

ASSESSMENT OF E-WASTE COLLECTION AND DISPOSAL ACTIVITIES IN GOVERNMENT AGENCIES, BUSINESS AND RESIDENTIAL AREAS IN MINNA METROPOLIS, NIGER STATE

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Abstract

E-waste and its devastating effects to human existence is one major global concern today. This study was designed to Assess E-waste collection and disposal activities in government agencies, business and residential areas in Minna metropolis, Niger State Nigeria. The research adopted a descriptive survey design. The target population was 226,661. Through Non-probability sampling techniques Purposive and convenience sampling method was used to sample 311 subjects from the population, they includes; 100 Repairers, 100 Users and 111 EEE Regulators taken from (NESREA 34, NISEPA 53, and FME 24). Structured questionnaire of 22 items was used for data collection. The instrument was validated by three experts and Cronbach Alfa (K-R20) statistic was used to ascertain the extent of homogeneity of the items and reliability coefficient of 0.75 was obtained. Data was collected and analyzed using statistical package for social science (SPSS version 20). Mean and standard deviation were used to answer the research questions, while ANOVA was used to test the hypotheses at 0.05 level of significant. The findings of the study show that, E-waste is sorted out from solid waste at the point of collection before disposal, E-waste are dumped indiscriminately along the streets and the individual that generate E-waste are responsible for the disposal. The study recommended among others, that Government should put in place effective monitoring system for management of e-waste in Niger State Nigeria and world at large.

Keywords: E-waste Electrical & Electronic waste (EEE), End of Life (Eol), Tukey Honestly Significant Difference (Tukey HSD).

Introduction

Electrical and Electronics Equipment waste is a global concern that needs to be addressed critically. Electrical and Electronics Equipment (EEE) is any item with circuitry or electrical components that uses electrical power or battery supply in homes, offices and business areas. Morgan (2006) describes e-waste as Waste Electronic and Electrical Equipment (WEEE) that are discarded because they have reached their end of life usage. Due to continuous development and high demand of new models of electrical gadgets, EEE becomes technologically obsolete in a matter of months and this contributes to a great increase in electronic waste, which is a threat to the environment and our health (Greenpeace International 2010). There is dare need for E-waste to be collected properly from the government areas, Business and Residential areas.

E-waste Collection activities is the way (Eol) end of life equipment are collected from the users and business areas for proper disposal. There are various possible ways of organizing collection systems, In developed countries, e-waste collection is organized to be collected at a point, where consumers are obliged to hand in their obsolete devices (Huisman, Magalini, Kuehr, Maurer, Oglvie, Poll, Delgado, Artim, Szlezak, & Stevels, 2008), the extended producer responsibility plan takes care of the product manufactured by the manufacturers, the users of EEE are meant to return the Eol equipment to the manufacturers, the users of in particular the informal method of collection of E-waste is still in operation. At the residential areas EEE are being used and at the end of their life cycle are discarded and collected by the scavengers and finally brought to small- and medium-sized scrap metal yards, where they are

environment which calls for assessment. Assessment is therefore the process of collecting facts about the happenings, characteristics and outcomes of a programme or issue in order to make judgment, improve the effectiveness of the programme (Patton, 2008). Lack of proper implementation of the laws and regulations for environmental legislations especially in E-waste have made collection and disposal of E-waste more complicated. It was on this note that this study assessed E-waste collection and disposal activities in government Agencies, business and Residential areas in Niger State.

Statement of the Problem

Rapid advancement of technologies has increase E-waste generation in Government Agencies, Business and Residential areas, evidence of this is shown with lots of discarded E-waste being littered around our environment and water ways. E-waste management activities such as collection and disposal according to Terada (2012) appear to be inefficient and inadequate and therefore pose a huge risk on human health and the environment. Niger State environmental protection agency (NISEPA) saddled with the responsibility of managing e-waste is mostly concerned only in collection and disposal of solid waste. Effort by the regulatory authorities seems to have little or no effect in the management. E-waste regulation seems not to be adequately adhered to, this is obvious going by the increasing amount of e-waste in our environment, and hence this study is set out to assess the E-waste management activities in government agencies, business and residential areas in Niger State, Nigeria.

Research Questions

- (i) What are the E-waste collection activities in government agencies, business and residential areas in Minna metropolis, Niger State?
- (ii) What are the E-waste disposal activities in government agencies, business and residential areas in Minna metropolis, Niger State?

Hypotheses

- Ho₁:** There is no significant difference in the mean responses of E-waste regulators, EEE repairers and EEE Users as regards E-waste collection practices in Minna, Niger State
- Ho₂:** There is no significant difference in the mean responses of E-waste regulators, EEE suppliers and EEE users as regards E-waste disposal practices in Minna, Niger State.

Methodology

The research design used for this study was the descriptive survey research design. The area of this study was Minna Metropolis Niger State, Nigeria. The target population for this study was 226,661 subjects which includes 2560 EEE repairers, 111 EEE Regulators taken from (NISEPA 53, NESREA 34 and FME 24) and 223, 990 EEE Users. Through a non-probability Sampling Techniques, Purposive sampling was used to select 100 EEE Repairers from the Association of Repairers in Minna, metropolis this is because repairers all over the metropolis have the same characteristics. Convenient sampling was used to select 100 EEE users reason been that their population is much and they are of the same characteristics everywhere. 111 regulators were gotten from the nominal roll of the various establishment; 53 from NISEPA, 24 from Federal Ministry of Environment and 34 from NESREA totaling 311 respondents. A structured questionnaire of five point scale was used and was validated by three experts from ITE Department, Federal University of Technology Minna, reliability coefficient of 0.75 was obtained using Cronbach Alpha. A 22 items questionnaire was used for data collection. Statistical package for social sciences (SPSS version 22.00) was used for data analysis. Mean and Standard deviation were used to answer the research questions. Analysis of Variance (ANOVA) was used to test the null Hypotheses at 0.05 level of significance. A total of 311 questionnaires were administered to the subjects, and 298 were retrieved, representing a 96% return rate.

to interpret the mean responses of each item in the real world of numbers. The mean score for a computed mean of 1.1. Therefore, the mean score for a variable with a mean of 1.1 is above this to be regarded as agree while the mean score of 1.0 is regarded as disagree. The mean responses between the mean score of 1.0 or greater shows a wide gap in the responses and therefore the null hypothesis is rejected. Otherwise the null hypothesis was accepted. Standard deviation was used to test the mean responses of the respondents. Item with standard deviation less than 1.0 is considered that the responses of the respondents are not to high and low. Item with standard deviation equal or above the value value indicated that the responses are far from the mean. As a rule of thumb, the null hypothesis is rejected when t-value was greater than the significance value (p < 0.05) otherwise this was not the significant difference (p > 0.05).

Question 1: What are the T waste collection practices in government agencies, commercial/residential areas in three metropolitan, Niger State?

Table 2: Mean with standard deviation of regulatory bodies, CCS Regulators, and CCS Users on the T waste collection practices

Item	Regulatory Bodies		Users		Regulators		Average		Remark
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
1. The T waste collection is done regularly	1.1	0.3	1.0	0.4	1.1	0.3	1.1	0.3	1
2. The T waste collection is done by the government	1.0	0.4	1.1	0.3	1.0	0.4	1.0	0.4	1
3. The T waste collection is done by the private sector	1.1	0.3	1.0	0.4	1.1	0.3	1.1	0.3	1
4. The T waste collection is done by the community	1.0	0.4	1.1	0.3	1.0	0.4	1.0	0.4	1
5. The T waste collection is done by the government and private sector	1.1	0.3	1.0	0.4	1.1	0.3	1.1	0.3	1
6. The T waste collection is done by the government and community	1.0	0.4	1.1	0.3	1.0	0.4	1.0	0.4	1
7. The T waste collection is done by the private sector and community	1.1	0.3	1.0	0.4	1.1	0.3	1.1	0.3	1
8. The T waste collection is done by the government, private sector and community	1.0	0.4	1.1	0.3	1.0	0.4	1.0	0.4	1
9. The T waste collection is done by the government, private sector and community	1.1	0.3	1.0	0.4	1.1	0.3	1.1	0.3	1
10. The T waste collection is done by the government, private sector and community	1.0	0.4	1.1	0.3	1.0	0.4	1.0	0.4	1

9	Standard vehicle is used by Niger State environmental protection Agency, (NISEPA) for transporting generated e-waste to the final site	3.38	1.24	3.22	.85	3.07	.74	3.22	.94	Agree
10	Inventory of e-waste are kept properly by the regulatory Agencies	3.09	1.11	2.98	.87	2.89	.91	2.99	.96	Disagree
11	Documented procedures for monitoring e-waste collection are kept by the Regulatory Agency.	3.25	1.22	3.00	.97	3.00	.76	3.08	.98	Agree
12	There is regular training of personnel in e-waste management.	2.77	1.26	2.94	.81	3.09	.72	2.93	.93	Disagree
Grand Mean		3.27	1.11	3.11	.87	3.06	.81	3.15	.93	Agree

Key: SD = Standard Deviation, EEE = Electrical Electronic Equipment

Result in table 1 showed that the mean of items 1, 2, 3, 4, 5, 8, 9, 11 are within 3.08-3.38 which is an indication that these are collection practices carried out in the study area. Mean of items 6, 7, 10 & 12 ranges between 2.89 - 2.99 indicating that these collection practices are not carried out. Mean of items 6, 7, 10 & 12 ranges between 2.89 - 2.99 indicating that these collection practices are not carried out. The standard deviation values for the 12 items in Table 1 ranges from 0.79 - 1.06, all of which are less than the standard deviation threshold value of 1.96, indicating that the responses of the respondents are close to one another. The implication of this is that the respondents have similar opinion on the collection practices in Minna, Niger State. Therefore, the closeness of the responses adds value to the reliability of the mean. Meanwhile, the grand mean of all the respondents is 3.15 which signify that most respondents agreed with the collection practices in management of E-waste in Minna Niger State.

Research Question 2: What are the E-waste disposal practices in government agencies, business and residential areas in Minna metropolis, Niger State?

Table 2: Mean with standard deviation of government regulatory bodies, EEE repairers, and EEE users on E-waste disposal practices

SN	Item	Regulatory Bodies		Users		Repairers		Averages		Remark
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	
1	E-waste is disposed along with other waste in the landfills.	3.62	1.28	3.45	.76	3.54	.91	3.54	.98	Agree
2	Special dumpsite is allocated for disposal of E-waste.	2.98	1.13	3.02	.81	2.95	.84	2.98	.93	Disagree
3	Individuals and organizations can freely dispose there e-waste at the dustbin.	3.92	.82	3.21	.93	3.41	1.09	3.51	.95	Agree

Table 3 shows the one-way between-groups analysis of variance that was conducted for the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste collection practices in Minna, Niger State. The result of the analysis showed an f-ratio of 3.632 and a significance criterion (sig) of .028 which is less than the p-value of .05. Therefore the null hypothesis was rejected. Hence, there is a significant difference in the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste collection practices in Minna, Niger State. See Table 4. on Post-hoc comment.

Table 4: Post-hoc comparisons using Tukey HSD test on the difference in the mean responses of E-waste regulators, EEE repairers and EEE Users as regards e-waste collection practices in Minna, Niger State

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Regulatory Bodies	User	.16444	.07497	.075	-.0125	.3414
	Repairer	.21330*	.08553	.036	.0114	.4152
User	Regulatory Bodies	-.16444	.07497	.075	-.3414	.0125
	Repairer	.04887	.07816	.806	-.1356	.2333
Repairer	Regulatory Bodies	-.21330*	.08553	.036	-.4152	-.0114
	USER	-.04887	.07816	.806	-.2333	.1356

*. The mean difference is significant at the 0.05 level.

Table 4 shows the result of the Post-hoc comparisons using the Tukey HSD test on the difference in the mean responses of E-waste regulators, EEE repairers and EEE Users as regards E-waste collection practices in Minna, Niger State. The results indicated that the mean response for regulatory bodies (whose mean difference was -0.164, and a significance criterion (sig.) of 0.75) was significantly different from the mean response for repairers (whose mean difference was 0.213 with a sig of 0.036). However, the mean responses for users did not differ significantly from either the mean responses regulatory bodies or repairers.

Hypothesis Two: There is no significant difference in the mean responses of E-waste regulators, EEE suppliers and EEE users as regards E-waste disposal practices in Minna, Niger State.

The result of one-way analysis of variance of the mean of responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste disposal practices in Minna, Niger State, shows that the Levene's test of homogeneity of variance that was conducted yielded 0.304, since 0.304 is higher than the confidence level of 0.05, the assumption of homogeneity of variance was met. Therefore, it is proper to make use of ANOVA for analyzing data for hypothesis two.

Table 5: Analysis of variance of the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste disposal practices in Minna, Niger State

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.573	2	.287	1.474	.231
Within Groups	42.018	216	.195		
Total	42.591	218			

Table 5 shows mean responses of E-waste collection practices in Minna, Niger State. The result of the analysis showed an f-ratio of 3.632 and a significance criterion (sig) of .028 which is less than the p-value of .05. Therefore the null hypothesis was rejected. Hence, there is a significant difference in the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste collection practices in Minna, Niger State. See Table 4. on Post-hoc comment.

Discussion
Finding on point of collection of E-waste regulators in Minna, Niger State. The results indicated that the mean response for regulatory bodies (whose mean difference was -0.164, and a significance criterion (sig.) of 0.75) was significantly different from the mean response for repairers (whose mean difference was 0.213 with a sig of 0.036). However, the mean responses for users did not differ significantly from either the mean responses regulatory bodies or repairers.

The finding kept close to the ground by Oteng-Afful (2010) informal sector strong network door to door because the control from significant disposal regards E-waste.

The finding of areas, research landfills by streets of Minna this landfill supported the parasitic disposal of e-waste on Schmidt (2000) contamination safely in a land

Findings emanate from streets and the reported that

Table 5 shows the one-way between-groups analysis of variance that was conducted for the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste disposal practices in Minna, Niger State. The result of the analysis showed an f-ratio of 1.474 and a significance criterion (sig) of 0.231 which is greater than the p-value of 0.05. Therefore the null hypothesis was accepted. Hence, there is no significant difference in the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste disposal practices in Minna, Niger State.

Discussion

Based on research question 1 reveals that E-waste are separated from other waste at the point of collection before disposal. In addition to this, the null-hypothesis which was tested at 0.05 level of significance revealed that there is a significant difference in the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste collection practices in Minna, Niger State. A post-hoc comparisons using the turkey HSD test was conducted and it revealed that significant difference was in the mean responses of regulatory bodies. These findings are in consonance with the findings by Sharma (2015) who reported that recovery of metals and other perceived working parts such as memory chips, Integrated Circuits (IC), aluminum, copper and steel from an obsolete EEE has to undergo dismantling and separation and the extracted materials are then sold to traders. The informal waste collectors (scavengers) use to move round Metropolis to pick the Eol gadgets with their pushcarts. Most of the collectors buy such e-waste for small amounts of money from businesses or private households. Due to the insufficient means and facilities used for waste transportation there is limit of the amount of waste that can be transported to the dumpsites per day. This may be responsible for the separation at the point of collection before disposal.

The finding also revealed that waste collection is on daily basis and waste collection centers are kept close to government, business and residential areas. This finding is in line with the report by Oteghang-Ababio (2012) who stated that despite the effectiveness of the formal sector, the informal sector operators dominate the e-waste management sector and they have active working networks, employ very cheap labour and are able to access areas, communities and door to door collection of e-waste paying for the waste they collect. This statement is evident because the waste collectors are everywhere on the street picking the waste without much control from government. The result of the analysis in hypotheses 1 showed that there was significant difference in the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste collection practices in Minna, Niger State.

The finding on the E-waste disposal practices in government agencies, business and residential areas, research question 2, revealed that E-waste is disposed along with other waste in the premises by Individuals and organizations. E-wastes are dumped indiscriminately along the streets of Minna. This is in agreement with Finlay (2013) who reported that wastes disposed at the landfill are carelessly dumped and are often not closely monitored. Okebukola (2001) also reported that inappropriate disposal of waste is a factor that spreads gastrointestinal and zoonotic disease primarily caused by vectors. This may be responsible for the negative impact of e-waste on human health and environment which has a direct link on how they are disposed. Schmidt (2006) argued that old landfills accepting E-waste will cause groundwater contamination, he stated that E-waste can be incinerated if it cannot be recycled and disposed properly in a landfill, owing to excessive toxin.

Findings emanating from Table 2 revealed that E-wastes are dumped indiscriminately along the streets and the persons that generate e-waste are responsible for the disposal. NISEPA (2010) stated that this is not a good development because of the various health implications

attached to e-waste. Open dumpsites are usually found in developing countries that do not have the landfill/incineration infrastructure. Niger State falls under the category of countries that have institutional, legal and financial challenge and weak administrative structures which results in open dumpsites. This finding is also in harmony with that of Musa, Saidu and Musa (2016) who stated that NISEPA and other stakeholders responsible for waste disposal should be more dedicated in the fight to minimize waste in the city, and government should provide more funds and employ some current measures in collecting and disposing of waste. Mavropoulou (2015) argued that open dumpsites need large land designated for the dumping of municipal waste, hazardous e-waste and other types of waste. The result of the analysis of hypotheses 2 showed that there is no significant difference in the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste disposal practices in Minna, Niger State. The opinion of the respondents is close, this may be due to the way E-waste are seen littered around the streets and corners of metropolis.

Conclusion

The high demand for electrical and electronics equipment globally contributes to a great extent the increase in electronic waste, these constitute a threat to the environment and our health. Several attempts have been made towards zero E-waste community but up till date they have not yielded satisfactory result. Hence, this study assessed the E-waste collection and disposal activities in government Agencies business and residential area in Minna metropolis, Niger State Nigeria. The study found out that E-waste is not collected and disposed adequately in Minna Niger State and the various environmental agencies responsible for effective management of e-waste are not adequately strengthened for effective management of E-waste in Minna metropolis Niger State, Nigeria

Recommendations

The following recommendations were made based on the findings of the study:

- (i) Environmental agencies should make sure that E-waste is separated at the point of collection before disposal and Collection of e-waste should also be on daily basis while waste collection centre should be kept close to government, business and residential areas.
- (ii) E-waste regulators should make sure that E-wastes are not dump indiscriminately along the streets and the individual that generate e-waste should be responsible for the disposal, this can be achieved by creating a public awareness.

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