

Determinants of Electronic Waste Management Practices among Information and Communication Technology Artisans in Ibadan, Nigeria

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Abstract

Information and communication technology (ICT) has been seen to be holding a central place in the development of many societies. Several countries have invested in its use over the years and as a result, much of electronic wastes have been generated, especially in developing countries. There is therefore a need to manage these wastes using good practices. The purpose of this study is to investigate the determinants of electronic waste management practices among information and communication technology artisans in Ibadan, Nigeria. The identified determinants are – government regulations, peer pressure, an organisation's reputation, client requirements, organisation's culture, and availability of relevant technology. The study adopted a survey research design. Copies of the questionnaire were administered to 235 respondents, while interviews were conducted with 11 key informants using the convenience sampling method. Friedman's related sample test, and linear regression analyses were carried out on questionnaire data, and thematic analysis was used to analyse the interview responses. The study provided answers to seven (7) research questions. Findings from the study revealed that most artisans manage their e-wastes by re-using parts of non-functioning electronic devices, repairing old devices, and selling e-wastes to scavengers. The study also revealed that government regulations, peer pressure, an organisation's culture, and an organisation's reputation have predictive relationships with the e-waste management practices that information and communication technology artisans adopt. The study recommended the development of an explicit e-waste management policy and regular delivery of orientation and

reorientation programmes by the government on electronic waste management practices.

Keywords: artisans, e-waste management, Ibadan, information and communication technology, Nigeria

Introduction

The introduction of information and communication technology (ICT) devices to every sector of the economy has made the society more dependent on its availability. In addition, ICT usage has improved the socio-economic development, it has reconfigured and redefined roles, structures and functions for different components of the society (Nwagwu and Olatunji, 2012). Consequently, the use of ICT has spread in both the developed as well as developing countries, bringing numerous advantages in the sectors of education, communication, commerce, governance and entertainment (Adediran and Abdulkarim, 2012). This has brought about an increase in the adoption and use of ICT with huge consequences for the large quantity of retired devices known as electronic wastes (Panambunan and Breiter, 2013; Ogungbuyi, Nnorom, Osibanjo and Schluep (2012); Ideho, 2012; Osibanjo, 2009).

ICT devices become electronic wastes (e-wastes) when they are considered to be at the end of their useful life. For example, non-functioning televisions, computers, printers, photocopiers, and mobile phones, when no longer wanted become e-wastes. Most often, these electronic products sometimes contain toxic materials requiring special end-of-life management, materials such as lead, mercury, arsenic, chromium, cadmium, and plastics (Ogungbuyi, Nnorom, Osibanjo and Schluep, 2012; Ideho, 2012; Kishore and Kishore, 2010; Wong, Duzgoren, Aydin, and Wong, 2007). These toxic substances have been discovered as potential contaminants in the environment and thus threaten human health (Robinson, 2009; Nwifo, 2010). E-waste has been known to impact health and the environment by its ability to infiltrate the food chain in the form of toxic chemicals and thereby exposing people to deleterious chemicals in form of polycyclic aromatic hydrocarbons and persistent organic pollutants (Borthakur, 2016).

Over the years, effective waste management in Nigeria has been an enormous task but has become more complicated due to the inclusion of e-

wastes which find easy access into Nigeria in the name of free trade and has further complicated the problems associated with waste management (Kurian, 2007). Nigeria has been a victim of poor e-wastes management (Okoye and Odoh, 2014; Ideho, 2012) and this was asserted in the 2005 Basel Action Network documentary “The Digital Dump” (Puckett, Westervelt, Gutierrez and Takamiya, 2005). Nigeria has become a major destination for e-wastes from Europe and Asia (Okoye and Odoh, 2014; Adediran and Abdulkarim (2012); Sthiannopkao and Wong, 2013; Ideho, 2012; Schwarzer, De Bono, Giuliani, Kluser and Peduzzi, 2005). This has lead to the manifestation of ICT artisanship designed to cater for the needs of consumers. These are people who provide services that cover repair and maintenance of ICT products. They are majorly found in various arrangements; ranging from the well-organised and established setups to the roadside shops (Omotayo and Babalola, 2016).

In Oyo state, despite the efforts of government to tackle the problem of waste management, especially in Ibadan metropolis, the challenge has remained, thereby leading to improper solid waste disposal. This manifests in the forms of waste being dumped on roadsides, walkways, and drainages (Moruff, 2014). In no other cities in the state are the threats of wastes better explained than it is via Ibadan (Onyemaechi and William, 2009). Ibadan is the capital of Oyo State and also the largest indigenous city in Africa with a population of 3.16 million in 2016 (Index mundi, 2016). As the nerve centre of industrial, economic, social and administrative activities of Oyo State, Ibadan has over the years witnessed population explosion, and is consequently facing increased environmental risks arising from arrays of sources which include air pollution from vehicles, household energy use, industrial and power plants; and also, environmental pollution from solid wastes including e-wastes (Tomori, 2007).

In order to model e-waste management strategies and its determinants in developing countries, Heeks, Subramanian, and Jones (2013) categorized e-waste strategy determinants into external determinants (government regulation, peer pressure, client requirements and corporate reputation) and internal determinants (financial impact, organisational culture and organisational leadership). In addition to that, previous studies have identified availability of technology (Mwathi, 2014) as a determinant of e-waste management practices (Qian, 2005; and Afangideh, Obong, and Robert, 2012). This study therefore adapted the model of Heeks et al. (2013)

in investigating the determinants of e-waste management practices adopted by ICT artisans in Ibadan, Oyo State, Nigeria.

Government regulation in this study was examined as policies and enforcement tactics that the government of Oyo State has put in place to ensure that ICT artisans properly manage e-wastes generated by them. Also, awareness of these policies and enforcement tactics among ICT artisans was accessed. Peer pressure was examined in the form of reminders, criticism and checks among ICT artisans for it has been observed that peers exert influence on environmental behaviour (Lynes and Andrachuk, 2008). Client requirements play a major role in determining an organisation's environmental practices (Benito and Benito, 2007). This can be requirements for particular environmental standards or actions. Hence, in this study, client requirement was measured in form of the concerns of clients of ICT artisans towards how non-functioning ICT products are managed.

It has also been observed by Heeks et al. (2013) that environmental actions connect to organisation's reputation. In this study, organisation's reputation was measured by accessing if artisans organisations are concerned about bad image and bad reputation that may be caused by lack of proper e-waste management. Organisational cultures in this study refers to norms, systems, beliefs, values, actions and behaviours that impact the way activities are performed within an organisation. It guides what happens in an organisation by defining appropriate behaviour for various situations (Ravasi and Schultz, 2006), including those associated with environmental strategy (Grenville, Nash, and Coglianese, 2008, Lynes and Andrachuk, 2008).

Organisational leadership is intertwined with organisational culture since an organisation's culture shapes the emergence of the organisation's leaders (Heeks et al., 2013). Thus, in this study, ICT artisan's organisational culture was measured by looking at activities like awareness and sensitisation programmes organised for members, rules, policies and ethical codes concerning management of e-wastes in their organisation. Technology was interpreted as the availability of relevant technology that can be used in the management of e-waste. Known technological measures to handle e-wastes include; reuse, recycle and recovery (Mwathi, 2014).

Having identified the determinants of e-waste management, there is a need to specify the e-waste management practices identified in this study. E-waste management practices may either be formal or informal. According to Chi, Streicher, Wang and Reuter (2010), informal e-waste recycling practices use low-cost primitive processes and do not use appropriate facilities to safeguard environmental and human health during the recycling process. It is an expanding low-cost recycling practice for managing e-waste in many countries that consists mainly of manual, unskilled labour (Sinha et al, 2007). It is very common in developing countries because it provides a profitable market for low wage-earners (Chi et al., 2010). The valuable components of e-wastes are processed into secondary raw materials in a variety of crude refining and conditioning processes, but no machinery or personal protective equipment is used for the extraction of these different materials. These types of processes are performed with bare hands and the help of hammers and screwdrivers and with very little personal protective equipment or pollution control measures in place.

Informal recycling includes open burning of plastics to reduce waste volume, open burning of insulated copper wires to salvage copper, strong acid leaching of Printed Wiring Board to recover precious metals and the heating and manual removal of components from printed circuit boards (Tshimbana, 2014). These crude material recovery processes have resulted in environmental pollution while exposing millions of people to pollutants (Widmer et al., 2005). Incineration of e-wastes helps to convert some hazardous e-waste substances into less hazardous compounds. However, it creates large amount of gases which are harmful and can find their way into the environment upon disposal by burning. According to Okuneye (2014), incineration can either be by using modern methods or traditional methods. The modern method involves incinerating e-wastes in a controlled complete combustion process. In this process, e-wastes are burned in specially designed incinerators at temperatures between 900 to 1000°C. This method helps in reducing the harmful gaseous substances that may be emitted during the incineration process. In contrast, the traditional method involves burning e-wastes in the open thereby exposing the environment and its inhabitants to the harmful gaseous emissions.

According to Terada (2012), the majority of e-waste currently generated ends up in domestic landfills. Landfills are problematic because the toxic materials in e-waste can leak into the land over time or can be

released into the atmosphere thereby impacting neighbouring communities and the surrounding environment. It was revealed by Pike research (2011) that by the early 2020s recycling and reuse activities will surpass the annual volume and weight of electronic devices that become e-waste, and thus will play a large part in mitigating the e-waste crisis but still, the total volume of e-waste in landfills will continue to increase throughout the period.

Formal e-waste management strategies involve environmentally healthy techniques such as reuse of functional of parts and refurbishing of old electronic gadgets. Refurbishing has to do with restoring old devices to make them functional. Reuse is an activity that involves extraction of useful and valuable substances found in e-waste. These have to do with direct second-hand use or use after slight modifications to the original functioning device. Recycling is the conversion of e-waste parts into other useful materials or to recover its original raw matter. These helps in the management of e-waste as they help to reduce the volume of waste (Okuneye, 2014).

Statement of the Problem

Poor disposal of e-waste is one of the fastest growing pollution problems worldwide. Various authors have studied e-waste management but there are no known studies that predicted the effects of government regulation, peer pressure, organisation reputation/image, client requirement, organisational culture, and availability of relevant technology as the determinants of e-waste management practices in Nigeria. Nnorom and Osibanjo (2008) studied the material flow of second-hand electronic devices into Nigeria, e-waste management practices, and the environmental, as well as the health implications of those practices in Nigeria. The study did not examine the e-waste management practices by artisans. This study has filled this gap, by studying e-waste management practices by artisans in Ibadan, Nigeria.

In the study by Ongondo, Williams and Cherrett (2011), the e-waste management practices in various countries and regions across the world were reviewed. Also, global trends in the quantities and composition of e-waste, and the various strategies and practices adopted by selected countries to handle, regulate and prevent e-waste were examined. The study did not examine factors that predict e-waste practices. This study has filled this gap, by studying factors that predict e-waste practices. Ifegbesan

(2011) studied the solid waste management practices of two Southwestern states (Oyo and Ogun). From the study it was observed that residents are ill-informed about e-waste collection, disposal, reduction and recovery, as well as the health and environmental hazards caused by their toxicity. However, the study did not address e-waste management practices and their determinants, these gaps were filled in this study.

Furthermore, Wang, Zhang, Yin and Zhang (2011) investigated the willingness and behaviour of residents in Beijing city towards e-waste recycling. It was deduced that convenience of recycling facilities and service, residential conditions, recycling habit and economic benefits are the four determinants of Beijing residents' willingness and behaviour towards e-waste recycling. More so, Okuneye's (2014) study, like Wang et al. (2011) is a behavioural study focusing on individuals. The present study focused on non-formal organisations with ICT artisans as a target population.

Mwathi (2014) examined the factors influencing effective management of e-waste with particular focus on cyber cafes in Nairobi Central Business District, Kenya. It was deduced that inadequate financial resources and facilities, lack of technical skill, lack of public awareness on e-waste were the factors that influence e-waste management among cyber cafe managers. Most other previous studies on e-waste focused mainly on legislators, producers or recyclers (Subramanian, Heeks and Jones, 2012) but this study focused on ICT artisans.

A study on artisans is important because, most consumers see them as the last resort for consultation when their devices develop problems; especially when the warranty period of their devices have elapsed. Often times, it is ICT artisans that determine when ICT devices become e-wastes and what happens to those e-wastes. The e-waste management practices of ICT consumers are driven by some determinants and understanding these determinants can be of help in planning e-waste interventions. Heeks et al. (2013) established that there has been little work on the determinants of e-waste management. Filling this gap necessitated this study which is to ascertain the determinants of e-waste management practices adopted by ICT artisans in Ibadan, Nigeria.

Objectives of the Study

The main objective of this study is to investigate the determinants of e-waste management practices of ICT artisans in Ibadan, Oyo State, Nigeria. However, the specific objectives are to:

- investigate e-waste management practices adopted by ICT artisans in Ibadan
- ascertain if government regulations determine the e-waste management practices adopted by ICT artisans in Ibadan
- ascertain if peer pressure and client requirement determine the practices adopted by ICT artisans in the management of e-waste
- find out if the e-waste management practices of ICT artisans are determined by their organisation's culture and organisation's reputation, and to
- determine if the availability of technology determines the practices used by ICT artisans in managing e-wastes

Research Questions

This study provided answers to the following research questions:

- What are the e-waste management practices adopted by ICT artisans in Ibadan to manage e-waste?
- Is there a predictive relationship between government regulation and e-waste management practices adopted by ICT artisans in Ibadan?
- Is there a predictive relationship between peer pressure and e-waste management practices adopted by ICT artisans in Ibadan?
- Is there a predictive relationship between organisation reputation and the e-waste management practices adopted by ICT artisans in Oyo State?
- Is there a predictive relationship between client requirement and the e-waste management practices adopted by ICT artisans in Ibadan?
- Is there a predictive relationship between organisation culture and the e-waste management practices adopted by ICT artisans in Oyo State?

- Is there a predictive relationship between availability of relevant technology to recycle e-waste and e-waste management practices adopted by ICT artisans?

Methodology

This study adopted a survey research approach in investigating the determinants of e-waste management practices among ICT artisans in Ibadan, Nigeria. Heeks et al (2013) identified government regulation, peer pressure, client requirements, corporate reputation, financial impact, organisational culture and organisational leadership as e-waste strategy determinants among Small Scale Enterprise in developing countries. Also, Mwathi (2014) identified availability of relevant technology as a determinant of e-waste management practices adopted by organisations. Figure 1 displays the research framework for this study. The framework is based on the adaptation of the Model of Factoral Determinants of E-waste Strategy (Heeks et. Al., 2013) and focussed on measuring the extent to which the identified factors determines e-waste management practices adopted by ICT artisans in Ibadan, Nigeria.

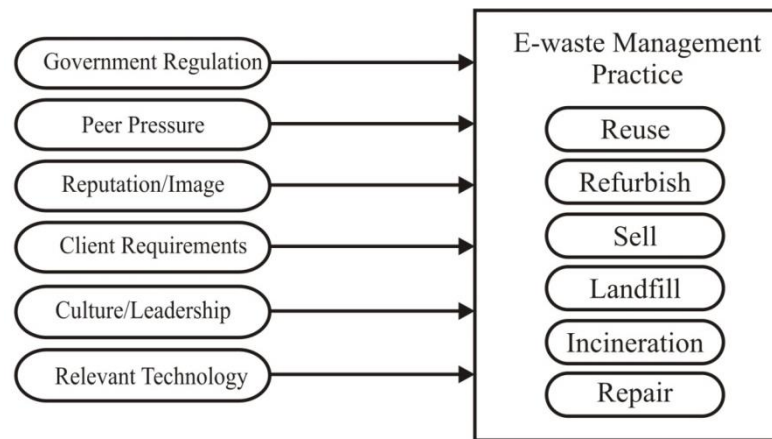


Figure 1: Research Framework

Source: Adapted from Heeks et al. (2013)

Respondents to this study were artisans who repair faulty ICT devices; radios, televisions, computers (desktops and laptops), printers and mobile phones. Multi-stage sampling technique was adopted for this study.

The first stage involved a purposive selection of the local governments in the urban areas of Ibadan. This is because ICT artisans are concentrated in these areas. Thus, the local government areas visited for this study were Ibadan North, Ibadan North-East, Ibadan North-West, Ibadan South-East and Ibadan South-West. Each local government has 6 units where the artisans hold meetings periodically. The second stage involved a purposive selection of markets where ICT artisans' workshops are concentrated. The markets were Beere Market, Ogunpa Market, Iwo Road Complex, Sango Market, and Agbowo Complex. The third stage involved using of convenience sampling method to select respondents. Based on Yusuf's (2013) opinion that for small populations (under 1000) a sampling ratio of 30% is needed to be accurate, but for a larger population, a sample ratio of 10% is needed to be accurate.

A pre-study visit to these markets revealed that; for ICT artisans that repair televisions and radios, each unit has an average of 45 members; while for ICT artisans that repair mobile phones, computers and printers, each unit has an average of 35 members. The estimated population of ICT artisans who repair mobile phones, computers and printers is 1,050 while the population of those that repair televisions and radios is 1,350. Thus, the estimated total population for the study is 2400. Using a sample ratio of 10% and the sample size of the study was 240 respondents.

The research instruments used for data collection were structured questionnaire and unstructured interview guide. The questionnaire was structured into 2 sections. Section 1 of the questionnaire contained 6 items with a 4-point scale to measure the practices adopted by respondents to manage e-wastes. The 4-point scale was rated 1, 2, 3, and 4 for "never", "seldom", "occasionally", and "regularly" respectively. Section 2 of the questionnaire consisted of 36 items aimed at measuring the degree to which variables in the research framework may determine the e-waste management practices adopted by respondents. These variables are government regulation, peer pressure, organisation reputation/image, and organisation culture. A 3-level scale with the rating 1, 2 and 3 to denote "no", "not sure" and "yes" respectively was used to measure government regulation, while a 5-level Likert scale was used to measure other variables with a rating of 1, 2, 3, 4, and 5 for "strongly disagree", "disagree", "undecided", "agree", and "strongly agree" respectively. The interview guide contained open ended questions. Questions in the guide collected data on adopted e-waste management practices. Also, questions

investigating respondent's perception towards the relationship between organisational characteristics and their e-waste management practices were also asked.

Results according to the Research Questions

This section presents the answers of the research questions in this study. Data was collected via questionnaires and interview. The threshold value for level of significance tests for finding relationships between the variables is 0.05.

Research Question 1: What are the e-waste management practices adopted by ICT artisans in Ibadan to manage e-waste?

Table 1 shows the e-waste management practices adopted by respondents. Friedman's related samples test shows that there are significant differences in the mean levels of how the respondents manage their e-wastes.

Table 1: E-waste Management Practices adopted by Artisans in Ibadan

E-waste Management Practices	Mean Standard Deviation		Mean Rank
We reuse valuable parts of non-functioning devices	3.46	0.91	4.46
We repair old devices	3.48	0.77	4.41
We sell e-waste to scavengers	3.07	0.98	3.77
We refurbish old devices	2.91	1.01	3.61
We dump e-waste in designated dumpsites	2.27	1.2	2.74
We burn e-waste in the open	1.66	1.1	2.01
Chi Square = 398.483, df = 5, Asymp. Sig. = .000			

With a mean rank of 4.46 and 4.41 respectively, reuse of valuable parts of non-functioning devices and repair of old devices are the two most used e-waste management practices adopted by respondents. Whereas, the least adopted e-waste management practices are dumping of e-wastes in designated dump sites and burning of e-waste with mean rankings of 2.74 and 2.01 respectively. The significant difference ($p < 0.05$) suggests that there are variations in e-waste management practices adopted by respondents.

The result of the interviews conducted also showed that reuse, selling and repairing of old devices were common practices adopted by artisans for e-waste management. Responses also revealed that storing of valuable parts for future use was also adopted by artisans. Some of their responses are:

"We reuse parts of faulty devices if they are compatible with the new one, there are some parts that we dump, and there are some that we keep for future use. And we sell our electronic wastes to scavengers" (Respondent 1)

"Nothing is a waste in electronics; every part of electronics is useful and whatever that is faulty in a device can be replaced with a spare part got from a previous device. We do not burn e-waste, we repair old devices and we store for future use" (Respondent 5)

"Virtually all parts of electronics are useful. Even if a device is not functioning properly as it ought to function, the parts are still useful for other things. Piling might constitute nuisance to the environment, as a result, we sometimes dispose them by selling them. We are aware of the effect of burning to climate change, we do not burn them. We hardly dump e-waste. We reuse and sell most times" (Respondent 6)

"After I have identified what is wrong with the device, I remove it and replace with any other one that I have in store. We do not burn them; we keep them because they may eventually be useful. We don't dump them. Sometimes we sell them" (Respondent 9)

"There is no part that is not useful, nothing gets wasted. And if a part is confirmed non-functioning, we sell them to scavengers. Yes, we reuse parts of faulty devices, and we repair old devices. We do not burn e-wastes" (Respondent 10)

Research Question 2: Is there a predictive relationship between government regulation and e-waste management practices adopted by ICT artisans in Ibadan?

The result of linear regression analysis in Table 2, shows that there is a predictive relationship between government regulation and the e-waste management practices adopted by artisans as $p = (0.026 < 0.05)$.

Table 2: Relationship between Government Regulation and E-waste Management Practices

E-waste Management Practices	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
(Constant)	16.944	0.938			18.073	0.000
Government Regulation	0.138	0.061	0.146		2.244	0.026
Notes: N = 233; df = 1; F_{ratio} 5.037; p = 0.026, R = 0.146; R square = 0.021						

For the interview, respondents were asked if they are aware of laws and regulations governing e-waste management in Oyo State; if there are punishments against defaulters of these laws; and if they are familiar with any government agency that deals with e-waste management. Responses correspond with the data from the questionnaire as most of the respondents agreed that there are laws governing e-waste management in Oyo State and that defaulters are punished. Some of their responses are:

"There is law against burning and dumping of e-waste and defaulters are fined or may be suspended for months" (Respondent 2).

"One of the reasons we do not dump is because of the existing law in Oyo State against dumping and burning of e-wastes and there is penalty for defaulters. There is a government agency that deals with e-waste management" (Respondent 4).

"Yes, we have heard about these laws, just that they are not well implemented. So, many people do not know except for those who come to meetings regularly where these laws are emphasized" (Respondent 6).

"Yes, there are laws concerning how e-wastes are to be managed. There are various types of punishment for defaulters" (Respondent 11).

Research Question 3: Is there a predictive relationship between peer pressure and e-waste management practices adopted by ICT artisans in Ibadan?

The result of linear regression analysis in Table 3, shows that there is a predictive relationship between peer pressure and the e-waste management practices adopted by artisans as $p = (0.013 < 0.05)$.

Table 3: Relationship between Peer Pressure and E-waste Management Practices

E-waste Management Practices	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
(Constant)	16.141	1.171			13.782	0.000
Peer Pressure	0.162	0.065	0.163		2.506	0.013
Notes: N = 231; df = 1; F _{ratio} 6.2281; p = 0.013, R = 0.163; R square = 0.027						

For the interview, respondents were asked if their colleagues speak to them about e-waste management or help them in managing their e-wastes. All respondents agree that they sensitise and encourage one another towards proper e-waste management. These responses match with the questionnaire result. Some of them are:

"We do enlighten each other on how to manage e-waste" (Respondent 2)

"We discuss among ourselves and sensitise each other on proper e-waste management. I do explain to my colleagues as well" (Respondent 4)

"We do have discussions among ourselves on how e-wastes are to be managed" (Respondent 7)

"Yes, we do, and our leaders do sensitise us about proper environmental sanitation" (Respondent 10)

"Yes, we do advise each other about e-waste management" (Respondent 11)

Research Question 4: Is there a predictive relationship between organisation reputation and the e-waste management practices adopted by ICT artisans in Oyo State?

The result of linear regression analysis in Table 4 reveals that there is a predictive relationship between organisation reputation and e-waste

management practices adopted by artisans as $F_{(1, 232)} = 1.065$, $p = 0.002 < 0.05$.

Table 4: Relationship between Organisation Reputation and E-waste Management Practices

E-waste Management Practices	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	14.180	1.532		9.256	0.000
Organisation Reputation	0.237	0.075	0.205	3.173	0.002
Notes: N = 232; df = 1; $F_{ratio} 1.065$; $p = 0.013$, $R = 0.205$; $R\ square = 0.042$					

For the interview, respondents were asked if they believe that the way they manage their e-wastes improves their organisation's influence and recognition. Most of respondents agree that their e-waste management practices improve their reputation and influence. Some of their responses are:

"It does improve our organisation's reputation" (Respondent 3)

"Yes, it improves our organisation's reputation because it makes my workshop clean and neat" (Respondent 4)

"Yes, it does improve our reputation because it makes the environment clean and it attracts customers" (Respondent 6)

"Everyone has his own perspective to reputation. Proper waste management may improve our reputation before some people and may not improve our reputation before others" (Respondent 7)

"Yes, it does, especially when an outdated device is brought for repair and we are able to repair it using a part we have in store" (Respondent 11).

Research Question 5: Is there a predictive relationship between client requirement and the e-waste management practices adopted by ICT artisans in Ibadan?

Table 5 reveals no predictive relationship between client requirement and e-waste management practices adopted by artisans $F_{(1, 233)} = 0.072$, $p = 0.789 > 0.05$

Table 5: Relationship between Client Requirement and E-waste Management Practices

E-waste Management Practices	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	18.801	0.744		25.278	0.000
Client Requirement	0.018	0.066	0.018	0.268	0.789
Notes: N = 233; df = 1; $F_{ratio} 0.072$; $p = 0.789$, $R = 0.018$; $R\ square = 0.000$					

For the interview, respondents were asked if their clients are interested in knowing what happens to non-functioning devices and e-wastes. It was deduced from the interview that only few of the clients are interested in the ways non-functioning devices are managed. Some of their responses include:

"Some customers ask while some do not" (Respondent 1)

"Some ask, and we do tell them that we normally refurbish and sell while some do not ask" (Respondent 3)

"No, they don't. They are only interested in repairing their faulty devices" (Respondent 6)

"Once I tell them what is faulty in their devices, they do not ask what I do to the faulty part" (Respondent 7)

"After letting them know the parts that are faulty, some of them do ask what I will do to them and some do not ask" (Respondent 8)

"No, they do not ask, what concerns them?" (Respondent 10)

Research Question 6: Is there a predictive relationship between organisation culture and the e-waste management practices adopted by ICT artisans in Oyo State?

It is deducible from Table 6 that organisational culture has a predictive relationship with e-waste management practices adopted by ICT artisans $F_{(1, 233)} = 8.560$ and $p = 0.004$.

Table 6: Relationship between Organisation Culture and E-waste Management Practices

E-waste Management Practices	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	15.944	1.064		14.992	0.000
Organisation culture	0.131	0.045	0.189	2.926	0.004
Notes: N = 233; df = 1; $F_{ratio} 8.560$; $p = 0.000$, $R = 0.189$; $R\ square = 0.036$					

For the interview, respondents were asked if there are laws and sensitisation programmes with regards to e-waste management in their organisation. Respondents were also asked if there are punishments for defaulters of these laws.

Almost all the respondents agreed that there are laws and sensitisation programmes with regards to e-waste management. Respondents also made it known that defaulters of these laws are punished. Some of their responses are:

"During meetings we sensitise each other on e-waste management. Executives enlighten us on e-waste management" (Respondent 1)

"There are laws in our organisation against improper e-waste management. Penalty is meted to defaulters of the law based on its magnitude" (Respondent 3)

"Yes, we do sensitise members on regular bases on the need for them to keep their environment clean and to manage their wastes properly. Yes, we have laws. We impose fine on members who fail to concur to those laws and when a member has been found to have defaulted the law on several occasions such member might be suspended" (Respondent 6)

"There are laws in our organisation and defaulters are fined"
(Respondent 7)

"There are laws concerning how e-wastes are to be managed. There are various types of punishments for defaulters" (Respondent 11)

Research Question 7: Is there a predictive relationship between availability of relevant technology to recycle e-waste and e-waste practices adopted by ICT artisans?

The result of F-ratio in Table 7 reveals that there is a no relationship between availability of relevant technology and e-waste management practices adopted by artisans; $F_{(1, 232)} = 2.359$, $p = 0.123 > 0.05$.

Table 7: Relationship between Relevant Technology and E-waste Management Practices

E-waste Management Practices	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	17.542	0.956		18.345	0.000
Relevant technology	0.092	0.060	0.102	1.547	0.123
Notes: N = 232; df = 1; $F_{ratio} 2.359$; $p = 0.123$, $R = 0.102$; R square = 0.010					

For the interview, respondents were asked if they have relevant technologies to recycle e-waste. Almost all the respondents said they do not have the relevant technologies to recycle e-waste.

Some of their responses are:

"I don't think we have even in Nigeria, let alone in Ibadan" (Respondent 2)

"We do not have relevant technology to manage e-waste" (Respondents 4)

"No, we don't. In fact, we don't have that. Such technologies require high level of expertise and are very costly" (Respondent 6)

"Although we have equipments to repair faulty devices, we do not have the technology to recycle e-waste" (Respondent 8)

"No, we do not have" (Respondent 10)

Discussion of Findings

The aim of this study was to examine the predictors of electronic waste management practices among ICT artisans in Ibadan metropolis. Findings from the study revealed that most of the artisans engage in proper e-wastes management which involves reusing valuable parts of non-functioning devices, repairing and refurbishing old devices. Although the burning and dumping of e-wastes at dumpsites are still being carried out by few artisans. This study also discovered that most of the artisans are aware of the government agencies that deal with e-wastes management and the punishment enforced by government for indiscriminate dumping of faulty devices. The result of these is that government regulation determines e-waste management practices adopted by artisans. This supports the findings of Mwathi (2014) but counters the observation of Okuneye (2015) that lack of government regulation hinders ICT artisans from carrying out proper e-waste management practices.

Furthermore, the study revealed that e-waste management practice of ICT artisans was not determined by their customers because majority of them stated that only few of their customers know and ask how they dispose their e-wastes. Also, majority of the artisans stated that it is important for them to manage e-wastes as their colleagues do in order to be recognised and to be on the same social level with their colleagues. This may be due to the proximity of artisans' workshops to each other. This finding supports the observation of Lynes and Andrachuk (2008) that peers exert influence on environmental behaviour.

Findings from this study also reveal that most artisans affirm proper management of e-waste to organisational reputation, and peer pressure. This agrees with the research findings of Heeks et al. (2013) that there is a positive significant relationship between organisational reputation and the e-waste management practices. Furthermore, the study revealed that organisational culture had a significant relationship with e-waste management practices because there are rules and policies governing how e-wastes are to be managed and there are laid down punishment for defaulters of these rules; making proper e-waste management a norm in their organization. This finding supports the research by Howard, Nash, & Coglianese (2008), that organisational culture impacts decisions and actions

associated with environmental strategy such as e-waste management practices.

It was also revealed from the study, that relevant technology and technical skills for dealing with e-waste such as recovering valuable items from ICT device and recycling devices are unavailable. The result shows that the resale of obsolete devices is one of the ways ICT artisans carry out e-waste management. Such practices are as a result of unavailable resources as many holds that the unavailability of relevant technology deters them from engaging in proper management of e-wastes.

Conclusion

This study established that although artisans in Ibadan manage their e-wastes in a proper manner, some of them still burn and dump e-waste in landfills. This shows that some artisans are not well sensitised about the environmental and health hazards caused by improper e-waste management activity. Thus, it becomes imperative for the government of Oyo State to regularly orientate ICT artisans about e-waste and its hazards through sensitisation programmes like seminars, workshops, rallies, road-shows and regular announcements on radio and television.

Summarily, government regulation, peer pressure, organisational reputation, organisational culture are the determinants of e-waste management practices, while client requirement and availability of relevant technology are not determinants of e-waste management practices adopted by ICT artisans. The study further revealed that reusing valuable parts of non-functioning ICT devices and repairing of old devices were the two most adopted e-waste management practices while burning and dumping of e-wastes were the two least adopted e-waste management practices that ICT artisans adopt in Ibadan.

Recommendations

The following recommendations have been made:

- The government of Oyo State should pass into law a more comprehensive bill that provides special consideration for e-waste disposal. The bill when passed into law should; empower the relevant agencies to sensitise the public, supervise and regulate the activities of e-waste management; formulate legal procedures for

reporting of illegal e-waste dumping; lay down legal procedures to be used in cases of default with stiff penalties for defaulters based on the toxicity of the waste, severity of environmental pollution and severity of health hazards.

- The study also recommends that artisans who repair phones and computers should liaise with the government to form a formidable association. This will encourage knowledge sharing and problem solving as a group. It will also make the planning of sensitisation programmes of government and non-governmental organisations easy.
- The government should therefore provide adequate technical aid and resources for proper e-waste management in order to keep the society safe from health and environmental hazards that can result from e-waste burning and other improper practices.

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