CONSUMER KNOWLEDGE, PERCEPTIONS, AND PRACTICES OF ELECTRONIC WASTE MANAGEMENT IN YENAGOA CITY, BAYELSA STATE

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Abstract

The study investigated the knowledge, perceptions, and practices related to electronic waste (e-waste) in Yenagoa City, Bayelsa State. Although existing research has addressed waste management in Nigeria, there is a paucity of empirical studies on e-waste management. The study utilised the Reasoned Action Theory as its theoretical framework and employed a cross-sectional survey design. A sample of 381 respondents was determined using Cochran's (1977) formula. A multistage sampling technique was employed, and a structured questionnaire was systematically administered to the participants. Quantitative data were analysed using descriptive statistics and the Chi-Square test at a significance level of P<0.05. The average age of respondents was 33.73±7.10 years. Most respondents had moderate knowledge (86.9%) regarding the components of e-waste. Additionally, a majority held a positive perception (60.6%) towards e-waste management. Statistically significant relationships were found between perceptions of e-waste management and variables such as sex (χ^2=128.69), education (χ^2=63.463), ethnic group (χ^2=120.585), marital status (χ^2=31.759), occupation (χ^2=165.947), and estimated monthly income (χ^2=59.290). While the majority disposed of their e-waste by selling it (66.1%), giving it to collectors (54.1%), or storing it (73.8%), some respondents reported dumping it in rivers (52.8%), reworking and reusing it (59.6%), landfilling it (53.0%), or taking it to designated dump sites. The socio-demographic characteristics of the respondents influenced their knowledge, perceptions, and practices concerning e-waste management. There is a need to raise awareness and educate residents on standard e-waste management practices.

Keywords: E-waste, Waste management, Perception, Pollution, Bayelsa State

Introduction

E-waste, or electronic waste, is now considered the world's fastest-growing waste stream. In 2016, it reached a staggering 44.7 million tonnes—equivalent to 4,500 Eiffel Towers (Baldé et al., 2017). By 2018, this figure had swelled to an estimated 50 million tonnes, prompting the United Nations to dub it a 'tsunami of e-waste'. The annual value of e-waste is a whopping £50 billion (World Economic Forum, 2019). The surge in e-waste is fuelled by rapid technological progress, shifts in media formats, falling prices, and planned obsolescence. While technical solutions exist, their implementation often requires a robust legal framework, efficient collection systems, and improved logistics.

Each year, about 50 million tonnes of e-waste are generated globally. The United States alone discards 30 million computers annually, while Europe bins 100 million phones yearly. The Environmental Protection Agency reckons that a mere 15-20% of e-waste is recycled, with the rest ending up in landfills or incinerators (US Environmental Protection Agency, 2012). In 2006, the UN estimated global e-waste at 50 million metric tonnes annually (Blau, 2006). UNEP's report "Recycling – From E-Waste to Resources" warns that e-waste production, including mobile phones and computers, could skyrocket by up to 500% over the next decade in some countries, like India. The United States tops the e-waste production chart, discarding roughly 3 million tonnes each year.

While there's agreement that discarded electronic devices are on the rise, opinions differ on the relative risks compared to other waste types, such as car scrap. Debate also surrounds whether limiting trade in used electronics would improve or worsen the situation. Despite global discussions on e-waste management and its potential environmental health impacts, there's a dearth of empirical studies examining the knowledge, perceptions, and practices related to e-waste in Nigeria, particularly in Bayelsa State.

Globally, electronic and electrical equipment waste has emerged as the fastest-growing waste stream (Saphores et al., 2012). This increase is largely due to the quick obsolescence of household electronic devices (Wang et al., 2010) and the rapid pace of technological progress, which drives demand for newer models whilst hastening the obsolescence of older ones (Otsuka et al., 2012). As a result, vast amounts of e-waste are generated, often poorly managed in developing nations. Current global e-waste production is expected to increase by 16-28% yearly (European Environmental Agency, EEA, 2003).

In contrast, whilst many developed countries have implemented effective laws and recycling systems for managing waste electrical and electronic equipment, developing nations, particularly Nigeria and Bayelsa State, are lagging (Afroz et al., 2013). E-waste management has thus become a major environmental issue. Poor handling practices, including informal disposal methods, lead to high toxicity from uncontrolled burning, dismantling, and recycling, potentially causing severe harm to ecological and human systems (Bhat & Patil, 2014).

Various studies have explored the knowledge, awareness, and management of e-waste and its health impacts. For example, Azodo et al. (2017) evaluated e-waste management knowledge

among Nigerian students, finding average understanding of proper e-waste management and its health implications. Nuwematsiko et al. (2021) investigated e-waste management among consumers in Kampala (Uganda), revealing that whilst two-thirds of consumers had poor knowledge of e-waste management, over three-quarters held positive views towards it.

Borthakur and Singh (2015) examined e-waste disposal behaviour and public awareness in India, uncovering high levels of confusion among stakeholders regarding the disposal of outdated electronics. Many consumers are unaware of proper disposal methods, despite 70-80% being inclined to regularly "upgrade" their electronics. Bhat and Patil (2014) studied e-waste consciousness and disposal practices in Pune City, finding good consumer awareness at a basic level, but residents lacked knowledge about collection centres, e-waste regulations, and proper disposal practices. Heacock et al. (2016) documented the health implications of e-waste, highlighting it as a growing global problem in urban areas.

Despite these studies, there is a notable lack of empirical research on the components, knowledge levels, management practices, and disposal methods of e-waste in Yenagoa City, Bayelsa State—a rapidly growing state capital with increasing consumption of electrical and electronic equipment. This research aims to address this gap by investigating the knowledge, perceptions, and practices related to e-waste in Yenagoa City to inform future environmental policy interventions.

Theoretical Framework
This research utilises the Theory of Reasoned Action (TRA), propounded by Martin Fishbein and Icek Ajzen in 1967. The TRA stems from earlier work in attitude theories, persuasion models and social psychology. Fishbein's ideas suggested a link between attitudes and behaviours (the A-B relationship), aiming to clarify how attitudes shape behaviours. The TRA is mainly used to forecast how people will act based on their existing attitudes and behavioural intentions. A person's choice to engage in a specific behaviour is swayed by the expected results of that behaviour.

The TRA's main aim is to grasp voluntary behaviour by examining the core motivations behind it, such as e-waste disposal. The theory claims that a person's intention to perform a behaviour is the key predictor of whether they will do it (Glanz et al., 2015). Moreover, normative factors—like social norms around the behaviour—also influence whether the behaviour will occur. The TRA states that an intention to perform a behaviour comes before the actual performance (Ajzen & Madden, 1986). This intention, called behavioural intention, stems from a belief that doing the behaviour will lead to a specific outcome. Behavioural intention is vital to the theory as these intentions are moulded by attitudes towards the behaviour and subjective norms. The TRA suggests that stronger intentions lead to greater effort in performing the behaviour, thus boosting the chances of its execution.

The TRA takes a positivistic approach to behavioural research, aiming to predict and explain one's intention to perform a behaviour. The theory requires behaviour to be clearly defined using four concepts: Action (e.g., disposal), Target (e.g., place of disposal), Context (e.g., environment), and Time (e.g., time of disposal). The TRA proposes that behavioural intention is the main driver of behaviour, with attitudes and norms being the two key determinants of behavioural intention

(Montaño et al., 1996). By studying attitudes and subjective norms, researchers can gain insight into whether an individual will carry out the intended action.

The TRA posits that attitudes are crucial in shaping behavioural intention, reflecting one's feelings about a particular action (Ajzen & Albarracín, 2007). Two factors influence these attitudes: the strength of beliefs about the behaviour's outcomes (their likelihood) and the evaluation of these potential outcomes (their desirability) (Montaño et al., 1996). Attitudes can be positive, negative, or neutral (Fishbein, 1967). The theory suggests a direct link between attitudes and outcomes; if someone believes a behaviour will yield a positive result, they're more likely to view it favourably. Conversely, if they expect an undesirable outcome, they're prone to a negative attitude. This concept is pertinent to e-waste disposal, where improper handling could harm the environment and health.

Behavioural beliefs help us understand people's motivations by connecting actions to specific outcomes (Ajzen, 2012). This idea suggests that individuals link behaviours with certain results or characteristics (Montaño et al., 1996). For example, someone might believe that a month of revision will boost their chances of passing a driving test, while not studying is associated with failure.

The evaluation of outcomes, on the other hand, refers to how people perceive and judge the potential results of an action in a simple "good-bad" manner (Montaño et al., 1996). For instance, a person might view not disposing of e-waste positively if it enhances environmental aesthetics or social status, but negatively if it poses environmental and health risks.

Subjective norms are another vital determinant of behavioural intention, referring to how perceptions of important groups, such as family, friends, and peers, influence behaviour. Ajzen defines subjective norms as the "perceived social pressure to perform or not perform the behaviour." The TRA suggests that people develop beliefs about whether certain actions are socially acceptable. These normative beliefs shape one's perception of the behaviour and influence the intention to carry it out or avoid it (Fishbein, 1967; Ajzen & Albarracín, 2007; Ajzen, 2012).

Materials and Methods

This study employed a survey research design, which entails the collection of quantitative data from a pool of respondents. This design was adopted based on the fact that it was most appropriate for a study like this which requires the collection of numerical data from the study population with a view of analyzing their opinions on a given social phenomenon just as it occurs in the population. In this regard, only those who have attained the age of 18 years and above were recruited as respondents in their households to gather relevant information about their knowledge, perceptions and practices towards e-waste management.

The study area is Yenagoa City, Bayelsa State. This city was selected as the research locale because it has a high population density of consumers of electrical and electronic equipment (EEP) compared to other communities or towns in Bayelsa State. Also, the city was selected because of the lack of empirical research on the knowledge, perceptions and practices towards e-waste and its management in the state. The study population for this research comprises adults aged 18 and above in the city of Yenagoa.

Given the fact that the exact number of adults who are above 18 years cannot be determined, the sample size for this study has been determined using the Cochran's sample size determination formula normally used for a population with an unknown figure. Using the Cochran's formula below, the sample size is calculated thus:

$$n = \frac{z^2 p(1-p)}{e^2}$$

Where n = Sample size

Z = statistics level of confidence

P = Probability of adults' predisposition to e-waste = 50% (0.5)

1 = Constant

e = marginal error at 5% (standard value of 0.05)

$$\frac{1.96^2 \ (0.5)(1-0.5)}{0.05^2} = \frac{3.8146 \ (0.5(0.5)}{0.0025}$$

$$\frac{3.8146 \ x \ 0.25}{0.0025} = \frac{0.95365}{0.0025}$$

$$n = 381.46 = 381$$

Thus, the sample size for this study was 381 subjects.

The study utilised a multi-stage sampling approach, combining non-probabilistic and probabilistic techniques to select participants across various city areas. This was done in stages as shown below;

Stage 1: Cluster Selection

- Method: Probabilistic single cluster technique
- Outcome: Three main city areas identified
1. Down Yenagoa (Onopa, communities beyond Goodluck Jonathan Bridge, Swali, Azikoro and Agbura)
2. City Centre (Amarata to Edepie)
3. Uptown (Akenpai to Igbogene)

Stage 2: Community Selection

- Method: Simple random sampling
- Outcome: Three communities chosen per cluster
o Down Yenagoa: Azikoro, Famgbe, Swali
o City Centre: Yenezue-Epie, Biogbolo, Etegwe
o Uptown: Akenpai, Agudama, Igbogene

Stage 3: Respondent Selection

- Method: Systematic sampling
- Process:
1. Random selection of initial household
2. Subsequent selections based on area-specific sample frame

Since this study is purely quantitative in nature, a structured questionnaire was used to collect the data from the respondents. The instrument was tailored to the study objectives. The administration of the instrument was done at respondents' houses.

The dependent variable in this study is knowledge of e-waste. The knowledge of e-waste is described as the extent to which respondents know about 11 constructs of e-waste knowledge which was measured by response of 'YES' "1" or 'NO' "0". For respondents who indicated yes for any of the constructs, the respondent was scored '1' which were later re-group LOW (scored 0 – 3), MODERATE (score 4 – 7) and HIGH (score 8 – 11). Furthermore, for the sake of the performance of logistic regression analysis, the scores were converted to dummy variables with those who had LOW KNOWLEDGE OF E-WASTE having between 0 and 5, and coded "0" and those who had HIGH KNOWLEDGE OF E-WASTE having between 6 and 11, and coded "1".

The study incorporates various socio-demographic factors as independent variables, including gender (measured on a nominal scale), age bracket (measured on either an interval or ordinal scale), faith (nominal scale), cultural background (nominal scale), educational attainment (ordinal scale), and other relevant factors. These variables provide a comprehensive understanding of the demographic influences in the study.

In terms of instrument validation, the research tool underwent a rigorous process. This included pilot testing, a face validity assessment, and a thorough review by colleagues in the Department of Sociology, Niger Delta University, Nigeria. Additionally, the instrument was tested on participants from a similar field. The measure for assessing e-waste knowledge demonstrated high reliability, with an inter-item coefficient of $\alpha=0.891$, indicating the consistency of the tool.

For the analytical approach, the study followed a quantitative framework, utilising both descriptive and inferential statistical methods. Descriptive statistics included simple percentages, distribution tables and the calculation of means for socio-demographic characteristics and other relevant factors. Inferential statistics were conducted using Chi-Square analysis, with all tests performed at a significance level of $p<0.05$.

Results

Socio-demographic characteristics of respondents

Table 4.1 presents the distribution of respondents by socio-demographic characteristics. On the sex of the respondents, the majority were male (66.7%) whereas 33.3% of them were females. On the age of the respondents, the mean age was 33.7 years, while the highest age group were those between the ages of 30 and 39 years (46.7%) followed by those in 20 – 29 years (33.1%). On the educational distribution of the respondents, the majority had tertiary education (59.8%) with only 7.1% of them who had no formal education.

On their religious affiliation, nearly all the respondents were adherents of Christianity (84.8%), followed by those who practiced traditional religion (13.1%). On the ethnic group of the respondents, more than half were Ijo ethnic group members (55.6%) followed by Igbo (15.0%) and Yoruba (14.7%) ethnic group. On their marital status, it was revealed that the majority were married (67.5%) while others were singles (32.5%).

Table 4.1: Distribution of respondents by socio-demographic characteristics

S/N	Variable name	Categories of variables	Frequency (n=381)	Percentage (%)
1.	Sex	Male	254	66.7
		Female	127	33.3
2.	Age (in years) Mean age= 33.73±7.10 years	20 – 29	126	33.1
		30 – 39	178	46.7
		40 – 49	51	13.4
		50 years and above	26	6.8
3.	Educational level	No formal Education	27	7.1
		Primary Education	26	6.8
		Secondary Education	100	26.2
		Tertiary Education	228	59.8
4.	Religion	Christianity	323	84.8
		Islam	8	2.1
		Traditional religion	50	13.1
5.	Ethnic group	Ijo (Ogbia, Ijaw, Nembe, Epie-Atissa)	212	55.6
		Igbo	57	15.0
		Hausa	19	5.0
		Yoruba	56	14.7
		Others	37	9.7
6.	Marital status	Single	124	32.5
		Married	257	67.5
		Divorced	-	-
		Widowed	-	-
7.	Types of Family	Monogamous	128	33.6
		Polygamous	176	46.2
		Single parenthood	77	20.2
8.	Occupation	Farming/Fishing	51	13.4
		Civil Service	78	20.5
		Public Service	25	6.6
		Teaching	26	6.8
		Artisan	48	12.6
		Trading	153	40.2
9.	Estimated Monthly income	Less than N20000	52	13.6
		N20000 – N39999	74	19.4
		N40000 – N59999	128	33.6
		N60000 – N79999	76	19.9
		N80000 – N99999	-	-
		N100000 and above	51	13.4

On the types of family, the highest proportion of the respondents were from polygamous family (46.2%), which was closely followed by those in monogamous family (33.6%) and single parenthood (20.2%). On the occupational distribution of the respondents, the highest proportion of the respondents were into trading (40.2%), followed by those in the civil service (20.5%) and farming (13.4%) among others. On the estimated monthly income of the respondents, about 33.6% of the respondents indicated that they earned between N400000 and N59999 (being the highest proportion), followed by 19.9% of the respondents earned between N60000 and N79999, and 19.4% of them who signified that they earned between N20000 and N39999 among others.

Identification of the constituents of electronic waste

This section presents the results on the constituents of electronic waste in respondents' households. Table 4.2 shows the distribution of respondents by the constituents of e-waste. It was found that more than half of the respondents recognized cell or mobile phones (66.4%), batteries (59.6%), computers – desktops (66.4%), and computers – laptops (40.4%) as e-waste.

Table 4.2: Distribution of respondents by constituents of electronic waste

S/N	Constituents of electronic waste	Frequency (n=381)	Percentage (%)
1	Cell or mobile phones	253	66.4
2	Batteries	227	59.6
3	Computers (Desktops)	253	66.4
4	Computers (Laptops)	154	40.4
5	Televisions	127	33.3
6	DVD (Digital Video Disc) players	128	33.6
7	CD (Compact Disc) players	175	45.9
8	Radios	304	79.8
9	CD/DVD Players	229	60.1
10	Personal stereos	231	60.6
11	Iron	99	26.0
12	Refrigerator	228	59.8
13	Generator or its parts	152	39.9
14	Wires/cables	306	80.3
15	Rechargeable lamps and bulbs or fluorescents	126	33.1
16	Ceiling or standing fans	255	66.9
17	Camera	306	80.3
18	Other household appliances	230	60.4

It was also found that they recognized televisions (33.3%), DVD players (33.6%), CD players (45.9%), radios (79.8%), personal stereos (60.6%) and iron (26.0%) as e-wastes. Further analysis revealed that refrigerator (59.8%), generator or its parts (39.9%), wires/cables (80.3%), rechargeable lamps and bulbs (33.1%), ceiling or standing fans (66.9%), camera (80.3%) and other household appliances (60.4%) as e-wastes.

Level of knowledge about electronic waste management among consumers

This section examined the level of knowledge about e-waste among the study population. The knowledge of e-waste was based on the identification of constituents of e-wastes and their knowledge about how it generates waste in the environment. Each of the constituents was scored "1" and summed up to form levels of knowledge. Respondents who scored between 0 and 4 was grouped as low knowledge, those who scored between 5 and 9 were grouped as moderate and those who scored more than 10 were grouped as high knowledge. Figure 4.1 displays the percentage distribution of the respondents by their knowledge of e-waste. The Figure shows that

the majority of the respondents had moderate knowledge of e-waste (86.9%) with only 13.1% of the respondents who had low knowledge about e-waste.
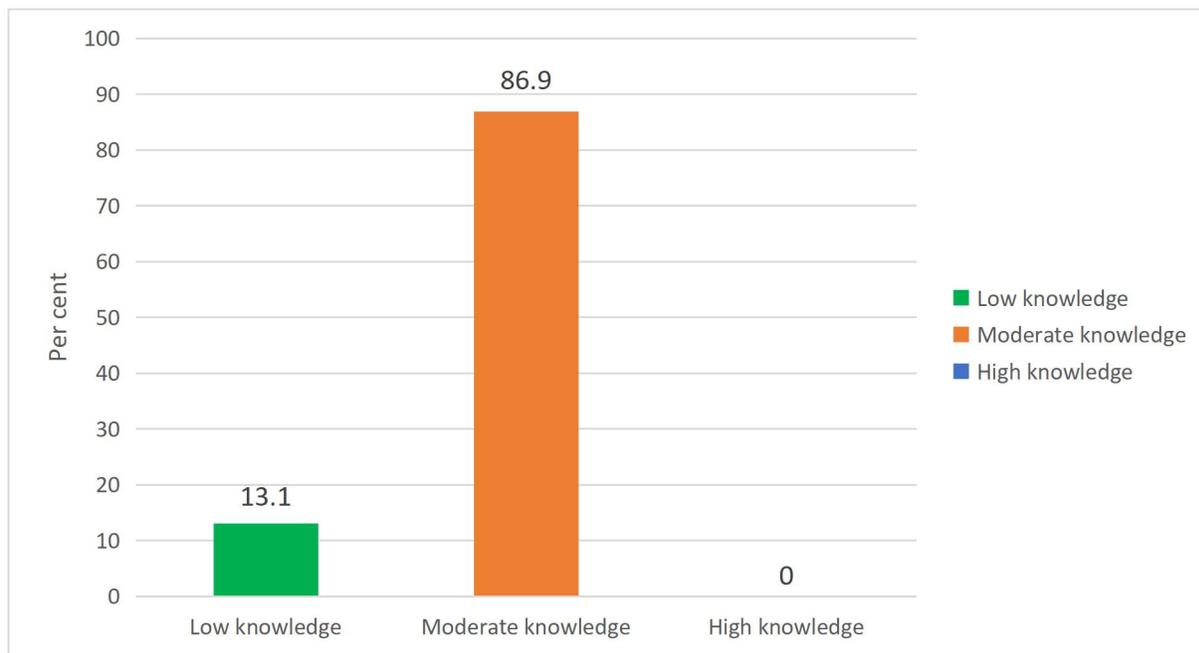
Figure 4.1: Percentage distribution of respondents by the knowledge of e-waste

Table 4.3 presents the relationship between socio-demographic characteristics and level of knowledge about e-waste using Chi Square statistical test. It was discovered that there were statistically significant relationship between sex (x^2=126.729, p<0.05), age (x^2=103.752, p<0.05), educational level (x^2=87.436, p<0.05), religion (x^2=38.011, p<0.05), ethnic group (x^2=154.882, p<0.05), types of family (x^2=45.045, p<0.05), occupation (x^2=99.976, p<0.05), estimated monthly income (x^2=130.733, p<0.05) and the level of knowledge about e-waste.

Table 4.3: Relationship between socio-demographic characteristics and knowledge of e-waste

Socio-demographic Variable	Categories of variables	Level of knowledge of e-waste		Chi Square
		Low (%)	High (%)	
Sex	Male	88.7	33.1	X^2=126.729
	Female	11.3	66.9	P=0.000
Age (in years) Mean age=33.73±7.10 years	20 – 29	33.5	32.5	X^2=103.752
	30 – 39	55.2	33.8	P=0.000
	40 – 49	-	33.8	
	50 years and above	11.3	-	
Educational level	No formal Education	11.7	-	X^2=87.436
	Primary Education	11.3	-	P=0.000
	Secondary Education	11.3	49.0	
	Tertiary Education	65.7	51.0	

Religion	Christianity	76.1	98.0	X^2=38.011
	Islam	2.2	2.0	P=0.000
	Traditional religion	21.7	-	
Ethnic group	Ijo (Ogbia, Ijaw, Nembe, Epie-Atissa)	77.8	21.9	X^2=154.882
	Igbo	13.0	17.9	P=0.000
	Hausa	5.2	4.6	
	Yoruba	0.9	35.8	
	Others	3.0	19.9	
Marital status	Single	32.6	32.5	X^2=0.001
	Married	67.4	67.5	P=0.974
	Divorced	-	-	
	Widowed	-	-	
Types of Family	Monogamous	44.8	16.6	X^2=45.045
	Polygamous	43.9	49.7	P=0.000
	Single parenthood	11.3	33.8	
Occupation	Farming/Fishing	22.2	-	X^2=99.976
	Civil Service	23.0	16.6	P=0.000
	Public Service	10.9	-	
	Teaching	-	17.2	
	Artisan	10.4	15.9	
	Others	33.5	50.3	
Estimated Monthly income	Less than N20000	11.7	16.6	X^2=130.733
	N20000 – N39999	21.7	15.9	P=0.000
	N40000 – N59999	33.5	33.8	
	N60000 – N79999	33.0	-	
	N80000 – N99999	-	33.8	
	N100000 and above	-	-	

*Significant at P<0.05

**Consumers' perception about electronic waste management**

This section explored the perception of respondents about e-waste management in their respective households. Table 4.4 shows the distribution of the respondents by perception about e-waste management. The table shows that the majority of the respondents had positive perception about the tendency to reuse any e-waste in the future (73.2%), possibility of recycling some of the e-wastes (65.9%), possibility of some e-waste recovery (54.1%) and the belief that legislation or laws on e-waste management should be respect. On the other hand, it was found that the majority had negative perception about the belief that instructions for disposals of e-waste should be observed (66.34%), money can be generated from e-waste (59.6%) and e-waste should be given to collectors (66.9%).

Table 4.4: Distribution by perception about e-waste management

S/N	Perception	Negative perception (%)	Positive perception (%)
1	Tendency to reuse any e-waste in the future	102 (26.8)	279 (73.2)
2	Possibility of recycling some of the e-wastes	130 (34.1)	251 (65.9)
3	Possibility of some e-waste recovery	175 (45.9)	206 (54.1)
4	The belief that instructions for disposals of e-waste should be observed	253 (66.4)	128 (33.6)

5	The belief that legislation or laws on e-waste management should be respected	152 (39.9)	229 (60.1)
6	Money can be generated from e-waste	227 (59.6)	154 (40.4)
7	E-waste should be given to collectors	255 (66.9)	126 (33.1)

The overall perception of the respondents about e-waste management was presented in Figure 4.2. The Figure shows that the majority had positive perception about e-waste management (60.6%), while 39.4% of the respondents had negative perception about e-waste management.
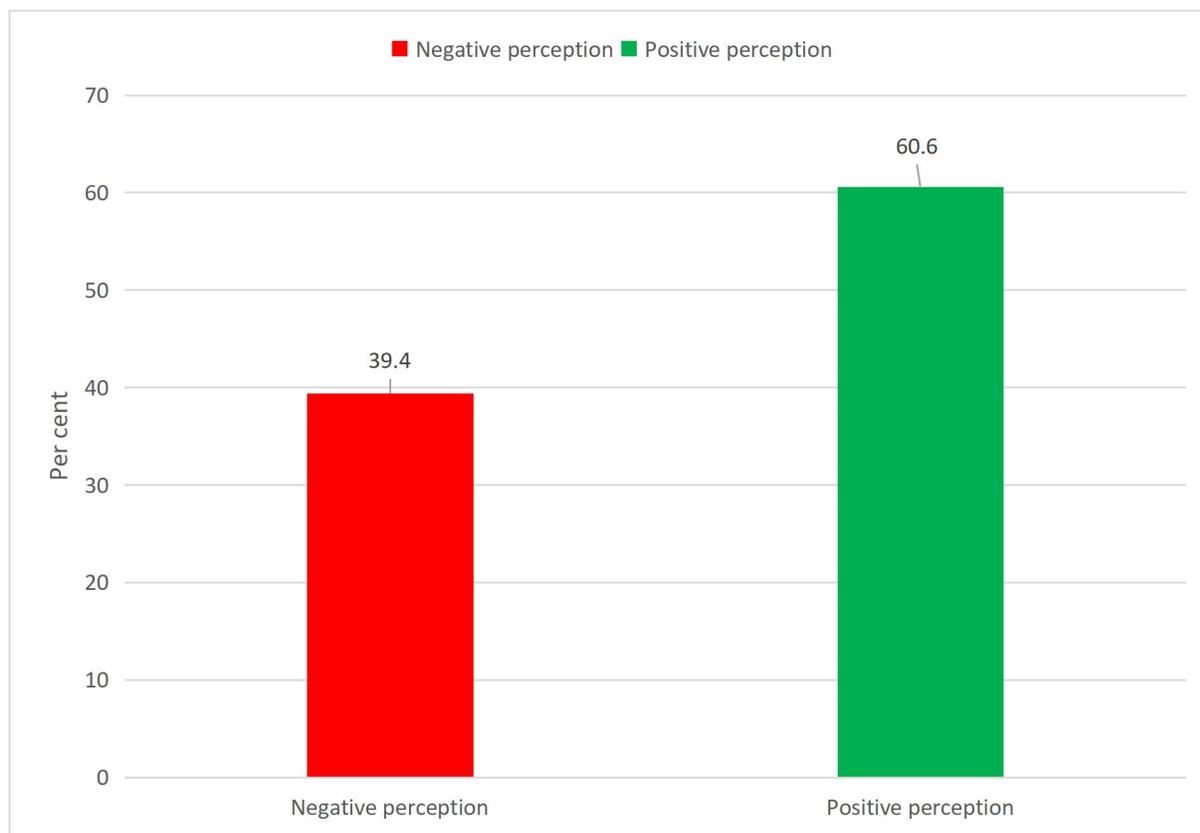
Figure 4.2: Percentage distribution of respondents by perception about e-waste management

Table 4.5 shows the relationship between socio-demographic characteristics and perception about e-waste management. It was revealed that there were statistically significant relationship between sex (x^2=128.69, p<0.05), education (x^2=63.463, p<0.05), ethnic group (x^2=120.585, p<0.05), marital status (x^2=31.759, p<0.05), types of family (x^2=43.127, p<0.05), occupation (x^2=165.947, p<0.05), estimated monthly income (x^2=59.290, p<0.05) and e-waste management.

Table 4.5: Relationship between socio-demographic characteristics and perception about e-waste management

Socio-demographic Variable	Categories of variables	Perception about e-waste management		Chi Square
		Negative (%)	Positive (%)	
Sex	Male	32.7	88.7	X^2=128.69
	Female	67.3	11.3	P=0.000
Age (in years)	20 – 29	49.3	22.5	X^2=49.037

Mean age=33.73±7.10 years	30 – 39	33.3	55.4	P=0.000
	40 – 49	17.3	10.8	
	50 years and above	-	11.3	
Educational level	No formal Education	-	11.7	X^2=65.463
	Primary Education	17.6	-	P=0.000
	Secondary Education	32.7	22.1	
	Tertiary Education	50.0	66.2	
Religion	Christianity	82.0	86.6	X^2=1.797
	Islam	2.0	2.2	P=0.407
	Traditional religion	16.0	11.3	
Ethnic group	Ijo (Ogbia, Ijaw, Nembe, Epie-Atissa)	55.3	55.8	X^2=120.585
	Igbo	0.7	24.2	P=0.000
	Hausa	4.7	5.2	
	Yoruba	36.0	0.9	
	Others	3.3	13.9	
Marital status	Single	49.3	21.6	X^2=31.759
	Married	50.7	78.4	P=0.000
	Divorced	-	-	
	Widowed	-	-	
Types of Family	Monogamous	16.7	44.3	X^2=43.127
	Polygamous	66.0	33.3	P=0.000
	Single parenthood	17.3	22.1	
Occupation	Farming/Fishing	-	22.1	X^2=165.947
	Civil Service	17.3	22.5	P=0.000
	Public Service	16.7	-	
	Teaching	-	11.3	
	Artisan	32.0	-	
	Others	34.0	44.2	
Estimated Monthly income	Less than N20000	-	22.5	X^2=59.290
	N20000 – N39999	16.0	21.6	P=0.000
	N40000 – N59999	50.0	22.9	
	N60000 – N79999	16.7	22.1	
	N80000 – N99999	-	-	
	N100000 and above	17.3	10.8	

*Significant at P<0.05

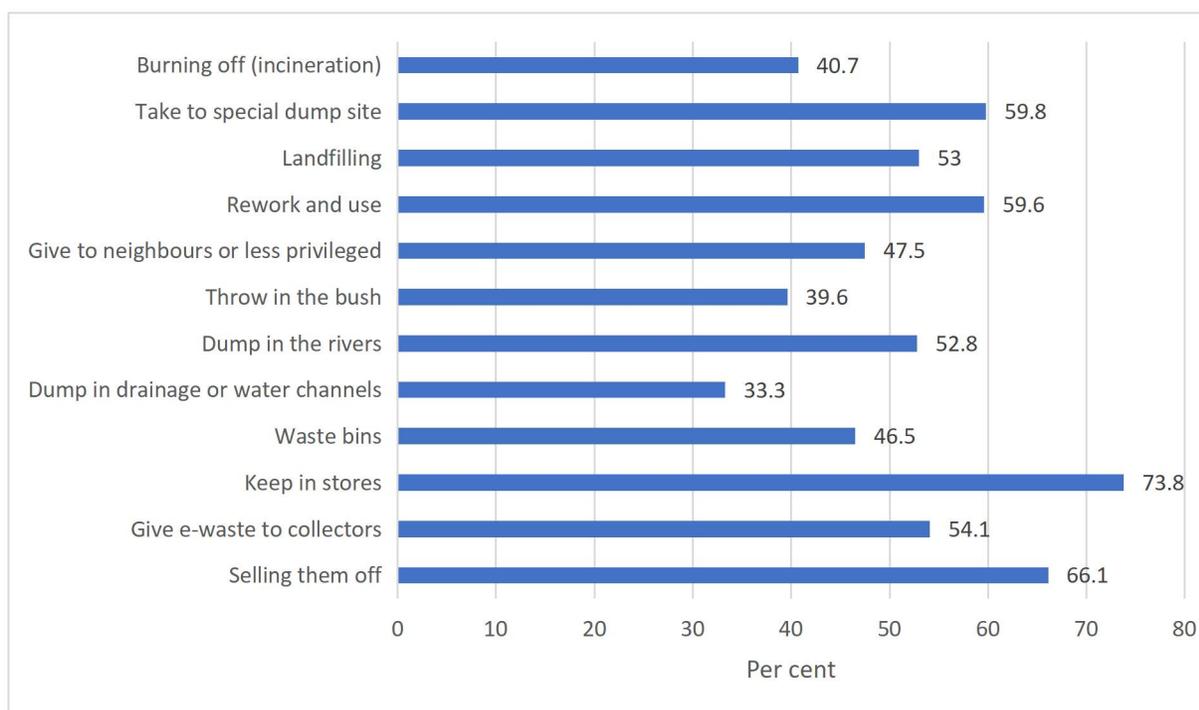## How consumers dispose their electronic waste

This section of the study examined how consumers dispose of their electronic waste. Table 4.6 shows the distribution of respondents by how respondents dispose of electronic waste. It was revealed that the majority indicated that they sold them off (66.1%), gave e-waste to collectors (54.1%) and kept them in stores (73.8%). Other respondents signified that they dumped in the rivers (52.8%), reworked and used (59.6%), landfilled (53.0%) and took to special dump sites. Further reports revealed that less than half of the respondents disposed of them in waste bins (46.5%), dumped them in drainage or water channels (33.3%), threw them in the bush (39.9%), gave to neighbours or less privileged and burned off (40.7%).

Table 4.6: Distribution by how respondents dispose electronic waste

S/N	How consumers dispose e-waste	NO (%)	YES (%)
1	Selling them off	129 (33.9)	252 (66.1)
2	Give e-waste to collectors	175 (45.9)	206 (54.1)
3	Keep in stores	100 (26.2)	281 (73.8)

4	Waste bins	204 (53.5)	177 (46.5)
5	Dump in drainage or water channels	254 (66.7)	127 (33.3)
6	Dump in the rivers	180 (47.2)	201 (52.8)
7	Throw in the bush	230 (60.4)	151 (39.6)
8	Give to neighbours or less privileged	200 (52.5)	181 (47.5)
9	Rework and use	154 (40.4)	227 (59.6)
10	Landfilling	179 (47.0)	202 (53.0)
11	Take to special dump site	153 (40.2)	228 (59.8)
12	Burning off (incineration)	226 (59.3)	155 (40.7)

Figure 4.3 also presents the percentage distribution of how respondents disposed of electronic waste. It was found that the highest proportion of the respondents kept them in the stores, followed by those who sold them off and those who took them to special dump sites.

Figure 4.3: Percentage distribution of respondents by how consumers dispose electronic waste

Discussion of Findings

In line with the socio-demographic characteristics of the respondents, it was found that the majority were male whereas few of them were females. This means that more male respondents presented themselves in each of the sampled households for the administration of research instruments which supports the prevalence of patriarchy in the study area. It was also found that

the mean age was 33.7 years. This suggests that the majority of the respondents were within their middle age bracket, and they were more likely to use gadgets that would generate e-waste than the older age groups.

Findings also revealed that the majority of the respondents had tertiary education compared to their categories of respondents with no or lower educational levels. This suggests that there were more learned people in the study area than those who were not. This may also have implications on the handling of e-waste generated in each household among the study population.

Findings indicated that the majority of the respondents were Christians by religion. This is true of the state where they were predominantly Christians as compared to northern Nigeria where they were predominantly Muslims. On the ethnic group of the respondents, it was found that they were predominantly Ijo ethnic group. This is also a true picture of the state where Ijo ethnic group dominate their ethnic affiliations. It was also found that about two-thirds of the respondents were married. This suggests that the majority fall within nuptial age groups.

On the types of family, the highest proportion of the respondents were from polygamous families. This suggests that there were large family members of extended families who may have generated more e-waste than those who were single or unmarried in the households. It was also found that the highest proportion of the respondents were into trading, followed by those in the civil service and farming among others. It then suggests that there were more respondents in the service economy than in another economic subsector.

Findings on the constituents of e-waste revealed that the majority recognized cell or mobile phones, batteries, computers – desktops, computers – laptops as e-waste. It was also found that they recognized televisions, DVD players, CD players, radios, personal stereos and iron as e-waste. Further analysis revealed that refrigerators, generators or their parts, wires/cables, rechargeable lamps and bulbs, ceiling or standing fans, cameras and other household appliances as e-waste. It was also found that the majority of the respondents had moderate knowledge of e-waste. This finding suggests only a few members of the study population do not know about e-waste.

Findings show positive perceptions about the tendency to reuse any e-waste in the future, the possibility of recycling some of the e-waste, the possibility of some e-waste recovery and the belief that legislation or laws on e-waste management should be respected. It was also found that the majority had a negative perception about the belief that instructions for the disposal of e-waste should be observed, money can be generated from e-waste and e-waste should be given to collectors. In the overall perception of the respondents about e-waste management, it was also found that the majority had a positive perception about e-waste management, with one-fourth having a negative perception about e-waste management. This means that while the majority were aware of the negative impact of e-waste on the environment, others did not see the negative impact of e-waste on the environment. This supports Owusu and colleagues' (2017) work that preventing wastage of useful parts had no negative impact on the environment.

Findings also revealed that the majority indicated that they sold them off, gave e-waste to collectors and kept them in stores. These practices support Owusu and colleagues (2017) who claimed and observed that this procedure of managing e-waste provided a source of livelihood for others while it is mainly practiced in a rudimentary manner. Some practices endanger the

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environment with how community members dispose of e-waste which include disposal into waste bins, dumping in drainage or water channels, throwing in the bush and burning off. Meanwhile, Wang *et al* (2012) suggested that indiscriminate disposal of e-waste cause damage to the skin, the nervous system and malfunction of the essential organs in the body.

Conclusion

This study focused on the knowledge, perception and practices of e-waste. The majority had moderate knowledge of the constituents of e-waste as they perceived its management positively. Despite this, some practices have not met standard practices in the management of e-waste among the study population such as burning them off and disposing of them in the rivers and water channels among others. However, disposing of the constituents of e-waste indiscriminately may pose serious hazards to the environment as they become threats to human lives. It is, therefore, expedient to state that the management of e-waste should be prioritized by the government and all concerned stakeholders in the environment through concerted efforts.

Recommendations
- There is a need for more sensitization on best practices in the disposal of e-waste in households through community leaders and religious group leaders.
- Every citizen should be sensitized to avoid the burning of e-waste or dumping it in the river or water channels to protect against environmental pollution and erosion by the Ministry of Environment through radio and television programmes.
- The Ministry of Environment should be empowered by the government to sanction any erring citizen who indiscriminately disposes of e-waste.
- There should be private-public partnership initiatives in the management of e-waste, especially on recycling and future reuse of the constituents through the establishment of an e-waste recycling company in the state.

References

Afroz, R., Masud, M. M., Akhtar, R., Duasa, J. B. (2013). Survey and analysis of public knowledge, awareness and willingness to pay in Kuala Lumpur Malaysia - a case study of household WEE management. *Journal of Cleaner Production, 52*, 185-193.

Ajzen, I. (2012). Martin Fishbein's Legacy: The Reasoned Action Approach. *The Annals of the American Academy of Political and Social Science, 640, 11-27*.

Ajzen, I., & Albarracín, D. (2007). Predicting and changing behavior: A reasoned action approach. In I. Ajzen, D. Albarracín, & R. Hornik (Eds.), Prediction and change of health behavior: Applying the reasoned action approach (pp. 3-21). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Azjen, I., & Madden, T. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology, 22(5), 453–474.*

Azodo, A. P., Ogban, P. U., & Okpor, J. (2017). Knowledge and Awareness Implication on E-Waste Management among Nigerian Collegiate. *J. Appl. Sci. Environ. Manage*, 21 (6), 1035-1040.

Baldé, C. P., Forti, V., Gray, V., Kuehr, R., & Stegmann, P. (2017). The Global E-waste Monitor–2017, United Nations University (UNU), International Telecommunication Union (ITU) & International Solid Waste Association (ISWA), Bonn/Geneva/Vienna. *ISBN Electronic Version*, 978-92.

Bhat, V. and Patil, Y. (2014). E-waste consciousness and disposal practices among residents of Pune city. *Procedia – Social and Behaviourial Sciences, 133*, 491-498.

Bhat, V., & Patil, Y. (2014). E-waste consciousness and disposal practices among residents of Pune city. *Procedia - Social and Behavioral Sciences, 133, 491 – 498.*

Blau, J. (2006). UN Summit on e-waste: Nokia, Vodafone and Others to Attend UN Summit on e-waste". *CIO business magazine.*

Borthakur, A., & Singh, P. (2015). Electronic waste in India: disposal behaviour and public awareness. Proceedings of the International Conference on Solid Wastes 2015: Knowledge Transfer for Sustainable Resource Management, Hong Kong SAR, P.R. China, 19 – 23 May 2015 (pp. 2090-2093).

European Environmental Agency, EEA. (2003). Waste from electrical and electronic equipment (WEEE) - quantities, dangerous methods substances and treatment methods. European Topic Centre on waste. European Environment Agency.

Fishbein, M. (1967). A behavior theory approach to the relations between beliefs about an object and the attitude toward the object. In M. Fishbein (Ed.), Readings in attitude theory and measurement (pp. 389-400). New York: John Wiley & Sons.

Glanz, K., Rimer, B. K., & Viswanath, K. (2015). Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. In Glanz, K., Rimer, B. K., & Viswanath, K. (Kasisomayajula) (Fifth ed.). Health behavior: theory, research, and practice. San Francisco, CA.

Heacock, M., Kelly, C. B., Asante, K. A., Birnbaum, L. S., Bergman, A. L., Bruné, M., Buka, I., Carpenter, D. O., Chen, A., Huo, X., Kamel, M., Landrigan, P. J., Magalini, F., Diaz-Barriga, F., Neira, M., Omar, M., Pascale, A., Ruchirawat, M., Sly, L., Sly, P. D., Berg, M. V., & Suk, W. A. (2016). E-Waste and Harm to Vulnerable Populations: A Growing Global Problem. *Environmental Health Perspectives,* 124(5), 550-555.

Montaño, D. E., Kasprzyk, D., & Taplin, S. (1996). The Theory of Reasoned Action and the Theory of Planned Behavior. In: Glanz, K, Lewis, FM, and Rimer, BK (Eds). Health Behavior and Health Education (Second Edition). San Francisco, CA: Jossey-Bass Publishers.

Nuwematsiko, R., Oporia, F., Nabirye, J., Halage, A. A., Musoke, D., & Buregyeya, E. (2021). Knowledge, Perceptions, and Practices of Electronic Waste Management among Consumers in Kampala, Uganda. *Journal of Environmental and Public Health,* 2021, 1-8.

Otsuka, M., Itai T., Asante, A. K., Muto, M., Tanabe, S. (2012). Trace element contamination around e-waste recycling site at Agbobgloshie, Accra city, Ghana. *Environmental Pollution and Ecotoxicology*, 6:161-167.

Owusu, G., Donkor, A., Ziwu, C., Nyarko, S., Tawiah, R., Bonzongo, J., Dubey, B., Asante, I., & Nyame, F. (2017). Public Perception of E-Waste Management and Disposal Practices in Accra Metropolis, Ghana. *Science & Environment,* 1(1), 79-89.

Saphores, J. M. Ogunseitan, O. A., & Shapiro, A. A. (2012). Willingness to engage in pro-environmental behaviour: An analysis of e-waste recycling based on a national survey of U.S. household. *Resources, Conservation and Recycling*, *60*, 49-63.

US Environmental Protection Agency (2012). *Statistics on the management of used and end-of-life electronics. US Environmental Protection Agency.*

Wang, H., Li, S., Li, F., Liu, Q., Ke, S. (2010). Study on the changes of urinary 8-hydroxydeoxyguanosine levels and burden of heavy metal around e-waste dismantling site. *Science of the Total Environment, 408*, 6092-6099.

World Economic Forum (2019). A new circular vision for electronics time, time for a global report. *World Economic Forum.*