KNOWLEDGE, ATTITUDE AND PRACTICE OF E-WASTE MANAGEMENT AMONG ELECTRONIC TECHNICIANS IN ONDO-WEST LOCAL GOVERNMENT AREA, ONDO STATE, NIGERIA

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ABSTRACT

E-waste or electronic waste contains numerous hazardous substances which pose a threat to the environment and human health if they are not disposed off in the correct manner. Subsequently, on average, 9% of the weight of e-waste is made of hazardous substances such as lead, cadmium, mercury (heavy metals) and other toxic chemicals which when burning them indiscriminately pollute the environment and cause health hazards to the people. This study, therefore, examined the knowledge, attitude and practice of e-waste management among electronic technicians in Ondo-west Local Government Area of Ondo State. Descriptive survey research design was used for the study Total enumeration sampling technique was used to select all the two hundred and five electronic technicians in Ondo-West Local Government Area of Ondo State. Self-developed questionnaire structured in line with the variables of the study was used. Four hypotheses were generated, tested and analysed using Chi-square, Cramer v and Pearson Product Moment Correlation at 0.05 alpha level. The result shows that electronic technicians do not have knowledge of e-waste management (X^2 crit = 16.919, Cal. = 16.102, df = 9, P > .05). They do not have positive attitude (X^2 crit = 14.067, Cal. = 13.626, df = 7, P > .05) , and do not practice formal e-waste management (X^2 crit = 23.685, Cal. = 21.984, df = 14, P > .05).There is significant relationship between knowledge and attitude towards e-waste management (r=.308, p<0.05).Based on the findings, it is recommended that government and policy makers should facilitate e-waste management facilities and legislation on health to educate and further create awareness on the negative health implications of indiscriminate e-waste management in Ondo-West Local Government Area of Ondo state. This will help avert/prevent health hazards to members of the community.

***Key Words**: Knowledge, Attitude, Electronic Technicians, E-waste management, hazards substances.*

Introduction

Electronics have become an integral part of daily life as a result of global growth. Manufacturers do produce new products of electronic gadgets on daily basis. This perhaps is as a result of competition among them or technological advancement. The development increases level of electronic waste being generated per individuals. However, how to effectively manage electronic waste has become a burden to our society. E-waste encompasses electrical appliances and electronic gadgets that have reached the end of life. Such electronic gadgets include: microwave ovens, refrigerators, electrical irons, washing machines, air conditioners, television and radio sets, computer systems, mobile phones, electronic accessories and the like.

E-waste (electronic waste) is the disposal of obsolete electronic goods such as cell phones, mp3 players, televisions, and computers (Terada, 2012). Alake and Ighalo (2012) defined e-waste as Waste Electrical and Electronic Equipment (WEEE) that are non-biodegradable, industrial and synthetic. Obsolete and discarded electrical and electronic equipment at end-of-life stage are also called e-waste (Benebo, 2009; Ogungbuyi, Nnoron, Osinbanjo and Schluep, 2012; Adediran and Abdulkarim, 2012). Electronic waste is further defined as unwanted electronic or electrical appliances such as old and outdated computers, laptops, televisions, cellular phones, mp3 players, telecommunication equipment, keyboards, mice, photocopiers, typewriters, (Ogbomo, Obuh and Ibolo, 2012).

Consequently, the volume of (WEEE) grows rapidly every year and is also believed to be one of the most critical waste disposal issues of the 21st century. To be precise, the United Nation Environmental Programme (2009) estimates that 20 to 50 tons of e-waste is being generated per year worldwide. It suggests the urgent need for developing an estimation technique compared to conventional municipal waste. Certain components of electronic products contain toxic substances that generate threats to the environment as well as the human health (United Nation and Environmental Programme, 2005; 2009). For example, television and computer monitors, generally, contain hazardous materials such as lead, mercury and Cadmium, while Nickel, Beryllium, and Zinc are often found in circuit boards. Due to the presence of these substances, recycling and the disposal of e-waste have developed to be matters of interest. The physical composition of e-waste is diverse and contains over 1000 different substances that can be categorised as belonging to either organic or inorganic fractions. Heavy metals form significant part of inorganic fraction, accounting for 20% to 50%. E-waste consists of hazardous metallic elements like lead, cadmium, chromium, mercury, arsenic, selenium and precious metals like silver, gold, copper and platinum (Woodell, 2008).

E-waste management relates to proper ways of discarding electronic products that are no longer satisfying the needs of the initial purchaser, and this varies from one country to the others. However, United Nation Environmental Programme (2009) stated that steps in proper e-waste management include: collection; sorting/dismantling and pre-processing (including sorting, dismantling, and mechanical treatment which can utilise high-tech or low-tech processes). It is also involves end-processing such as: End-Processing refining and disposal Effective collection is crucial to the success of the entire e-waste management system.

Collection process aims at gathering discarded products from customers to the recovery point (Brito and Dekker, 2002). In this process, the transportation and inventory costs of returned products, differs from product to another according to the type of reverse logistics system which could be implemented. An efficient E-waste collection and transportation system will ensure re-use, recycling and adequate E-waste management including prevention of damage or breaking components that contain hazardous substances.

The purpose of dismantling and pre-processing in e-waste management is to liberate the materials and direct them to the appropriate final treatment processes. Hazardous substances have to be removed and stored or treated safely, while valuable components need to be taken out for re-use or to be directed for efficient recovery processes. The main activities of pre-processing are separating, sorting, and shredding. After pre-processing, end-processing results to final recovery of the individual materials present in the products. The final recovery of elements requires state of the art technologies and highly skilled people. End-processing plants require very high continual investment, and therefore require high volumes of e-waste to be economically viable (United Nation Environmental Programme, 2009).

In Nigeria and most developing Africa countries, e-waste management practices remain primitive and take place mainly in the informal sector. This informal processing may result in serious health and pollution problems. It has been reported that e-waste disposal has become problematic, especially when humans and the environment come in contact with hazardous chemicals during the process of dismantling electronic products (Puckett, Byster, Westervelt, Guitierrez, and Davis, 2002). Moreover, control of e-waste in Nigeria is inadequate. There has been insufficient enforcement of environmental laws and difficulties in implementing Extended Producer Responsibility and producer take-back, together with a general lack of awareness, funds, and no material recovery facility for e-waste and/or appropriate solid waste management infrastructure in place. Waste materials often end up in open dumps and unlined landfills (Wanjiku, 2008).

According to Sarkar (2008), E-waste contains numerous hazardous substances which may pose a threat to the environment and human health if they are not disposed of in the correct manner. Subsequently, on average, 9% of the weight of e-waste is made of hazardous substances such as lead, cadmium, mercury (heavy metals) and other toxic chemicals. Furthermore, in a study by Benedicta (2012) on e-Waste management; a case study of Lagos State, Nigeria, it was discovered that 57% of electronic importers agreed that they experienced respiratory problems as a result of interaction with e-waste while 85% of Computer and Photocopying Services and 96% of Local Recyclers (waste scavenging) agreed that they experienced respiratory problem.

Overall, human health risks from e-waste include breathing difficulties, respiratory irritation, coughing, choking, pneumonitis, tremors, neuropsychiatric problems, convulsions, coma and even death (Yu, Welford and Hills, 2006). E-waste workers are also exposed to other hazards leading to physical injuries and chronic ailments such as asthma, skin diseases, eye irritations and stomach disease (Raghupathy, Kruger, Chaturved, Arora, and Herizer, 2010). (Liu, 2009), stated that pollution generated by e-waste processing brings about toxic or genotoxic effects on the

human body, threatening the health not only of workers but also of current residents and future generations living in the local environment. The researcher observed during the preliminary studies that electronic technicians indiscriminately disposed their waste by burning as well as dumping. Long-range transport of pollutants has also been observed by researcher, which suggests a risk of secondary exposure in remote area. This can lead to series of diseases. There has been paucity of research on this topic, particularly, in Ondo-West Local Government Area. Hence this researcher seeks to find out the knowledge attitude and practice of E-waste management among Electronic technicians in Ondo-West Local Government Area of Ondo State Atmospheric pollution due to burning and dismantling activities seems to be the main cause of occupational and secondary exposure to diseases (Sepúlveda, 2010).

Research hypotheses

The following null hypotheses were tested at 0.05 alpha level

1. There will be no significant knowledge of e-waste management among electronic technicians in Ondo West Local Government.
2. There will be no significance difference in positive attitude towards e-waste management among electronics technicians in Ondo West Local Government.
3 There will be no significance difference in practice towards E-waste management among electronics technicians in Ondo West Local Government.
4. There will be no significant relationship between knowledge and attitude towards e-waste among electronic technicians in Ondo-West Local Government Area

Methodology

The descriptive survey research design was used for this study. The use of this research design was considered appropriate because of its merit, which suits a study of this nature. According to Thomas and Nelson (2001), descriptive research design helps a researcher in the collection of information, identifying problems, making comparison and carrying out systematic evaluation. The population for this study was made up all electronic technicians in Ondo-West Local Government Area, Ondo State. The sample for this study was two hundred and five (205) respondents made up of all electronic technicians in Ondo-West Local Government Area, Ondo State. Total enumeration sampling technique was used.

The instrument for this study was a self-developed structured questionnaire designed according to the variables to be tested in the hypotheses. The questionnaire was in two sections A and B. Section A focused on demographic data of the respondents. Section B sought information on Knowledge of E-Waste Management Scale (KEWMS), Attitude towards E-Waste Management Scale (AEWMS), Practice towards E-Waste Management (PEWM) and relationship between knowledge and attitude towards e-waste management Scale (RKAEWMS). All items in the instrument were close ended and were in line with the modified Likert type scale of Yes or No. Twenty five (25) respondents from electronic technicians in Ondo-East Local Government Area of Ondo, who were not part of the actual respondents, were used in the pilot test. The data collected was subjected to Cronbach Alpha to determine the reliability and co-efficient of 0.68 was obtained. The completed copies of the questionnaire were collected, coded and analysed using both descriptive and

inferential statistics. The descriptive statistics of frequency count and percentage was used to analyse the demographic information while inferential statistics of Chi-Square, Cramer V and Pearson Product Moment Correlation were used to test the hypotheses at 0.05 level of significance.

Results

Hypothesis One: There will be no significant knowledge of E-waste management among electronic technicians in Ondo West Local Government

Table 1: Chi-square table showing the knowledge of e-waste management among electronic technicians

	Yes	%	No	%	X^2cal	X^2crit	Df	P
Have you heard about electronic waste before?	90	48.1	97	51.9	16.102	16.919	9	.056
Do you have adequate knowledge of electronic waste management?	52	27.8	135	72.2				
Are there any risks associated with poor electronic waste management to the environment	58	31.0	129	69.0				
Does improper electronic waste management cause diseases?	53	28.3	134	71.7				
Does improper electronic waste management cause pollution to the environment?	64	34.2	123	65.8				
Does Electronic waste comprise of harmful substances?	71	38.0	116	62.0				
Do you know that some components of electronic waste require special treatment before disposed?	48	25.7	139	74.3				
Does indiscriminate dumping of electronic waste affect soil and aquatic animals?	91	48.7	96	51.3				
Can electronic waste be recycled for further use?	90	48.1	97	51.9				
Does electronic waste constitute nuisance to the workshop?	120	64.2	67	35.8				

The table above shows that electronic technicians in Ondo-West Local Government Area do not have significant knowledge of e-waste management (X^2 crit = 16.919, Cal. = 16.102, df = 9, P > .05). It was observed that the X^2 crit. was greater than theX^2 cal.). The null hypothesis is, therefore, accepted.

HypothesisTwo: There will be no significance difference in positive attitude towards E-waste management among electronics technicians in Ondo West Local Government

Table 2: Chi-square table showing attitude towards e-waste management among electronic technicians

	Yes	%	No	%	X^2cal	X^2crit	Df	P
Do you belief in electronic waste management?	82	43.9	105	56.1	13.626	14.067	7	.094
Does Electronic waste generation require adequate treatment and disposal?	71	38.0	116	62.0				
Does disposing of electronic waste a waste of effort to you?	119	63.6	68	36.4				
Does management of electronic waste be the responsibility of Government alone	156	83.4	31	16.6				
Artisans are not supposed to have role in minimising electronic waste?	108	57.8	79	42.2				
It is better I dump electronic waste anywhere that is convenient.	96	51.3	91	48.7				
There is no reason for electronic waste management.	87	46.5	100	53.5				
Will you adopt any National policy or regulations that can manage electronic waste?	127	67.9	60	32.1				

The table 2 above shows that electronic technicians in Ondo-West Local Government Area do not have significant positive attitude towards e-waste management (X^2 crit = 14.067, Cal. = 13.626, df = 7, P > .05). It was observed that the X^2 crit. was greater than theX^2 cal.). The null hypothesis is, therefore, accepted.

Table 3: Cramer V table showing the direction and magnitude of attitude towards e-waste management among electronic technicians

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Nominal by Nominal	Phi	-.129			1.004
	Cramer's V	.129			1.120
	Contingency Coefficient	.101			1.010
Interval by Interval	Pearson's R	-.129	.042	-6.453	1.050[c]
Ordinal by Ordinal	Spearman Correlation	-.129	.042	-6.453	1.111[c]
N of Valid Cases		187			

Table 3 further reveals that there is no significant positive attitude towards e-waste among electronic technicians.

Hypothesis Three: There will be no significance difference in practice towards E-waste management among electronics technicians in Ondo West Local Government

Table 4: Chi-square table showing practice of e-waste management among electronic technicians

	SA	A	D	SD	X^2cal	X^2crit	df	P
I use electronic waste part as spare part for repairing	171	91.4	16	8.6	21.984	23.685	14	.061
I usually keep my electronic waste inside my workshop	168	89.8	19	10.2				
I burn electronic cable that is not useful again	150	80.2	37	19.8				
I burn un-useful electronic plastic cover	135	72.2	52	27.8				
I dismantle electronic waste to remove some useful part	156	83.4	31	16.6				
I dispose electronic waste outside my workshop	36	19.3	151	80.7				
I keep electronic waste in front of my shop	104	55.6	83	44.4				
I dispose my electronic waste in an open dump site	152	81.3	35	18.7				
I dump my electronic waste in any available place(s)	121	64.7	66	35.3				
I dump my electronic waste in sea or river	100	53.5	87	46.5				
I sell my electronic waste to recycler	142	75.9	45	24.1				
I give out my electronic waste to scavenger	143	76.5	44	23.5				
Does your association have rules in compliance with Government regulation for e-waste management?	85	45.5	102	54.5				
Is there any designated area for electronic waste collection in your town?	18	9.6	169	90.4				
Are there institutional structures for electronic waste management collection and enforcement in your area?	14	7.5	173	92.5				

Table 4 above shows that electronic technicians in Ondo-West Local Government Area do not have significant practice of formal e-waste management. Most of their e-waste methods of disposal were majorly based on informal methods (burning, dismantling and open dumping) (X^2 crit = 23.685, Cal. = 21.984, df = 14, P > .05). It was observed that the X^2 crit was greater than the X^2 cal.). The null hypothesis is, therefore, accepted.

Hypothesis Four: There will be no significant relationship between knowledge and attitude towards e-waste among electronic technicians in Ondo-West Local Government Area.

Table 5: Correlastion table showing the relationship between knowledge and attitude towards e-waste management

		Knowledge	ATTITUDE
Knowledge	Pearson Correlation	1	.308
	Sig. (2-tailed)		.000
	N	187	187
Attitude	Pearson Correlation	.308	1
	Sig. (2-tailed)	.000	
	N	187	187

Table 5 shows that there is significant relationship between knowledge and attitude towards e-waste among electronic technicians in Ondo-West Local Government Area (r=.308, p<0.05), therefore, the null hypothesis is rejected.

Discussion of findings

This study shows that electronic technicians in Ondo West Local Government area did not have significant knowledge of E-waste management. The finding corroborates Qingbin, Zhishi, and Jinhui (2012) submission that residents have limited understanding of e-waste hazards. This indicates that some appropriate measures need to be taken to solve e-waste issues. It was also discovered that the electronic technicians did not have significant positive attitude towards E-waste management and this is in line with Sakalli (2001) submission that attitudes are developed based on feelings, knowledge and thoughts and on individuals' social values and beliefs. They change from individual to individual. The attitude of an individual is the combination of what he thinks, what he believes, how he feels and how he acts.

Electronics technicians in Ondo West Local Government Area did not have significant formal practice of E-waste management and the finding is in line with Miller (2005) who reported that people stored e-waste devices for unspecified period until they sell the devices. The rest are either donated or thrown to the dump site, and there are some who do both selling and donating depending on the condition of usability of the devices. It was also discovered that there are significant relationship between knowledge and attitude towards e-waste management. This finding

also corroborates with Qingbin, Zhishi, and Jinhui's (2012) submission that residents' limited understanding of e-waste knowledge is assumed to be interrelated with the practice and attitude in managing the e-waste at end of life.

Conclusion

The environment is undoubtedly mankind's most common heritage. Hence, no effort made towards its preservation is too much. In the light of this, the preservation of human beings and the environment in which they live are undoubtedly mankind's greatest priorities. Based on the findings of the study, it was obvious that electronic technicians in Ondo-West Local Government Area of Ondo State burnt their electronic waste, make use of open dump site and it is also evident that there are no e-waste regulation and facilities in the town and were not aware of health implications of improper e-waste management.

Furthermore, the electronic technicians in Ondo-West Local Government Area of Ondo State do not have significant knowledge of e-waste management, they do not have significant positive attitude towards e-waste management and do not practice what is expected as formal e-waste management. However, it is important for goverment to make legislation and educate individuals on effective e-waste policies and sensitise electronic technicians and other users on the inherent dangers of indiscriminate e-waste disposals. This will help spark off interest on effective and health friendly e-waste arrangement among electronic technicians and other users.

Recommendations

Based on the findings of this study, the following recommendations are made:

I. State/Local Government should make provision for e-waste management facilities and legislations.

II. State/Local Government should organised health education and create awareness on health and environmental implication of indiscriminate e-waste management.

III. Mass and social media should increase their effort towards public health and environmental health education.

IV. There should be incentives to encourage citizens and electronic technicians to shun indiscriminate e-waste and willingness to release all e-waste in their possession.

V. Local capacity for the recovery of copper, steel, lead, silver, gold, platinum group metals, plastics, etc. from e-waste, and separation of e-waste from municipal solid waste should be developed.

VI. There should be a policy on the disposal of electronic waste and to be monitored and enforced by the Ministry of Environment for proper e-waste monitoring.

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