

**ASSESSMENT OF THE E-WASTE MINIMIZATION AND
REGULATION ENFORCEMENT ACTIVITIES IN
GOVERNMENT AGENCIES, BUSINESS AND
RESIDENTIAL AREAS IN MINNA METROPOLIS, NIGER
STATE, NIGERIA**

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Abstract

This study was designed to assess E-waste minimization and regulation enforcement activities in government agencies, business and residential areas in Minna metropolis, Niger State, Nigeria. Two research questions and two null hypotheses tested at 0.05 level of significance guided the study. The research adopted a descriptive survey design. 311 respondents were sampled out of a 226,661 population which comprises of: NESREA 34, NISEPA 53, FME 24, USER 100 and REPAIRERS 100. Structured questionnaire titled: E-waste minimization and regulation enforcement activities in government agencies, business and residential area (EMREGBRA) was used for data collection. The instrument was validated and reliability was checked using Cronbach Alfa (K-R20) and found to be 0.89. Mean and standard deviation were used to answer the research questions. While one-way analysis of variance (ANOVA) was used to test the Null hypotheses at 0.05 level of significance. Post-hoc (Tukey Honest Significant Differed (HSD)) was used to test the difference for rejected hypotheses at (P<0.05). The findings of the study shows that, refurbishing and repairers are carried out to minimize E-waste, Measures for enforcement of e-waste management are not provided. The study recommended among others that: The implementation of current and effective E-waste legislation and the national regulations regarding importation of used electrical and electronics goods should be fully enforced and Government should provide adequate measures and infrastructure for enforcement of E-waste management,

Introduction

Changes and innovations in technology have left the world with a threat of deterioration in environmental condition and human health. E-waste contains hazardous components and are still handled in an environmentally unfriendly manner in most developing nations like Nigeria. This is obvious, going by the way E-waste are sorted locally by the scavengers. E-waste has grown not in the developed countries but also among the developing countries, reflecting a continuous growth and tolerance for cross-border movement (Ray, 2008).

Schluep (2009) revealed that in most developing country, between 20 and 50 million tons of E-waste are generated globally. The growth rate is nearly three times faster than the overall municipal solid waste stream. Electrical and electronic waste are obsolete devices such as televisions, computers, monitors, entertainment electronics, mobile phones, mice, cameras, scanners, manufacturing control equipment, and medical devices, to mention a few. Davis and Heart (2008) described E-waste as obsolete, end-of-life or discarded appliances that use electricity. Some of the end-of-life appliances can be refurbished or repaired for use.

Refurbishing is the process of re-using, or distribution for re-use of electronic equipment and components, rather than discarding them at the end of their life cycle (Osuagwu & Ikerionwu, 2010). Repairs and refurbishing consist of all the repairs and services carried out in electronics in order to extend the life span of the equipment and keep the devices in the supply chain. The process can be relatively easy and inexpensive. However, the repaired equipment must be tested to meet manufacturer specification before sending it into the market (ATC Logistics, 2010). This exercise which is mostly carried out by electronic technicians help to minimize E-waste.

Electronic technicians contribute in minimizing E-waste by applying the

principle of (3R) reuse, recycling and recovery (Fodor & Klemes, 2011). Extended producer responsibility (EPR) is also another way to minimize E-waste. By this, manufacturers are encouraged to recycle their WEEE in the environment, by retrieving their products that have come to their end of life (Eol), to a particular point for recycling. This will lead to reduction in the amount of greenhouse gas emissions caused by e-waste. These activities can be enforced by the regulatory bodies.

E-waste regulation enforcement is a process of ensuring that laid down rules on e-waste are observed or implemented adequately. The regulations are directed towards sustainable environment friendly practices. The regulations are put in place to ensure that waste is managed in a manner that will protect human health and the environment against the adverse effects which may result from the waste. Federal Ministry of Environment (FME) is saddled with the responsibility of regulation and enforcement of the Harmful Waste Act in relation to E-waste importation and generation in Nigeria. Its ineffectiveness led to unchecked increases in the activities carried out in e-waste markets, fuelling the continued degradation of human health and the environment. Subsequently, the National Environmental Standards and Regulations Enforcement Agency (NESREA) was established.

NESREA is empowered to enforce all environmental standards, regulations, rules, laws, policies and guidelines in Nigeria. It is also empowered to enforce compliance with regulations on the importation, exportation, production, distribution, storage, sale, use, handling and disposal of hazardous chemicals and waste. It is also responsible for enforcing all Multilateral Environmental Agreements (MEAs) to which Nigeria is a treaty. The regulations prohibit the transit of toxic or hazardous wastes destined for another country through the territory of Nigeria without a valid prior informed consent (PIC) for such movement issued by NESREA. Nevertheless, this regulatory

body is faced with the challenge of porous borders and indiscriminate smuggling of E-waste from channels other than sea ports, also insufficient manpower deter them from carrying out their mandate effectively.

Niger State Environmental Protection Agency (NISEPA) is responsible for the management of waste, electrical electronics equipment inclusive. However, the inadequacies of most municipal governments to manage and handle waste in some developing countries such as Nigeria, has necessitated the involvement of private, informal and community-based groups to participate in the minimization of e-waste by sorting out the useful components for reuse. These activities will certainly help to minimize E-waste, however, the activities of the regulatory bodies seem to have little effect since e-waste are still seen around the environments. This calls for proper assessment in order to improve their effectiveness. Assessment is 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).

The Niger State Environmental Protection Agency (NISEPA) strategic waste management established for integrated waste management in 2008 for the control of environmental waste was meant to undertake sample survey of waste generation and management sensitizing along with guiding stakeholders on strategy for waste management. The effect of this strategy is not felt since the informal and traditional method of minimization activities is still paramount in the state. This may be that the waste regulations are not adequately adhered to. Going by the increasing amount of e-waste in our environment, this study was set out to assess the E-waste minimization and regulatory enforcement activities in government agencies, residential and business areas in Minna Metropolis of Niger State, Nigeria.

Research Questions

- i. What are the E-waste minimization activities in government agencies, business and residential areas in Minna metropolis of Niger State?
- ii. What are the E-waste regulations enforcement Activities among NISEPA, NESREA and FME in Minna, Niger State?

Hypotheses

H01. There is no significant difference in the mean responses of E-waste regulators, EEE repairers and EEE users as regards E-waste minimizing practices in Minna, Niger State.

H02. There is no significant difference among the mean responses of E-waste regulators NISEPA, NESREA and FME as regards E-waste regulation enforcement practices in Minna, Niger State.

METHODOLOGY

The research design used in this study is the descriptive survey design. In a typical survey, the researcher selects a sample of respondent and administers a standardized structured questionnaire in order to elicit information from them (Nworgu, 2006). The population for this study was 226,661 subjects out of which 311 respondents were sampled.

A 22 – items questionnaire titled: E-waste Minimization and Regulation Enforcement Activities in Government Agencies Business and Residential Area (EMREGBRA) was administered by the researcher with the aid of two research assistants. The instrument was validated and pilot tested and reliability coefficient of 0.89 was obtained using Cronbach Alfa. Statistical package for social sciences was used for data analysis (SPSS version 22.00). Mean and Standard deviation were used to answer the research questions. Analysis of Variance (ANOVA) was used to test null Hypotheses. The Tukey HSD was used to carry out a Post-hoc test to show the significant difference.

RESULTS**Research Question 1**

What are the E-waste minimization practices

in government agencies, business and residential areas in Minna metropolis of Niger State?

Table 1 Mean and standard deviation of government regulatory bodies, EEE Repairers, and EEE Users on E-waste minimization practices.

SN	ITEM	REGULATORY BODIES		USERS		REPAIRERS		AVERAGES		REMARK
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	
1	Refurbishing, repairs are carried out to minimize E-waste.	3.59	1.23	3.40	1.03	3.27	.73	3.42	1.00	Agree
2	Financial resources are put in place by the government for establishment of infrastructure for e-waste management.	2.95	1.17	3.16	.88	2.89	.82	3.00	.96	Agree
3	Reuse of e-waste is practiced in the State	3.17	1.15	3.02	.90	3.00	1.03	3.06	1.03	Agree
4	Hazardous e-wastes are converted to non-hazardous waste by the manufactures.	2.75	1.10	2.96	.90	2.84	.78	2.85	.93	Disagree
5	Refuse collection centres close to government, business and residential areas are provided.	3.36	1.28	3.13	.99	2.95	.75	3.15	1.01	Agree
6	Technology used to sort useable materials from e-waste is provided by government in Niger State.	2.55	1.07	2.93	.88	2.88	.85	2.79	.93	Disagree
7	Manufacturers employ the principle of reuse in their products to minimize e-waste.	3.06	1.04	2.94	.98	2.91	.75	2.97	.92	Disagree
8	Business centers, institutions and government Agencies help to minimize generation of e-waste by selling or donating used electrical and electronic equipment.	3.42	.97	3.63	.76	3.27	.87	3.44	.87	Agree
9	Suppliers of Electrical and electronic equipment are adequately encouraged in implementing the minimization practices in e-waste regulation.	3.28	.92	3.20	.64	2.84	.65	3.11	.74	Agree
10	Personnel to manage e-waste in Niger State are specially trained.	2.78	1.05	3.00	.96	3.07	.89	2.95	.97	Disagree
	GRAND MEAN	3.09	1.10	3.14	.89	2.99	.81	3.07	.94	Agree

Result presented in table 1 reveal that mean of items 1, 2, 3, 5, 8 and 9 on E-waste minimization practices ranges from 3.00 - 3.44. This is an indication that these minimization practices are carried out in the state. Mean items 4, 6, 7 and 10 ranges from 2.85- 2.95 reveal that these practices are not carried out in the study area. The value of the standard deviation ranges from .96 - 1.03 signifies that the respondents

were closer to one another in their responses which means they agree to the items listed. Meanwhile, the grand mean stands at 3.07 which shows that most respondents agree with the E-waste minimization practices.

Research Question 2

What are the E-waste regulations enforcement practices among NISEPA, NESREA and FME in Minna, Niger State?

Table 2

Mean and Standard Deviation responses of government regulatory bodies, EEE Repairers, and EEE Users on E-waste regulation enforcement practices among NISEPA, FME, NESREA.

SN	ITEM	REGULATORY BODIES		USERS		REPAIRERS		AVERAGES		REMARK
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	
1	Current and effective e-waste legislation is provided	3.63	.58	3.30	1.29	4.00	.00	3.64	.62	Agree
2	National regulations regarding importation of used electrical and electronics goods are fully enforced.	3.50	.98	3.83	.79	3.90	.57	3.74	.78	Agree
3	Regulatory agencies imposed e-waste regulations on manufacturers and suppliers.	3.71	.69	3.67	1.12	3.70	.48	3.69	.76	Agree
4	Rules and regulations governing electronic waste collection and disposal are effectively enforced in Niger State.	3.58	.65	3.20	.85	3.70	.48	3.49	.66	Agree
5	Measures for enforcement of e-waste management are provided.	3.88	.74	3.40	1.13	3.70	.48	3.66	.78	Agree
6	Federal and state ministry form a synergy for better implementation of e-waste regulation	4.00	.66	3.30	1.32	3.90	.32	3.73	.77	Agree
7	Co-operation by the stakeholders, Government agencies, EEE user, Importers is seen to be effective.	3.79	.83	3.50	1.07	3.90	.57	3.73	.82	Agree
8	E-waste is separated from municipal solid waste by Niger State environmental protection Agency.	3.58	1.02	2.72	1.07	3.20	.42	3.17	.84	Agree
9	Suppliers are influenced by the regulatory bodies to improve on environmental impact.	3.33	1.09	3.77	.97	3.10	.32	3.40	.79	Agree
10	Decision making process on e-waste management is encouraged by the Local governments.	3.42	1.10	3.00	1.08	3.50	.53	3.31	.90	Agree
11	Inventory of e-waste is provided which help NISEPA in proper management.	3.29	1.16	2.70	1.26	3.00	.00	3.00	.81	Agree
12	Documented procedures for assessment of e-waste in Niger State are provided.	3.75	.61	2.83	1.12	3.20	.42	3.26	.72	Agree
	GRAND MEAN	3.62	.84	3.27	1.09	3.57	.38	3.49	.77	Agree

Table 2 reveals that the respondents agree with all the items. The mean average ranges from 3.00 - 3.74. This is an indication that E-waste regulation is enforced by the regulatory bodies in Niger State. The standard deviation value ranges from .62 - .90 this indicates that the respondents were closer to each other in their responses to the

items. The grand mean of 3.49 also indicates that the regulatory bodies agree with the E-waste regulation enforcement practices in the state.

H_{01} . There is no significant difference in the mean responses of E-waste regulators, EEE repairers and EEE users as regards E-waste

Table 3

Analysis of variance of the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste minimizing practices in Minna, Niger State.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.768	2	.384	1.317	.270
Within Groups	62.983	216	.292		
Total	63.752	218			

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 minimizing practices in Minna, Niger State. The result of the analysis showed an f-ratio of 1.317 and a significance criterion (sig) of .270 which is greater than the p-value of .05. Therefore the null hypothesis was not rejected. Hence, there is no significant difference in the mean

responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste minimizing practices in Minna, Niger State.

H_{02} There is no significant difference among the mean responses of E-waste regulators NISEPA, NESREA and FME as regards E-waste regulation enforcement practices in Minna, Niger State.

Table 4

Analysis of variance of the mean responses among E-waste regulators (NISEPA, NESREA and FME) as regard E-waste regulation enforcement practices in Minna, Niger State.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.803	2	.901	3.936	.025
Within Groups	13.972	61	.229		
Total	15.775	63			

Table 4 shows the one-way between-groups analysis of variance that was conducted for the mean responses of E-waste regulators (NISEPA, NESREA and FME) as regards E-waste regulation enforcement practices in Minna, Niger State. The result of the analysis showed an f-ratio of 3.936 and a significance criterion (sig) of .025 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 (NISEPA, NESREA and FME) as regards E-waste regulation enforcement practices in Minna, Niger State. The observed significant difference was subjected to a Post-hoc comparison using the Tukey HSD test. The result revealed that the mean response for NISEPA was significantly different from the mean response for NESREA. However, the mean responses for FME did not differ significantly from either the mean responses

Table 5

Post-hoc comparisons using Tukey HSD test on the difference in the mean responses of E-waste regulators NISEPA, NESREA and FME as regards E-waste regulation enforcement practices in Minna, Niger State.

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
NISEPA	NASREA	.35067*	.13107	.026	.0358	.6655
	FME	.05567	.18013	.949	-.3771	.4884
NASREA	NISEPA	-.35067*	.13107	.026	-.6655	-.0358
	FME	-.29500	.17475	.218	-.7148	.1248
FME	NISEPA	-.05567	.18013	.949	-.4884	.3771
	NASREA	.29500	.17475	.218	-.1248	.7148

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

Post-hoc comparisons using Tukey HSD test on the difference in the mean responses of E-waste regulators NISEPA, NESREA and FME as regards E-waste regulation enforcement practices in Minna, Niger State is shown in table 5. The post-hoc analysis showed that the mean response of NISEPA (whose mean difference was -0.35067, and a significance criterion (sig.) of 0.026) was significantly different from the mean response for NESREA (whose mean difference was 0.35067 with a sig of 0.026). However, the mean responses for FME did not differ significantly from either the mean responses NISEPA or NESREA.

Discussion of findings

Findings on E-waste minimization

practices in government agencies, business and residential areas in Minna metropolis, Niger State revealed that refurbishing and repairs are carried out to minimize E-waste and the manufacturers employ the principle of reuse in their product to minimize E-waste. This finding may be attributed to the idea of zero waste community, the consumers have to imbibe the best practice in E-waste minimization of not producing the waste in the first place, if not, E-waste will continue to be one of the contending challenges in contemporary African countries including Nigeria. In the same vein, Fodor and Klemes (2011) stated that effective waste management through strict environmental regulations and minimizing generation with maximum application of

3Rs (reuse, recycling, and recovery) will be of great importance in E-waste minimization anywhere in the world. The finding also revealed that suppliers of Electrical and electronic equipment are adequately encouraged in implementing the minimization practices of E-waste regulation. This is supported by Stehlik (2010) who reported that EU legislation stipulated that biodegradable waste should be minimized to 75% by 2010, 50% in 2013 and 35% by 2020. This is necessary due to the fact that maximizing E-waste can be of great economic value to the citizen, this is because components from one Eol electronics can be used to refurbish another electronics and it may also be sold or donated rather than disposed. In order to optimize electronics recycling, attention should be paid to maximizing eco-efficiency that is the environmental and economic balance by maximizing physical recycling and revenue obtained from it, can be used to minimizing environmental burden and total costs connected with the recycling chain (Hagelken, 2006). The result of the analysis of hypotheses 1 showed that there is no significant difference in the mean responses of E-waste regulators, EEE repairers, EEE Users as regards E-waste minimizing practices in Minna, Niger State. This may be true going by the number of Repairers in Minna metropolis.

The answer to research question 2 on E-waste regulations enforcement practices among NISEPA, NESREA and FME in Minna metropolis, Niger State revealed that there is lack of current and effective e-waste legislation and the national regulations regarding importation of used electrical and electronics goods are not fully enforced. E-waste management and disposal is regulated by legislations and policies implemented at the federal, state and local government levels in Nigeria. National regulations such as national waste management rules of 1991 which controls the collection, disposal, minimization and management of harmful solid waste generated in the metropolis and through manufacturing process and the 1989

National Policy on Environment (NPE) are of immense importance in the assessment of E-waste management in Nigeria, unfortunately most of this policies are not implemented in Niger State as revealed by the outcome of this research work. The turkey HSD post-hoc comparison test was conducted and it showed that the significant difference was in NISEPA. This is in agreement with report by Wanjiku (2008) who stated that the ratified Basel Convention, the BAN Amendment and the Bamako Convention restrict the trans-boundary movement of hazardous waste E-waste inclusive. The National Toxic Dump Watch Programme (NTCWP) also required importers of e-waste to be registered with NESREA (Lagos State Environmental Protection Agency, 2011). Osibanjo & Nnorom (2007) in their finding suggest that there is therefore urgent need for our country to introduce legislation dealing specifically with E-waste. Finding also revealed that measures for enforcement of e-waste management are not provided. This is in line with the outcome of Basel Convention (2011) which show that environmental awareness was low and strident regulations and its enforcement was lacking this brought about the dumping of UEEE in Nigeria which Niger State is a partaker. The result of the analysis of hypotheses 4 showed that there is a significant difference in the mean responses of E-waste regulators (NISEPA, NESREA and FME) as regards challenges in E-waste minimizing practices in Minna, Niger State. The divergent opinion of the respondents may lie on the different support received from the government.

Conclusion

Based on the findings of the study it was concluded that current and effective e-waste legislation and the national regulations regarding importation of used electrical and electronics goods are not fully enforced hence the effects of refurbishing and repair will not reflect much in minimization activities and measures for enforcement of e-waste management are not provided.

Recommendations

Based on the findings, the following recommendations were made:

- i. Environmental agencies should make refurbishing and repairs compulsory to minimize E-waste. Manufacturers also should employ the principle of reuse in their product to minimize e-waste and suppliers of Electrical and electronic equipment should be adequately encouraged to implement the minimization practices of e-waste regulation.
- ii. The implementation of current and effective E-waste legislation and the national regulations regarding importation of used electrical and electronics goods should be fully enforced and Government should provide adequate measures for enforcement of e-waste management.
- iii. Government also needs to put in place effective monitoring system for management of E-waste in Niger State.

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