, book chapters, research materials, future research works, universities.

REFERENCES

Abdul Rahman Mahmud (2008). *Urus Sisa Elektronik*. July 23. Retrieved from the Utusan Malaysia website: http: //www.utusan.com.my.

ABI Research (2012). *Samsung Ships Twice as Many Smartphones as Apple in Q3*. Retrieved from the ABI website: https://www.abiresearch.com/press/samsung-ships-twice-as-many-smartphones-as-apple-i/.

ABI Research (2014). Mobile Handset 2014 Predictions. *Geographic Analysis Report.*AN-1525. January 3, 2014. Retrieved from the ABI Research website: https://www.abiresearch.com/market-research/product/1017954-mobile-handset-2014-predictions/.

Academy of Social Science (2015). Championing Original and Authoritative Research. *Campaign for Social Science*: London. Retrieved from the Academy of Science website: http://www.palgrave.com/gp/social-science-matters/10-reasons-for-social-science.

Acaroglu, Leyla (2013). Where Do Old Cellphones Go to Die? Sunday Review. New York Times. May 5, 2013.

Acock, A., and Stavig, G. (1979). A Measure of Association for Nonparametric Statistics. *Social Forces, 57*(4):1381-1386. Doi:1. Retrieved from http://www.jstor.org/stable/2577276 doi:1.

Ahmed, Sarwar Uddin. (2011). Informal Sector E-waste Recycling Practices in Bangladesh. *A Research Report Series 60010*. Pathway, Dhaka, Bangladesh.

Adamowicz, Wiktor, Peter Boxall, Michael Williams, and Jordan Louviere (1998). Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation. *American Journal of Agricultural Economics*. **80**. 64-75, 1998.

Adlan Jaafar (2012). Pencemaran dan Isu Alam Sekitar, Harian Kosmo. January 6, 2012.

Afroz, R., K. Hanaki and R. Tuddin (2010). The Role of Socio-Economic Factors on Household Waste Generation: A Study in a Waste Management Program in Dhaka City, Bangladesh. *Research Journal of Applied Sciences.* **5.** Issue: 3. 183-190. Medwell Journals.

Agamuthu, Pariathamby and Tanaka, Masaru (*eds.*) (2014). Municipal Solid Waste Management in Asia and the Pacific Islands: Challenges and Strategic Solutions. Springer-Verlag. Singapore. DOI.10.1007/978-981-4451-73-4.

Anon (2013). *Everything You Need to Know about Mobile Phone Recycling.* Sell My Old Mobile Phone 2010-2013. Retrieved on July 21, 2016 from the Sellmyoldmobilephonewebsite:http://www.sellmyoldmobilephone.co.uk/Everything-you-need-to-know-about-Mobile-Phone-Recycling-article17/.

Ajzen, I. és Fishbein, M. (1980): Understanding Attitudes and Predicting Social Behavior. Prentice-Hall, Englewood Cliffs, NJ.

Allers, Maarten A. and Hoeben, Corine (2010). Effects of Unit-Based Garbage Pricing: A Differences-in-Differences Approach. *Environ Resource Econ* (2010) **45.** 405–428. DOI 10.1007/s10640-009-9320-6. Springer, Netherland.

Anthony, Paulie (2013). *Cell Phone Toxins and the Harmful Effects on the Human Body When Recycled Improperly*. Retrieved from the E-cycle website: http://www.e-cycle.com/cell-phone-toxins-and-the-harmful-effects-on-the-human-body-when-recycled-improperly/.

Ari, Vidyadhar (2016). E-Waste in Transition - From Pollution to Resource. Review of Technology of Metal Recovery from Electronic Waste. http://dx.doi.org/10.5772/6156.

Badruddin, M., *et al.* (2002). The Role of Socio Economic and Cultural Factors in Municipal Solid Waste Generation. A Case Study in Taman Perling Johor Bahru. *Journal of Technology*, **37**:55-64.

Bandara, N.J.G.J, *et al.* (2007). Relation of Waste Generation and Composition to Socio-Economic Factors: A Case Study. *Environmental Monitoring and Assessment,* (2007) **135**:31-39.

Basel Action Network (BAN) (2004). *Mobile Toxic Waste: Recent Findings on the Toxicity of End-of-Life Cell Phones.* April 2004. Retrieved from BAN website: http://archive.ban.org/library/mobilephonetoxicityrep.pdf.

Bauer, S. and M. L. Miranda (1996). *The Urban Performance of Unit Pricing: An Analysis of Variable Rates for Residential Garbage Collection in Urban Areas*. A

Report Prepared for the Office of Policy, Planning, and Evaluation; The U.S. Environmental Protection Agency.

BBC (2014). *Who What Why: How Much Gold Can We Get From Mobile Phones*? 16 August 2014. Retrieved from BBC.com's website: http://www.bbc.com/news/blogs-magazine-monitor-28802646.

Beavis, Gareth (2016*). Best Phone 2015: The 10 Best Smartphones We've Reviewed*. Retrieved from the Techradar's website: http://www.techradar.com/news/phone-and-communications/mobile-phones/20-best-mobile-phones-in-the-world-today-645440.

Begum, R. A., *et al.* (2009). Attitude and Behavioral Factors in Waste Management in the Construction Industry of Malaysia. *Resources, Conservation and Recycling*. **53**: 321–328.

Berglund C. (2005). The Assessment of Households' Recycling Costs. The Role of Personal Motives. *Ecol .Econ*. **56**: 560-569.

Berita Harian (2016). *Kitar Semula Barangan Electronic Tahun Depan.* July 19.

Bernama (2008, October 15). *Hand phone Users Can Now Switch Service Providers without Having to Change the Number*. Retrieved from the Bernama website: http://web10.bernama.com/maritime/news.php?id=364800&lang=en.

Bernama (2008, July 23). *Nokia Launches First Recycling and Care Kiosk in Malaysia*. Retrieved from the South-South Information Gateway website: http://www.ssig.gov.my/blog/2008/07/22/nokia-launches-first-recycling-and-care-kiosk-in-malaysia/.

Bernstad, A. La Cour Jansen.J, and Aspergren, H. (2010). *Influence of Information Stretegies on Waste Recycling Behavior. Evaluation of A Full Scale Experiment.* Environmental Evaluation of Solid Household Waste Management. The Augusten Borg Ecocity Example. Lundt University.

Bertram, Dane (2007). *Likert Scales Are the Meaning of Life.* Retrieved from University of St-Andrews.ac.uk website: https://www.standrews.ac.uk/media/capod/students/mathssupport/Likert.pdf.

Bhattacharya, Bhaskar and Habtzghi, DeSale (2002). Median of the *p* Value under the Alternative Hypothesis. *The American Statistician (American Statistical Association)* **56** (3): 202–6.

Bland, J.M.; Altman, D.G. (1996). *Statistics Notes: Measurement Error*. BMJ. 312 (7047): 1654. doi:10.1136/bmj.312.7047.1654.

Bordoux, L., Leone, F., Nicolai, M., and Papameletiou, D. (1996). *The Recycling Industry in the European Union: Impediments and Prospects.* Institute for Prospective Technological Studies (IPTS). EUR 17271 EN. Spain:55.

Buletin Umum (1996*) Penawar Racun, Laporan Pendedahan Plumbum Buletin Umum, Bilangan* 10, *Pusat Racun Negara*, Universiti Sains Malaysia. Retrieved from the USM *Pusat Racun Negara* website: http://www.prn.usm.my/old_website/mainsite/bulletin/1996/penawa10.html.

Cellular News (2012). *Malaysian Networks to Offer Smartphone Subsidies for Young Customers.* 28th Dec 2012. Retrieved from the Cellular News website http://www.cellular-news.com/story/Operators/57945.php.

Che Asmah Ibrahim (2013). *Policy Update from Malaysia*. Hazardous Substances Division. Department of Environment. Retrieved from the DOE website: http://www.epa.gov/sites/production/files/2014-05/documents/malaysia.pdf.

Chen, Charles (2015). Topics in Integrated Circuits for Communications. Institute of Electrical and Electronics Engineers. Communications Magazine • April 20.

Chua Yan Piaw (2013). *Mastering Research Statistics.* McGraw Hill Education (Malaysia) Sd. Bhd.

Cocks, K., and Torgerson, D. J. (2013). Sample Size Calculations for Pilot Randomized Trials : A Confidence Interval Approach. *Journal of Clinical Epidemiology, 66*(**2**):197–201. doi:10.1016/j.jclinepi.2012.09.002.

Conover, William J (1980). *Practical Nonparametric Statistics.* John Wiley and Sons, 1980 (2nd Edition):225–226.

Creswell, J. W., and Plano Clark, V. L. (2007). *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: Sage Publications.

Cronbach, L. J. (2004). My Current Thoughts on Coefficient Alpha and Successor Procedures. *Educational and Psychological Measurement.* **64**, 391-418.

Curtis, J., S. Lyons and A. O'Callaghan-Platt, (2009). Managing Household Waste in Ireland: Behavioural Parameters and Policy Options. *Working Paper* No. 295.

Cybo.com (2015). *Kedai Telefon Bimbit dalam Poskod 81300 Johor Bahru*. Retrieved from Cybo.com's website: https://poskod.cybo.com/malaysia/81300_johor-bahru/kedai-telefon-bimbit/?p=3.

CWTA (2009). Recycle My Cell. Canadian Wireless Telecommunications Association (CWTA), Canada. Retrieved from RCBC's website: <http://rcbc.bc.ca/>.

Dahlén L., Aberg, H., Lagerkvist, A., and Berg, P.E.O. (2008). Evaluation of Recycling Programs in Household Waste Collection Systems. *Journal of Environmental Management*. Elsevier.

Dahlen, Lisa and Lagerkvist, Anders (2010). Evaluation of Recycling Programs in Household Waste Collection Systems. *Waste Management and Research*. 2010: **28**: 577–586. DOI: 10.1177/0734242X09341193

Daniel, E.G.S, Nadeson, T., and Mohd Shafiee Abd Ghani (2006). Organizing For Action in Environmental Education through Smart Partnership: A Malaysian Experience. *International Conference for the Environment.* Zimbabwe, April 2006.

Darby L and Obara L. (2005). Household Recycling Behavior and Attitudes toward the Disposal of Small Electrical and Electronic Equipment. *Resources Conservation Recycling* 2005.**44**:17–35.

Davies J., Foxall G.R. and Pallister J. (2002). Beyond the Intention–Behavior Mythology. An Integrated Model of Recycling. *Marketing Theory* **2**:29-113.

Denne, T., R. Irvine, N. Atreya and M. Robinson (2007). *Recycling: Cost Benefit Analysis.* A Report Prepared by Covec for Ministry for the Environment, New Zealand.

Department of Environment (2006). 2005 Malaysia Environmental Quality Report. Putrajaya.

Department of Environment (2008). Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia. Department of Environment.

Department of Environment (2009). Malaysia Environmental Quality Report (2008). Putrajaya.

Department of Environment (2012a). Current Practice of Recycling and Treatment of Hazardous Wastes in Malaysia. *Annual Workshop Report*. Hazardous Substance Division. Department of Environment, Malaysia.

Department of Environment (2012b). *The E-Waste Inventory Project in Malaysia*. Retrieved from the Ministry of the Environment's website: http://www.env.go.jp/en/recycle/asian_net/Project_N_Research/E-wasteProject/06.pdf.

Department of Environment (2016*). E-Waste Alam Alliance*. Retrieved from DOE website: http://www.doe.gov.my/household-ewaste/wp-content/uploads/2016/10/Information-for-inclusion-in-the-DOE-Portal.pdf.

DEFRA (2013). *Department for Environment, Food and Rural Affairs Annual Report and Accounts*. ISBN 978147410802. Department for Environment, Food and Rural Affairs.

Department of Statistics (2002). Department of Statistics Malaysia. Retrieved from the Department of Statistics website: http://www.statistics.gov.my/portal/index.php.

Department of Statistics (2010). *Laporan Kiraan Permulaan 2010. Jabatan Perangkaan Malaysia.* Retrieved from the Department of Statistics website: http://www.statistics.gov.my/portal/index.ph.

Department of Statistics (2012*). Key Summary Statistics for Local Authority Areas, Malaysia 2010*. Department of Statistics, Malaysia.

Digital News Asia (2017). Pulse on Malaysia's Digital Economy 2016. 23 January 2017).

Do Valle PO, Reis E, Menezes J, Rebelo E. (2004). Behavioral Determinants of Household Recycling Participation. *Environment and Behavior*. **36** (4):505–40.

Duncombe, Richard (2009). Impact Assessment of Mobile Phones on Development: Concepts, Methods and Lessons for Practice. *Center for Development Informatics.* ISBN: 978-1-905469-06-2.

East, Robert (1993). *Changing Consumer Behaviour*. London: Cassell Educational Limited.

Else (2003). Internal Document. Else Refining and Recycling Ltd., Shefford.

Emmenegger, M F. *et al.* (2006). Life Cycle Assessment of the Mobile Communication System UMTS: Towards Eco-Efficient Systems. *International Journal of Life Cycle Assessment* **11.** 4: 265–276.

Environmental Leader LLC (2009). *Just 8% of Mobile Phones Recycled or Refurbished.* Retrieved from the Environmental Leader website: http://www.environmentalleader.com/2009/11/02/just-8-of-mobile-phones-recycled-or-refurbished/?graph=full&id=1

Environmental Leader LLC (2009). *Mobile Phone Manufacturers Drop Ball on Recycling.* Business Sector Media LLC. July 10, 2008. Retrieved from the Environmental leader's (LLC) website: http://www.environmentalleader.com/2008/07/10/mobile-phone-manufacturers-drop-ball-on-recycling.

Environmental Literacy Council (2008). Cell Phone Life Cycle. Retrieved from the Enviroliteracy's website: http:// www.enviroliteracy.org/article.php/1119.html.

Erkman, S., 2002. The Recent History of Industrial Ecology in Ayres, R.U. and Ayres, L.W. (*Eds.*). *A handbook of Industrial Ecology*. UK: Edward Elgar, Cheltenham.

EPA (2014). *The Life Cycle of a Cell Phone. Office of Solid Waste. U.S.A.*

Fatihah Suja, Rakmi Abdul Rahman, Arij Yusof, and Mohd Shahbudin Masdar (2014). *Waste Management Scenarios in Malaysia. Journal of Waste Management*. Volume 2014, Article ID 609169. Hindawi Publishing Corporation. http://dx.doi.org/10.1155/2014/609169.

Ferrara, Ida and Missios, Paul (2005). Recycling and Waste Diversion Effectiveness: Evidence from Canada. *Environmental and Resource Economics* (2005) **30**: 221–238. Springer.

Fiorillo, Damiano (2011). Household Waste Recycling: National Survey Evidence from Italy. MPRA Paper No. 33631, 22. September. 14:06 UTC.

Fishbein, B.K. (2002). *Waste in the Wireless World: The Challenge of Cell Phones*. INFORM, USA.

Fullerton, D. and T.C. Kinnaman (1996). Household Responses to Pricing Garbage by the Bag. *The American Economic Review*. **86**. No. 4: 971-984. American Economic Association.

Gartner (2014). *Gartner Says By 2018, More Than 50 Percent of Users Will Use a Tablet or Smartphone First for All Online Activities.* Retrieved from Gartner Gartner's Publication website: http://www.gartner.com/newsroom/id/2939217.

Gartner (2015). Gartner Says Worldwide Market for Refurbished Smartphones to Reach 120 Million Units by 2017. Retrieved from the Gartner's Publication website: http://www.gartner.com/newsroom/id/2986617.

Gillroy, John M. and Shapiro, Robert Y. (1986). The Polls: Environmental Protection. *Public Opinion Quarterly*. Summer. **50** (2), 270-279.

Gorecki, Paul K, Lyons, Sean and Tol, Richard S J. (2010). *Waste Policy in Ireland: Comments on Radical Proposals on the Way Forward.* Retrieved from https://www.esri.ie/pubs/SUB200901.pdf. ESRI Publication.

Gorecki, Paul K., J. Acheson and S. Lyons (2010). *An Economic Approach to Municipal Waste Management Policy in Ireland*. A Report Prepared for Dublin City Council. Dublin: Economic and Social Research Social Research Institute (ESRI).

Ha, J.H, Chin B, Park D.H, *et al*. (2008). Characteristics of Excessive Cellular Phone Use in Korean Adolescents. *Cyber-psychological Behav*ior 2008; **11**: 783–784.

Hagelüken, Christian (2007). Hagelüken, Christian (2007). Metal Recovery from e-Scrap in a Global Environment. *The 6th Session of Open-Ended Working Group (OEWG) Basel Convention*. Geneva. September 7.

Hansmann R, Bernasconi P, Smieszek T, Loukopoulos P, Scholz RW. (2006). Justifications and Self-Organization as Determinants of Recycling Behavior: The Case of Used Batteries. *Resources, Conservation and Recycling*. **47**:133–59.

Harris Poll. (2008). *Cell Phone Usage Continues to Increase.* The Harris Poll #36, April 4, 2008.

Herat S, and Agamuthu P. (2012). E-Waste: A Problem or an Opportunity? Review of Issues, Challenges and Solutions in Asian Countries. *Waste Management Resources.* 2012 Nov; 30(**11**):1113-29. Doi: 10.1177/0734242X12453378.

Hiong Laurel Tan Bee (2015), *SKMM Jadi Pemangkin, Sedia Platform Rakyat Malaysia Bangun Aplikasi Mudah Alih*. Retrieved on April 1, 2016 from http://kpdnkk.bernama.com/

Ho Sew Tiep, Tong, David Yoon Kin, Elsadig Musa Ahmed, and Lee Chee Teck (2015). E-Waste Management Practices of Households in Melaka. *International Journal of Environmental Science and Development,* Vol. 6, No. 11, November 2015.

Hong, Seong Hoon, Richard M. Adams and H. Alan Love (1993). An Economic Analysis of Household Recycling of Solid Wastes: The Case of Portland, Oregon. *Journal of environmental economics and management*. **25**.2: 136-146.

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**:1635–43.

Hubbard, R. (2004). Blurring the Distinctions Between *p*'s and *a*'s in Psychological Research. *Theory Psychology* June 2004. **Vol. 14** no. 3 295-327.

Hyunjin Cha, Lidia Oshlyansky and Paul Cairns (2005). *Mobile Phone Preferences and Values: The U.K. vs. Korea*. Retrieved from IWIPS website http://www-users.cs.york.ac.uk/~pcairns/papers/IWIPS_2005.pdf.

Inform Inc. (2012). *The Secret Life of Hand Phones.* Retrieved from the Inform Inc. website: http://www.informinc.org/pages/media/the-secret-life-series/the-secret-life-of-cell-phones.html).

International Data Corporation (IDC, 2015). *Smartphone Vendor Market Share, 2015 Q2*. Retrieved from the IDC website: http://www.idc.com/prodserv/smartphone-market-share.jsp.

ISWA (2016). European Union: New Initiative to Capture Critical Raw Materials from Waste Electronics. *Global News.* Issue 39. February. Retrieved from the International Solid Waste Association (ISWA) website: http://www.iswa.org/iswa-global-news-issue-39-february-2016/#c4358.

International Telecommunication Union (2009). *Press Release.* ITU. Geneva, 2nd March 2009. Retrieved from the ITU Website: http://www.itu.int/newsroom/press_releases/2009/07.html.

Iwan, b; Chamhuri, S, and Hassan Basri (2012). Current Status of Municipal Solid Waste Generation in Malaysia. *Advanced Science Engineering Information Technology.* **Vol.2.** 2012(2). ISSN.2088-5334.

Haikal Jalil (2015). Mobile e-Waste Programme Sets One-million Target. Sun Daily. August, 18.

Japan International Cooperation Agency (JICA) (2014). *Data Collection Survey on E-waste Management in Malaysia and Surrounding Countries*. July 2014. Ministry of Foreign Affairs of Japan, Regional Affairs.

Jenkins, R.R., Martinez, S.A., Palmer, K., Podolsky, M.J., (2003). The Determinants of Household Recycling: A Material Specific Analysis of Recycling Program Features and Unit Pricing. *Journal of Environmental Economics and M*anagement **45.** 294-318. Elsevier.

Kansas Department of Health and Environment (2015). *Why Should You Recycle E-Waste?* Retrieved from the Kansas Department of Health and Environment website: http://www.ksewaste.org/ewaste_why.html.

Karjaluoto,H., Karvonen,J., Kesti, M, Koivumaki, T., Manninen M., Pakola J., Ristola A., and Salo, J (2005). Factors Affecting Consumer Choice of Mobile Phones: Two Studies from Finland. *Journal of Euro-marketing.* **14**(3) (2005). 59-82.

Kerlinger, F.N. and Lee, H.B. (2000). *Foundations of Behavioral Research*. Harcourt College Publishers, 2000.

Kaos, Joseph (2016). A Million of E-Waste Produced Yearly. The Star. July 19, 2016. Retrieved from The Star Online website: http:/www.thestar.com.my/news/nation: /2016/07/19/ a-million-tonnes-of-e-waste-produced-yearly.

Kling, Maximilian; Seyring, Nicole and Tzanova, Polia (2016). Assessment of Economic Instruments for Countries with Low Municipal Waste Management Performance. *Waste Management and Research* 1–11. Sage Publication. DOI: 10.1177/0734242X16644521.

Kraus, Stephen J. (1995). Attitudes and Prediction of Behaviour: A Meta-Analysis of the Empirical Literature. *Personality and Social Psychology Bulletin*. **21** (1), 58-75. DOI: 10.1177/0146167295211007.

Kumaran, Loghun (2016). Recycling Gives New Life to E-Waste. Malaymail. September 14, 2016. Retrieved from the Malaymail online website. http://www.themalaymailonline.com/malaysia/article/recycling-gives-new-life-to-e-waste#sthash.X3RqKiwM.dpuf.

Laerd Statistics (2014). Retrieved from Laerd Statistics website: https://statistics.laerd.com/spss-tutorials/cronbachs-alpha-using-spss-statistics.php.

Lee Min, Keong (2008). Nokia Kiosks Collect Phones for Recycling. Retrieved on September 18, 2008.from Cnet website; http://news.cnet.com/8301-11128_3-10045417-54.htm.

Liu, C. M. (2002). The Effects of Promotional Activities on Brand Decision in the Cellular Telephone Industry. *Journal of Product and Brand Management.* 11(**1**), 42-51.

Liu X, Tanaka M, Matsui Y. 2006). Electrical and Electronic Waste Management in China: Progress and the Barriers to Overcome. *Waste Manage Res* 2006. **24**:92-102.

Majláth, Melinda. (2010). *Psychographic Differences between Environmentally Friendly and Non-environmentally Friendly Consumers*. A Phd Thesis. School of Art and Design, Aalto University, Helsinki.

Mäkelä, M (2011). *The Complexity of Mobile phone recycling, Developing User Oriented Design Guidelines and Future Concepts for Mobile Phone Recycling*, School of Art and Design, Aalto University, Helsinki.

Maisto, Michelle (2014, October 3). ABI: Chinese Phone Vendors to Grab Greater Global Market Sharey Michelle Maisto. Retrieved from the eweek.com website: http://www.eweek.com/mobile/abi-chinese-phone-vendors-to-grab-greater-global-market-share.html.

Malaysia (2006a). *Environmental Quality (Scheduled Wastes) Regulations 2005 (Amendment 2007).* Regulations, Rules and Orders (2011). International Law Book Services.

Malaysia (2006b). *Environmental Quality (Scheduled Wastes Transporter) Order 2005. Regulations, Rules and Orders* (2011). International Law Book Services.

Malaysia (2006c). *Street, Drainage and Building Act 1974 (Act 133) (Amendment 2006).* The Commissioner of Laws Revision, Malaysia in Collaboration with Malayan Law Journal Sdn Bhd and *Percetakan Nasional Malaysia* Bhd.

Malaysia (2006d). *Local Government Act (Act 171).* The Commissioner of Laws Revision, Malaysia in Collaboration with Malayan Law Journal Sdn Bhd and *Percetakan Nasional Malaysia* Bhd.

Malaysia (2007). *Solid Waste and Public Cleansing Management Act 2007*. (Act 672). Solid Waste and Public Cleansing Management Corporation Act 2007. (Act 673). *Percetakan Nasional Malaysia Berhad* (Appointed Printer to the Government of Malaysia).

Malaysia (2008). *Environmental Quality (Scheduled Wastes) Regulations (2005). Environmental Quality Act 1974 (Act 127), Regulations, Rules and Orders* (2011). International Law Book Services.

Malaysia (2011). *Environmental Quality Act of 1974 (Act 127).* Regulations, Rules and Orders (2011). 978-967-89-2135-0. International Law Book Services MCMC (2005). Hand Phone Users Survey 2005. *Statistical Brief No.3*. SBN: 1823-2523. Malaysian Communication and Multimedia Commission.

Malaysia (2012a). *The Customs (Prohibition of Imports) Order 2012*. Published by Attorney's General Chamber of Malaysia. December, 2012.

Malaysia (2012b). *Custom (Prohibition on Export) Order 1998 (Amendment 2006).* Published by Attorney's General Chamber of Malaysia. December, 2012.

MCMC (2009). *Facts and Figures - Statistics and Records*. Malaysian Communications and Multimedia Commission.

MCMC (2010). *Facts and Figures - Statistics and Records*. Unpublished report. Malaysian Communications and Multimedia Commission.

MCMC (2015a). *Hand Phone Users Survey.* Statistical Brief Number Seventeen. 2014. ISSN 1823-2523. Malaysian Communications and Multimedia Commission.

MCMC (2015b). Internet Users Survey. Population by States and Ethnic Group. Department of Information, Ministry of Communications and Multimedia Commission, Malaysia. 2015. ISSN 1823-2523

MCMC (2016). *Old Phone, New Life.* Mobile e-waste. Malaysian Communication and Multimedia Commission.

Mamat, R.C., Chong, T.L. (2007). Public's Role in Solid Waste Management. IMPAK. Quarterly DOE Update on Environment. *Development and Sustainability*. Issue 4: 5–7.

Martin, Bridget and Simintiras, Antonis C. (1995). The Impact of Green Product Lines on the Environment: Does What They Know Affect How They Feel? *Marketing Intelligence and Planning*. **13** (4), 16-23.

Maxis' Q1 Earnings Rise 6.1 Percent to RM573M. New Straits Times. June 1, 2012.

Mazzanti, Massimiliano and Zoboli, Roberto 2009. Municipal Waste Kuznets Curves: Evidence on Socio-Economic Drivers and Policy Effectiveness from the EU. *Environ Resource Econ*. **44**:203–230. DOI 10.1007/s10640-009-9280-October 2009. 44:203. Springer.

Meen-Chee, H. and S. Narayanan. (2006). Restoring the Shine to a Pearl: Recycling Behavior in Penang, Malaysia. *Development and Change*. **37**: 1117–1136.

Messenger, Ben (2013). E-Waste Recycler ECOvanta Secures e-Stewards Certification. *Waste Management World*. Retrieved from the Waste Management World website: http://www.waste-managementworld.com/articles/2013/04/ ewaste-recycler-ecovanter-secures-estewards-certification.html.

Ministry of Housing and Local Government (2003). Local Government Department. Overview of Solid Waste Management in Malaysia. Universiti Kebangsaan Malaysia Guest Lecture.

Mobile Muster (2010). Official Recycling Program of the Mobile Phone Industry. Retrieved from the Mobilemuster website: http://www.mobilemuster.com.au/ ?Page=691.

Mohamed, A. F. (2009). *Recycling Systems in Malaysia: Case Studies on Industrial Waste*, in Kojima, M. and E. Damanhuri (*Eds*.). 3R Policies for Southeast and East Asia. ERIA Research Project Report. 2008-6-1:.53-72. Jakarta: ERIA.

Mohd. Azam Osman, Abdullah Zawawi Talib, Zainal Abidin Sanusi, Tan Shiang-Yen, Abdullah Sam Alwi (2012), A Study of the Trend of Smartphone and Its Usage Behavior in Malaysia. *International Journal on New Computer Architectures and*

Their Applications (IJNCAA) **2(1):** 275-286. The Society of Digital Information and Wireless Communications, 2012 (ISSN: 2220-9085).

Mohd. Azam Osman, Maziani S., Azlan O., and Tan Shiang-Yen (2011). Consumer Behaviors toward Usage of Smartphone in Malaysia. *2011 International Conference on Software and Computer Applications. IPCSIT Vol.9 (2011) © (2011) IACSIT Press, Singapore.*

Mohd. Badruddin Mohd Yusof (2004). *The Effects of Socio-Economic Characteristics on Household Wastes in Johor Bahru District*. PhD Thesis, Faculty of Civil Engineering, Universiti Teknologi Malaysia.

Mohd. Badruddin Mohd Yusof (2003). The Public Attitudes and Perceptions of Solid Waste Management in Johor Bahru: *Conference Proceeding (the 17th International Conference of Solid Waste Management, Philadelphia, PA, U.S.A.).* October 23-25, 2003.

Mohd. Dinie Muhaimin Samsudin, Mashitah Mat Don (2009). Municipal Solid Waste Management in Malaysia: Current Practices, Challenges and Prospect. *Jurnal Teknologi (Sciences and Engineering) **62**:1 (2013), 95–101*

Mohd. Razman Salim, Fadil Othman and Sabarinah Marzuky (1994). Problems and Challenges of Solid Waste Management: A Case Study in South Johor, Malaysia. *Jurnal Fakulti Kejuruteraan. Universiti Teknologi Malaysia. **Vol**. 7. No.1:. 1-8.*

Monavari, S.M., *et al. (*2011). The Effects of Socioeconomic Parameters on Household Solid Waste Generation and Composition in Developing Countries (A Case Study: Ahvaz, Iran), *Environmental Monitoring and Assessment*, April 2011.

Most, E., (2003). Calling All Cell Phones: Collection, Reuse, and Recycling Programs in the US. INFORM, USA.

Neu, Wendy (2013, September 10). Responsible E-Waste Recycling Will Protect Environment and Create Jobs. Retrieved from the Waste-management-world website: http://www.waste-managementworld.com/topics/device/mobile/t/80638061/responsible-e-waste-recycling-will-protect-environment-create-jobs.htm?m_n=true

Nixon, H., and Saphores, J. M. (2009) Information and The Decision to Recycle: Results From A Survey Of US Households. *Journal of Environmental Planning and Management*, 52(2), 257-277.

Nnorom I.C., Ohakwe, J. and 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** (2009) 1629–1637.

Nor 'Atiyyah Mohamed (2011). *E-Waste Management in Kajang Commercial Area.* Master Thesis. Universiti Putra Malaysia.

Nokia (2005). Integrated Product Policy Pilot Project Stage I Final Report: Life Cycle Environmental Issues of Mobile Phone. NOKIA. Espoo, Finland: NOKIA Corporation, Retrieved from Europaeuint website: *http://europaeuint/comm/environment/ipp/pdf/impact_nokiapdf; January, 2005.*

Nokia, (2010). *Nokia Sustainability Report 2010, 15.8.2011.* Retrieved from Nokia website: http://www.nokia.com/corporate-responsibility/reporting Nokia (2011a). Materials and substances. Retrieved from Nokia. Com

Nokia (2011b). *Consumer study 2011*.Unpublished report.

Nurbaiti Hamdan (2016). E-waste and Discarded Mobile Phones Pose Real Danger to Environment. The Star. 11 July 2016.

Ojeda-Benıtez S., Vega CA, Marquez-Montenegro MY. (2008). Household Solid Waste Characterization by Family Socioeconomic Profile as Unit of Analysis. *Resources, Conservation and Recycling*. **52**:992–9.

Oladele A. Ogunseitan (2013). The Wild West of Electronic Waste. *Project Syndicate.* Retrieved on from the Projectsyndicate.org.'s website: .*http://www.project-syndicate.org/commentary/the-wild-west-of-electronic-waste.*

Ongondo, F.O. and Williams, I.D., (2011a). Greening Academia: Use and Disposal of Mobile Phones among University Students. *Waste Management.* **31**. (2011)1617-1634.

Ongondo, F.O. and Williams, I.D. (2011b). Mobile-phone Collection, Reuse and Recycling in the UK. *Waste Management* .**31:** 1307–1315.

Oskamp S, Harrington MJ, Edwards TC, Sherwood DL, Okuda SM, Swanson DC. Factors Influencing Household Recycling Behavior. *Environment and Behavior*. 1991; **23** (4):494–519.

Palatnik, R. R. *et al.* (2014). Greening Household Behavior and Waste. Organization for Economic Co-operation and Development (OECD) *Environment Working Papers.* No. 76, OECD Publishing.

Park, N., Kim, Y. C., Shon, H. Y., and Shim, H. (2013). Factors Influencing Smartphone Use and Dependency in South Korea. *Computers in Human Behavior*, **29** (4): 1763-1770.

Pew Research Center (2015). The Smartphone Difference. Retrieved from Pew Website: http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/.

Phnom Penh Municipality Report (2009). *WEEE/E-Waste Management Report* Phnom Penh Municipality Kingdom of Cambodia. The Ministry of Environment (MoE).

Polák, M., and Drápalová, L. (2012). Estimation of End of Life Mobile Phones Generation: the Case Study of the Czech Republic. *Waste Management*. **32**, 1583-1591.

Pongrácz, E. and Pohjola, V.J. (2004). Re-defining Waste, the Concept of Ownership and the Role of Waste Management. *Resources, Conservation and Recycling*. **40**: 141–153.

Purcell, M. and W.L. Magette. (2010). Attitudes and Behavior towards Waste Management in the Dublin, Ireland region. *Waste Management*. **30:** 1997–2006.

Rayapura, A., (2005). *Wireless Waste-The Challenge of Mobile phone and Battery Recycling.* INFORM, USA.

Richter, Felix (2013). *Samsung Ships Twice as Many Smartphones as Apple in Q2*. Jul 26, 2013. Statista.com. Retrieved on January 10, 2016. http://www.statista.com/chart/1302/smartphone-shipments-in-q2-2013/t

Robinson, Brett H. (2009). E-waste: An Assessment of Global Production and Environmental Impacts. *Science of the Total Environment.* **408:**183–191.

Salleh, Mohd Nazeri (2001). Solid Waste Management by Federal Government Authorities in Malaysia Territories. Guide Books Basic Improvement of Municipal Solid Waste Management. *Lestari* -Universiti Kebangsaan Malaysia.

Safiek Mokhlis and Azizul Yadi Yaakop (2012). Consumer Choice Criteria in Mobile Phone Selection: An Investigation of Malaysian Universiti Students. *International Review of Social Sciences and Humanities*. .**Vol. 2**, No. 2 (2012): 203-212.

Saphores, J. M., Ogunseitan, O. A., and Shapiro, A. A. (2012). Resources, Conservation and Recycling 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:10.1016/j.resconrec.2011.12.003.

Saphores J-D, Nixon H, Ogunseitan OA, Shapiro AA. (2006(a)). Household Willingness to Recycling Electronic Waste. An Application to California. *Environmental and Behavior*. **38**:183–208.

Saphores J-D, Nixon H, Ogunseitan OA, Shapiro AA. (2006(b)). *Household Willingness to Recycle Electronic Waste – An Application to California University of California.* Postprints Year. Paper 1165; 2006.

Satyabrata and Nanjundappa (2008). Mobile Phone Waste: Current Initiatives in the Asia and the Pacific. *Tech Monitor*. Jul-Aug 2008: 32-38.

Scharnhorst, W.; Althaus, Hans-Jo¨r; Classen, Mischa, Jolliet, Olivier; M. Hilty, Lorenz (2005). The End-of-Life Treatment of Second Generation Mobile Phone Networks: Strategies to Reduce the Environmental Impact. *Environmental Impact Assessment Review*. **25** (2005): 540-566.

Schnell, Audrey (2016) *When Unequal Sample Sizes Are and Are Not a Problem in ANOVA.* The Analysis Factor. Word Press. USA.

Sheereen N. Zulkefly and Rozumah Baharudin (2009). Mobile Phone Use amongst Students in a University in Malaysia: It's Correlates and Relationship to Psychological Health. *European Journal of Scientific Research*. ISSN 1450-216X. **Vol.37** No.2 (2009):.206-218. EuroJournals Publishing, Inc. 2009.

Sidique, S.F., S.V. Joshi and F. Lupi (2010), Factors Influencing the Rate of Recycling: An Analysis of Minnesota Counties Resources. *Conservation and Recycling*. **54**: 242–249.

Sidique, S.F., Lupi, F., Joshi, S.V. (2010b).The Effects of Behaviour and Attitudes on Drop-Off Recycling Activities. *Resources, Conservation and Recycling*. **54**(3):163-170.

Singh, Ajay S. and Masuku, Micah B. (2014). Sampling Techniques and Determination of Sample Size in Applied Statistics Research: An Overview. *International Journal of Economics, Commerce and Management.* United Kingdom. **Vol. II,** Issue 11, Nov 2014.

Siti Nur Diyana Mahmud and Kamisah Osman (2010). The Determinants of Recycling Intention Behavior among the Malaysian School Students: An Application of Theory of Planned Behavior. *Procedia Social and Behavioral Sciences.* **9** (2010):119–124.

Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K. B., Miller, H. L. (Eds.). (2007). Contribution of Working Group I to the Fourth Assessment *Report of*

the Intergovernmental Panel on Climate Change. Cambridge, UK: Cambridge University Press.

Song, Qingbin, Wang, Zhishi, and Li, Jinhui (2012). Residents' Behaviors, Attitudes, and Willingness to Pay for Recycling E-Waste in Macau. *Journal of Environmental Management*. **106:** 8-16.

Slavik J and Pavel J (2013). Do The Variable Charges Really Increase the Effectiveness And Economy of Waste Management? A Case Study of the Czech Republic. *Resources, Conservation and Recycling* **70**: 68–77.

Spector, P. E., Liu, C., and Sanchez, J. I. (2015). Methodological and Substantive Issues in Conducting Multinational and Cross-Cultural Research. *Annual Review of Organizational Psychology and Organizational Behavior*. **2**:9, 1.9-31.

Star (2016). *Recycle? Malaysians want to see the money.* The Star. Monday, 11 July 2016.

SWCorp. (2016). Solid Waste Management and Public Cleansing Corporation (Corporate-info). Retrieved from the SWCorp website:http://www.ppsppa.gov.my/.

Swider, Matt (2017). iOS 10 and iOS 10.3 Features and Updates. *The Radar.* June 05, 2017.

Tanskanen, Pia (2012). Electronics Waste: Recycling of Mobile Phones, Post-Consumer Waste Recycling and Optimal Production, Enri Damanhuri (Ed.), *InTech.* ISBN: 978-953-51-0632-6,

Tariq Yousuf (2013). E-Waste Management in Bangladesh: Present Trend and Future Implication. Retrieved from ISWA website: http://www.iswa.org/index.php?eID=tx_iswaknowledgebase-download& document. *Id* =2204.

Total Environment Center (2008). Tipping Point: Australia's e-Waste Crisis. Total Environment Center. Australia.

Toner, Kaitlin, Gan, Kaitlin, Muping, and Leary, Mark R. (2014). The Impact of Individual and Group Feedback on Environmental Intentions and Self-Beliefs. *Environment and Behavior*. **46**(1) p. 24–45.

Tourism Malaysia (2013). Johor Map.

Timlett, R.E. and Williams, I.D. (2008). Recycling in a Densely Populated Urban Environment. *Conference on Urban Issues and Solutions*. May 11-15. Alberta, Canada.

United Nations Environment Programme (UNEP), 2007). E-waste. *Inventory Assessment Manual.* Volume I. United Nations Environment Programme.

United Nations Environment Programme (UNEP) (2010). Mobile Phone Partnership Initiative Guidance Document on the Environmentally Sound Management of Used and End-Of-Life Mobile Phones. *Guidance Document on the Environmentally Sound Management of Used and End-Of-Life Mobile Phones*. Retrieved from UNEP website: http://archive.basel.int/industry/mppi/gdfd30Jun2010.pdf.

Utusan Malaysia (2012). *Mengurus Sisa Pepejal*. November 11.

Vicente, P and Reis, E. (2008). Factors Influencing Households' Perception in Recycling. *Waste Management Resources*. **26**. 140-146.

Wagner, T.P. (2009). Shared Responsibility for Managing Electronic Waste: A Case Study of Maine, USA. *Waste Management.* **29** (12), 3014–3021.

Waste-management-world (2010, September). *WEEE Recycling Efforts in New York*. Retrieved from the Waste-Management-World website: http://www.waste-management-world.com/topics/device/mobile/t/66499339/weee-recycling-efforts-in-new-york.htm.

WEEE Directive (EU, 2002a). *Official Journal of the European Union*. Retrieved on Nov.3, 2012 from the Eurolex website: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:037:0024:0038:en:PDF

Wong, C.S.C., Duzgoren-Aydin, N.S., Aydin, A. and Wong, M.H.(2007c). Evidence of Excessive Releases of Metals from Primitive E-Waste Processing in Guiyu. *Environmental Pollution.* **148**: 62-72.

Wong, C.S.C., Wu, S.C., Duzgoren-Aydin, N.S., Aydin, A. and Wong, M.H. (2007b). Trace Metal Contamination of Sediments in An E-Waste Processing Village in China. *Environmental Pollution*. **145**: 434-442.

Wong, M.H., Wu, S.C., Deng, W.J., Yu, X.Z., Luo, Q., Leung, A.O.W., Wong, C.S.C., Luksemburg, W.J. and Wong, A.S. (2007a). Export of Toxic Chemicals – A Review of The Case of Uncontrolled Electronic-Waste Recycling. *Environmental Pollution*. **149** (2): 131-14.

Yaffee, R.A. (1998). *Enhancement of Reliability Analysis: Applications of the Intra-class Correlation with SPSS V8*. March 11, 1998. World Wide Web URL: http://www.nyu.edu/acf/socsci/Docs/intracls.html.

Yaffee, Robert A. (2003**).** *Common Correlation and Reliability Analysis with SPSS for Windows*. Information Technology. NYU. 6 June 2003.

Yamaguchi, Y., K. Tahara, N. Itsubo and A. Inaba, (2003). A Life Cycle Inventory of Cellular Phone. *Proceedings of Eco Design 2003: Third International Symposium on Environmentally Conscious Design and Inverse Manufacturing,* Tokyo, Japan. 445-45.

Yamane, T. (1983). *Statistics: An Introductory Analysis*. New York, USA: Harper and Row.

Yammiyavar, Pradeep G. and Kumar, Vikash (2011). *Research into Design-Supporting Sustainable Product Development*. Amaresh Chakrabarti (ed.) Indian Institute of Science, Bangalore, India: Published by Research Publishing. ISBN: 978-981-08-7721-7.

Yildirim, Caglar (2014). *Exploring the Dimensions of Nomophobia: Developing and Validating a Questionnaire Using Mixed Methods Research*. Iowa State University Graduate Theses and Dissertations. Digital Repository @ Iowa State University.

Yusof, M. B. M., *et al.* (2002). The Role of Socio-Economic and Cultural Factors in Municipal Solid Waste Generation: A Case Study in Taman Perling, Johor Bahru. *Jurnal Teknologi*. **37**((F) Dis): 55–64.

Yin, Jianfeng, Gao Yingnan, and Xu, He (2013). Survey and Analysis of Consumers' Behavior of Waste Mobile Phone Recycling in China. *Journal of Cleaner Production*. Elsevier. **Vol. 65.** 15 February 2014. 517-525. https://doi.org/10.1016/j.jclepro.2013.10.006.

Zaim Zamani (2015). Malaysia's Recycling Rate is Still Low. The Sundaily. April 21, 2015.

Zinwas, Mathew J. and Molenda, Mathew A. (2009). Dietary Nickel as a Cause of Systemic Contact Dermatitis. *Journal of Clinical and Aesthetic Dermatology.* June 2(**6**):39-43.

Zurbrugg, C.(2002). Urban Solid Waste Management in Low-Income Countries of Asia How to Cope with the Garbage Crisis, in Scientific Committee on Problems of the Environment (SCOPE). *Urban Solid Waste Management Review Session*: Durban, South Africa.