

HOUSEHOLD ELECTRONIC WASTES (E-WASTES) GENERATION AND MANAGEMENT IN NIGERIA

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ABSTRACT

The rapid turnover in technology in developed and developing countries like Nigeria, has created a new environmental problem in electronic waste (e-waste) management due to high obsolescence rate of consumption. Households are one of the major consumers of electronic equipment and consequently the major sources of electronic wastes (e-waste). In this study, an assessment of the sources, types, lifespan, and the end-of-life management options of electronic equipment acquired by households in three cities in Nigeria (Lagos metropolis, Kaduna metropolis and FCT Abuja) have been studied and compared. Also, a census of the number of out-of-use electronics currently in the households was carried out. The results of the study revealed that both new and used (secondhand) electronic equipments are acquired in households in the study areas. The study also showed that the average lifespan of desktop computers, laptop computers, printers, mobile phones is 2.5-3.5 years, while televisions have lifespan of 3.5-5.5 years. Mobile phones and televisions had the highest average penetration rates of 4.88 and 1.96 respectively while printers had the least penetration rate of 0.6. The most preferred end-of-life options for e-wastes in the study areas were storage and sales, which indicates that users still value their equipment at its end-of-life. The study recommended appropriate e-waste management strategies such as establishment of e-waste collection centers and awareness creation in the households on the need for proper e-wastes disposal.

Keywords: e-waste, household, electronic equipment, penetration rate, end-of-life

INTRODUCTION

The rapid growth in information based industries and services coupled with higher levels of economic development in most African countries (Paul and Tshetlthane, 2013) including Nigeria have resulted in high demand for ICT electronic equipment with resultant high rate of electronic waste (e-waste) generation. Being one of the fastest growing forms of solid waste, e-waste is of more concern globally due to its toxic constituents.

Households, due to their large numbers, are one of the major consumers of electronic equipment especially ICT devices and are consequently major sources of e-wastes generation. The 2009 Residential Energy Consumption Survey (RECS) shows that U.S. households continue to increase their use of consumer electronics, especially televisions, personal computers, and related equipment. According to the survey, nearly 45% of households in 2009 had three or more televisions, an increase from less than 30% in 1997. Similarly, the majority of households had no computer in 1997; now over 76% have at least one computer. This trend is not different from what is obtainable in other developed worlds as well as developing countries like Nigeria.

The increase in households' acquisition of consumer electronics can be attributed to constant availability of newer technology and designs as well as falling prices (Prashant, 2008). Nigeria has the highest number of mobile phone subscribers in Africa having more than 93 million subscribers in 2011 (GSMA, 2011) and about 142 million in 2015 (NCC, 2015). This high mobile phones usage by most Nigerians can also be attributed

to falling prices of mobile phones as well as inefficient and expensive landline connections. Falling prices as well as availability of fairly used television sets at affordable prices may also be responsible for the high number of television in most households.

The concerns over excessive acquisition of electronic equipment generally in developing countries like Nigeria is the lack of capacity for handling and recycling the hazardous materials contained in e-waste generated from them. This usually leads to the disposal of both e-waste and municipal wastes in the same dumpsites; thereby polluting the environment with heavy metals such as Cd, Pb, Hg; and chemicals like polychlorinated dibenzo-p-dioxins (PCDDs) and furans (PCDFs), polybrominated diphenyl ethers (PBDEs) and polycyclic aromatic hydrocarbons (PAHs) thereby creating health risks to the nearby community and the population at large (Wong et al., 2007). The management of e-wastes at the end of its useful life poses serious challenges to the existing solid waste management structures resulting in widespread contamination of the environment.

An estimated 400,000 units of used desktop computers (PCs or CRTs) are imported into Nigeria every month (Nnorom and Osibanjo, 2008; BAN, 2005). Also, the trading of used electronics is currently booming at the famous 'computer village' in Lagos, Nigeria owing to this large-scale importation of used electronics. This makes the acquisition of electronic equipment affordable to middle and low income earners but unfortunately lead to increase in e-waste generation in the country.

This study assess the acquisition of electronic equipment and generation of e-wastes in households in Nigeria; and also determine the fate of obsolete electronics equipments with a view to providing information required in drawing up management plans for e-wastes in the country.

MATERIALS AND METHODS

Study Area

The cities where the study was conducted are- Kaduna metropolis in the northern Nigeria, Abuja (FCT) municipality in central part of the country and Lagos metropolis in the southern part of the country. The sampling locations are as shown in Figure 1.

Data Collection

Field studies were conducted through self-administered questionnaires and checklists in three cities in three different states (Lagos State, Kaduna Sate and Abuja) in

Nigeria from February to August 2011. For the three cities selected, questionnaires were administered to households in high, medium and low income earning areas of each of the cities. The number of questionnaires administered and the number of responses received are as shown in Table 1. The distribution of the questionnaires was however constrained by the number of households that were willing to respond to it. The information sought for in the questionnaires administered included: sources of electronic equipment, the number of electronic equipment in possession, lifespan, quantity as well as fates of each of the obsolete electronic equipment of the sampled households in the three cities. The penetration rates of electronic equipment into the households in each of the selected areas were also obtained as given in equation 1.

$$\text{Penetration Rate} = \frac{\text{Number of households with electronic equipment}}{\text{Total number of households}} \times 100 \quad (1)$$

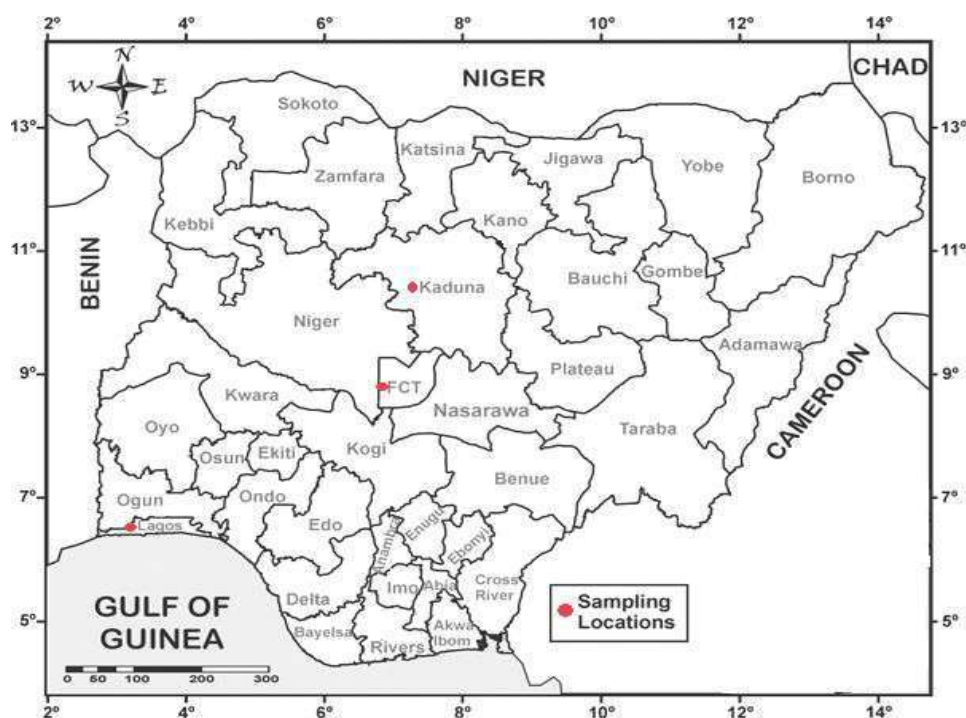


Figure 1: Map of Nigeria showing the 3 states under study

Table 1: Number of questionnaires sent and replies received from households in the study areas

Study areas	Number contacted	Number of replies
Lagos	80	72
Kaduna	250	236
Abuja	50	40

RESULTS AND DISCUSSION

Sources of new equipment in households

It was observed as shown in Figures 2 to 4 that households obtain their electronic equipment, from various sources including retailers, branded and unbranded assemblers, second hand markets and auction sales; although purchase from retailers is the most preferred choice in the three study areas. In Lagos and Kaduna, about 50-60% of households obtain their electronic equipment from retailers while in Abuja, 70-90% of household patronize retailers of electronic equipment.

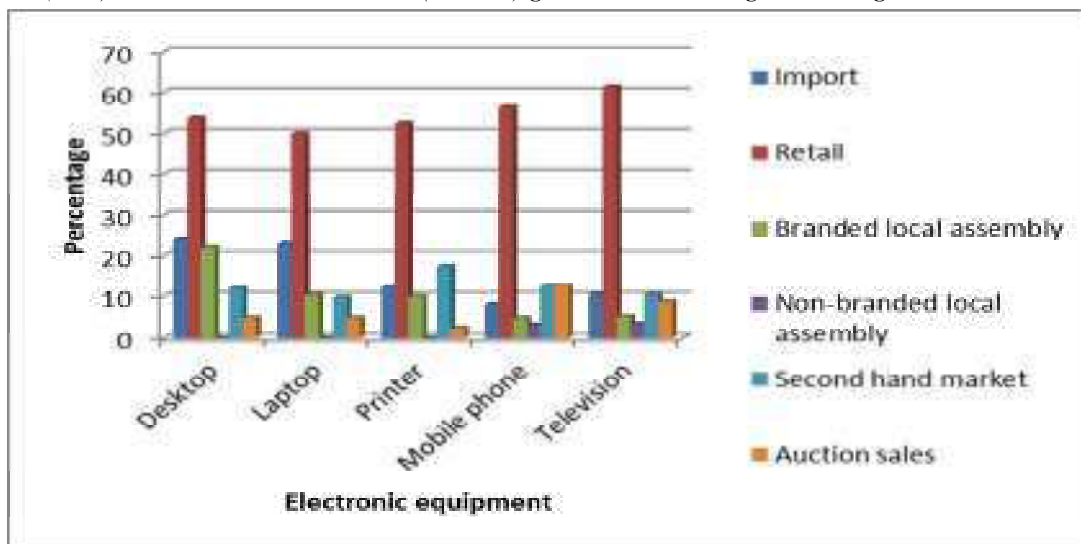


Figure 2: Purchase of electronics by Households in Lagos

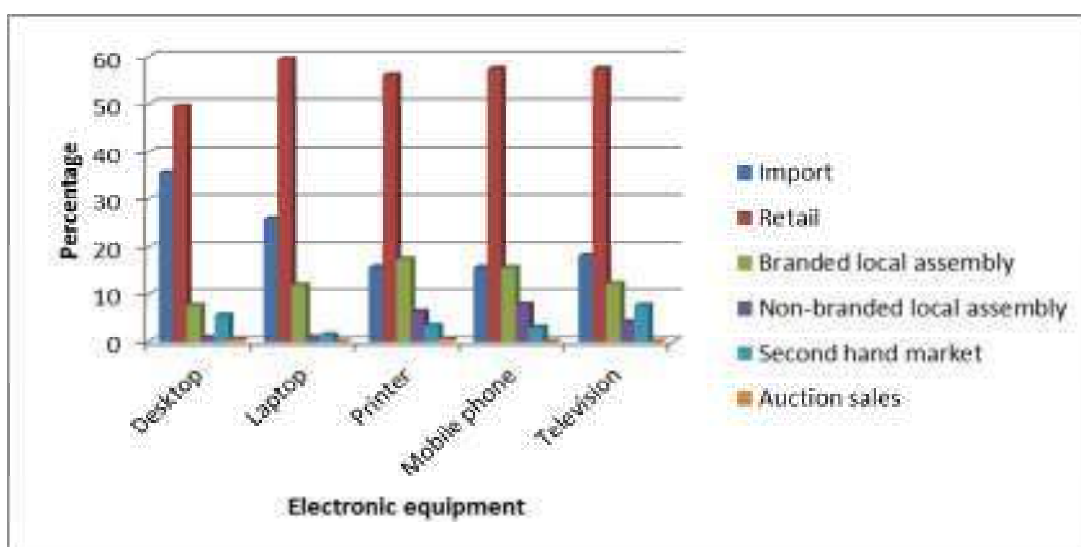


Figure 3: Purchase of electronics by Households in Kaduna

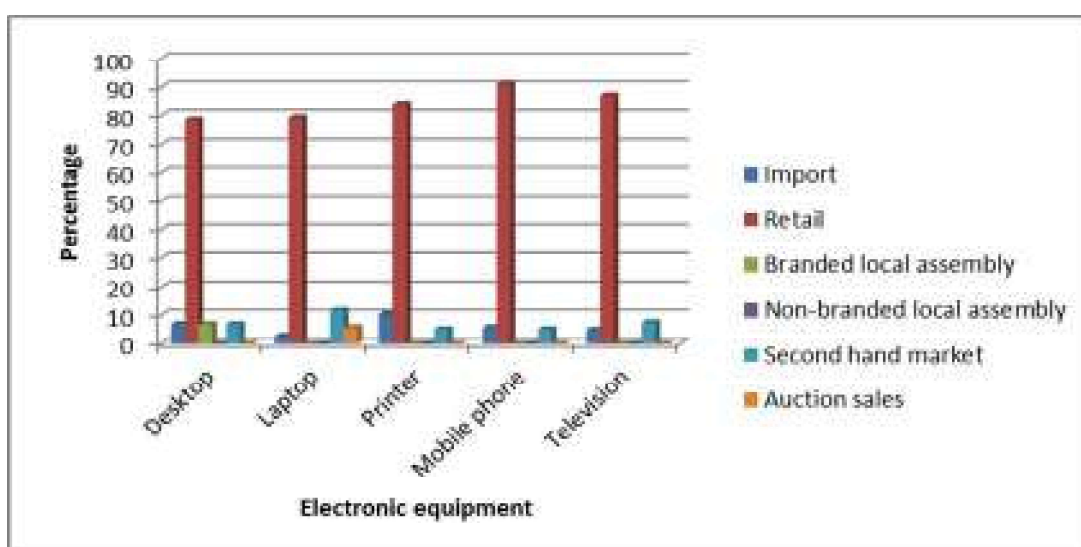


Figure 4: Purchase of electronics by Households in Abuja

Acquisition of Electronic Equipment (New, Used or Both)

The study (Figure 5) showed that for the three study areas, about 50% of the households acquired only new electronic items while the remaining 50% comprise of households that purchase either entirely used electronic equipment or combination of both new and used electronic gadgets.

However, in Abuja, no household was found to acquire only used electronic items. It was observed that the type of electronic equipment acquired is dependent on the economic status of the households and this explains why no household in FCT was found to have only used electronic items in their homes because of the high level of income associated with the area.

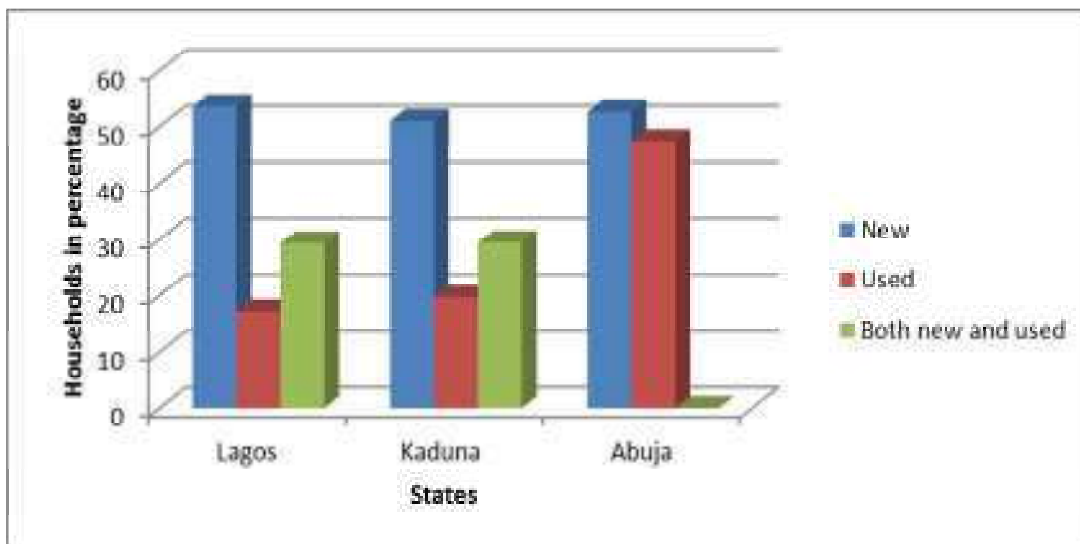


Figure 5: Acquisition of electronic equipment (new, used or both) in Lagos, Kaduna and Abuja

Type of Electronic Equipment in Use

The types of electronic equipment in use by the various households in the three study areas as revealed by the information obtained from the questionnaires used in this study is illustrated in Figure 6. The figure shows that the households in all the study areas possess more of mobile phones (45-55%) and to a lesser extent televisions (15-23%) which are both higher than the other electronics under study. This shows the high penetration rates of mobile phones into the country and the case is similar to all cities all over the worlds. Television is also a form of information as well as entertainment during relaxation and this explains why it is also one of the highest numbers of electronic items in use in the households. This trend for mobile phones could be attributed to the fact that Nigeria has the highest number of mobile phone subscribers in Africa, having more than 93 million subscribers in 2011(GSMA, 2011) and about 142 million in 2015 (NCC, 2015). The high mobile phones usage by most Nigerians can also be attributed to falling prices of mobile phones as well as inefficient and expensive landline connections. Falling prices as well as availability of fairly used television sets at affordable prices may be responsible for the high number of television sets recorded in the study areas. Also, it was observed that significant amount of Laptops (15%) were possessed by households in Abuja as compared to desktop computers whereas in Lagos and Kaduna, almost equal percentage of desktops and laptops (~10%) were in possession of the households.

Usage times/Lifespan of Electronic Equipment in households

The average usage times or lifespan of electronic equipment in households in Lagos, Kaduna and Abuja are as shown in Figures 8. The study revealed that the average lifespan of desktop computers, laptop computers, printers, mobile phones is 2.5-3.5 years, while televisions have lifespan of 3.5-5.5years. The usage time of televisions were observed to be generally higher than other electronics in the study areas. However, the actual lifespan of electronic equipment could be in two folds if it is given another chance for reuse after it might have been refurbished, repaired or given out to a new user. This has been found to be the trend in the material flow of electronic equipment in Nigeria (Ibrahim et al. 2013) and as such the actual lifespan of desktop computers, laptop computers, printers, mobile phones is likely to be 5- 7 years, while televisions could have lifespan of about 7- 11years.

Penetration Rates of Electronic Equipment into Households in the study areas

The penetration rates of electronic equipment were utilized to compare the rate of use of each of the electronic equipment considered in the study areas because the number of households that disclosed the electronic equipment in their possession differed for the different areas surveyed. The number of households that disclosed the numbers of electronic equipment in their possession was 45, 68 and 38 for Lagos, Kaduna and Abuja respectively.

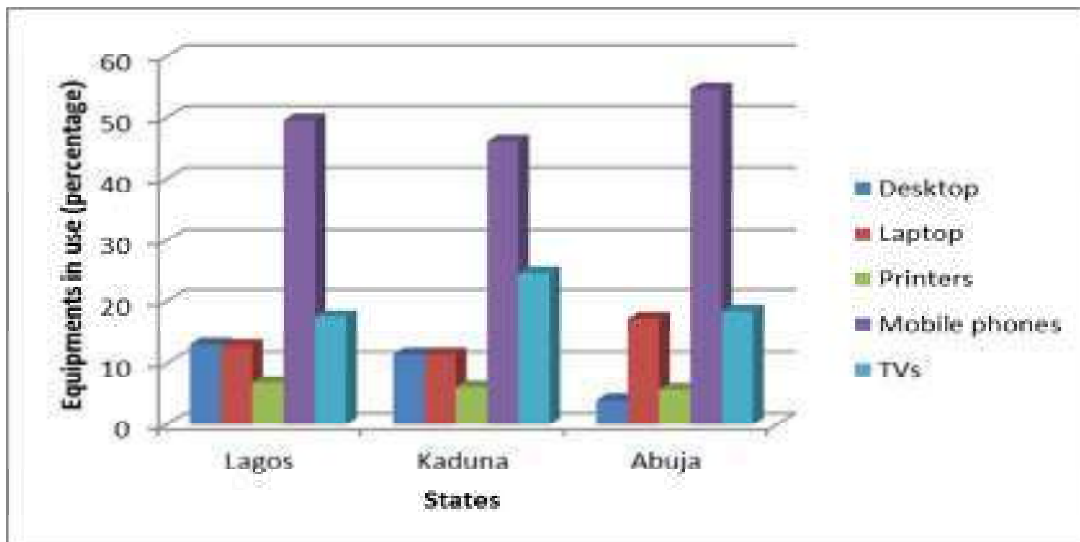


Figure 6: Types of electronic equipment in use in Lagos, Kaduna and Abuja

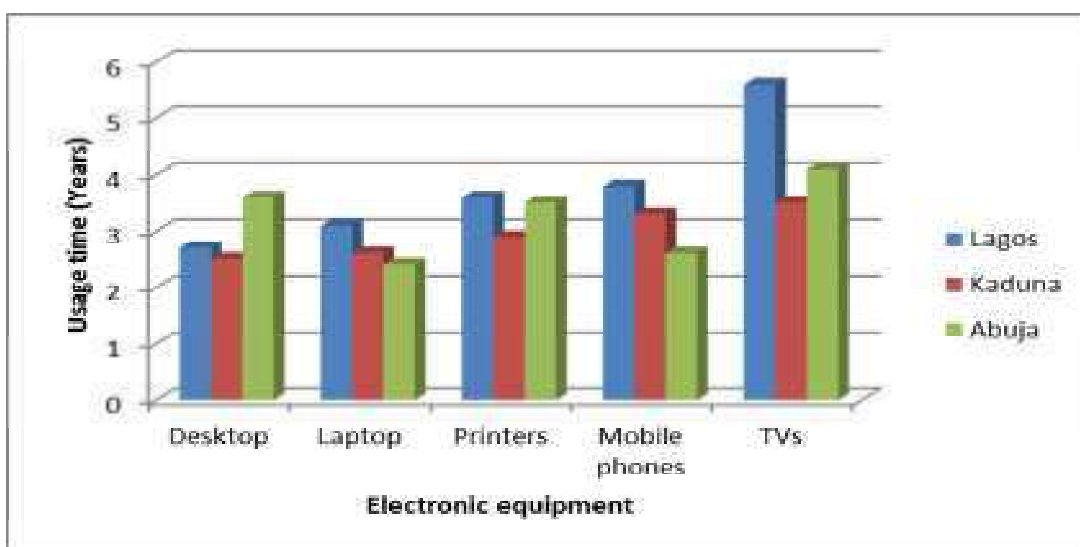


Figure 7: Usage times of electronics in Lagos, Kaduna and Abuja.

Table 2: Penetration rates of electronic equipment into households in Lagos, Kaduna and Abuja

Study Areas	Penetration rates of electronic equipment into households				
	Desktop	Laptop	Printers	Mobile phone	Television
Lagos	1.38	1.36	0.71	5.20	1.84
Kaduna	1.09	1.09	0.57	4.37	2.34
Abuja	0.37	1.61	0.53	5.08	1.71
Total Average	0.95	1.35	0.60	4.88	1.96

Table 2 shows the penetration rates of the selected electronic equipment into the households which give an estimate of the number of each type of electronic equipment owned per household in Lagos, Kaduna and Abuja. The result shows that the average penetration rates of desktop computers, laptop computers, printers, mobile phones and televisions were 0.95, 1.35, 0.60, 4.88 and 1.96 respectively per household. This finding is similar to that obtained in Melaka in Malaysia where the average possessions of televisions, PCs and mobile

phones in households were found to be 1.86, 1.75 and 3.1 respectively (Ho et al 2015). Apart from televisions, Lagos recorded the highest penetration rates in all other electronic equipment considered in the study. This could be due to the easy access to electronic equipment in Lagos as most of the importations are through the port in Lagos. Of all the electronic equipment studied, mobile phones had the highest penetration rates in all the three study areas surveyed; this can be attributed to

the increasing falling prices of mobile phones which make it affordable to the average Nigerian.

Fate of Obsolete Electronic Equipment

The study revealed that storage and sales are the popular end-of-life options for obsolete electronic equipment from households in Lagos and Kaduna while storage is not a popular option for households in Abuja where disposal with general wastes is a more preferred option. This can be attributed to the fact that e-waste trade and refurbishing is more established in Lagos and Kaduna where e-waste management is a form of enterprise for those involved in the trade of these obsolesces electronic equipment. Studies have shown that the income generated from e-waste trade is comparable with that of other similar livelihood supports in the urban areas in Nigeria (Ibrahim *et. al.* 2012). However, in Abuja, direct disposal is common due to absence of electronic repair workshops or a e-wastes scrap dealers due to the well-developed nature of the area where the study was conducted. The fact that storage and sales of obsolete equipment is the most preferred end-of-life options for e-wastes suggest that users still value their electronic equipment even at its end-of-life. The storage of obsolete electronic equipment as an end-of-life management option is also

advantageous because it limits the amount of e-wastes disposed with municipal wastes. Other end-of-life options in the study areas include donation as gift to friends or relatives and recycling (re-use in other forms) as shown in figures 8-10.

Out-of -use electronics equipment in households

The study investigated the amount of electronic equipments that were out of use in the study areas and it was found (Table 3) that televisions were the most common out-of- use electronic equipment (42.1%, 32.1% and 16.9% for Lagos, Kaduna and Abuja respectively) and next to it is mobile phones except for Kaduna which had more of out of use desktop computers and printers (23.0% and 15.4% respectively) than mobile phones (15.2%). This is similar to the results of the type of electronic equipment in possession of households which showed that televisions sets and mobile phones were the highest number of equipments in use. This implies that more out of use electronic equipments (e-wastes) are generated from the equipments that were highest in possession. Hence e-waste management strategies could be directed towards reduction of acquisition of television sets and mobile phones in households as well as recycling of the obsolete ones.

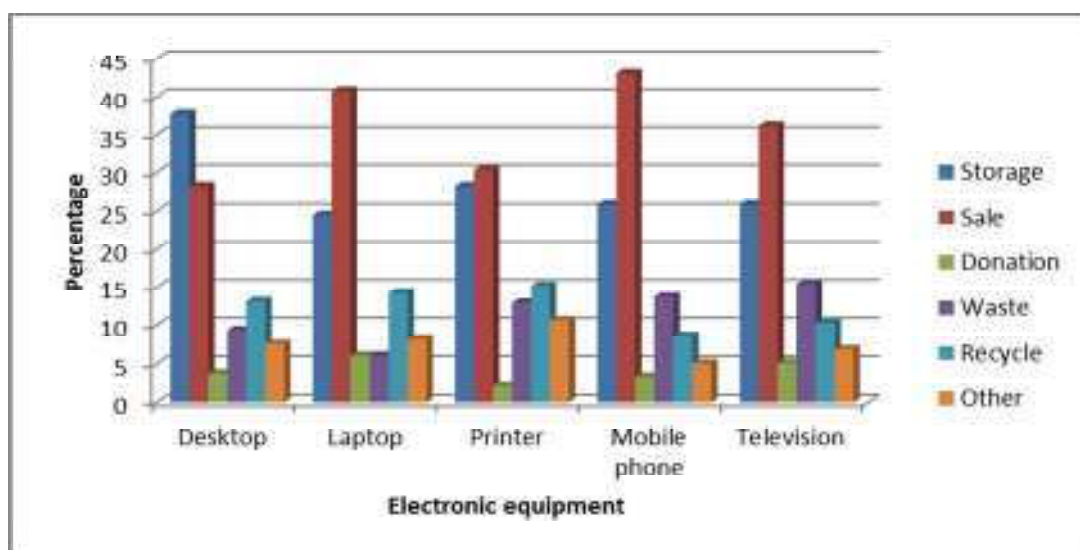


Figure 8: Fate of obsolete electronic equipment in households in Lagos.

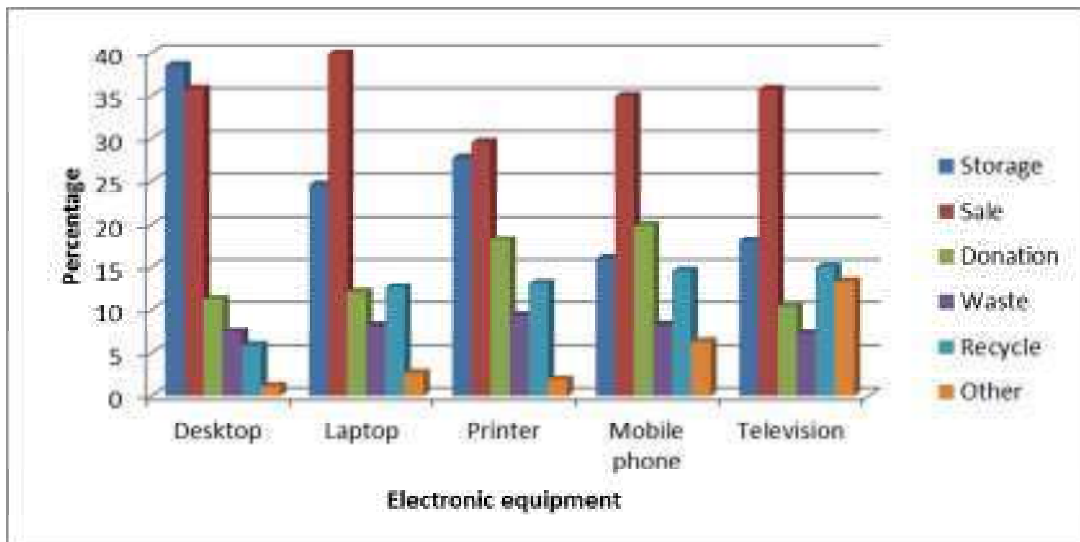


Figure 9: Fate of obsolete electronic equipment in households in Kaduna.

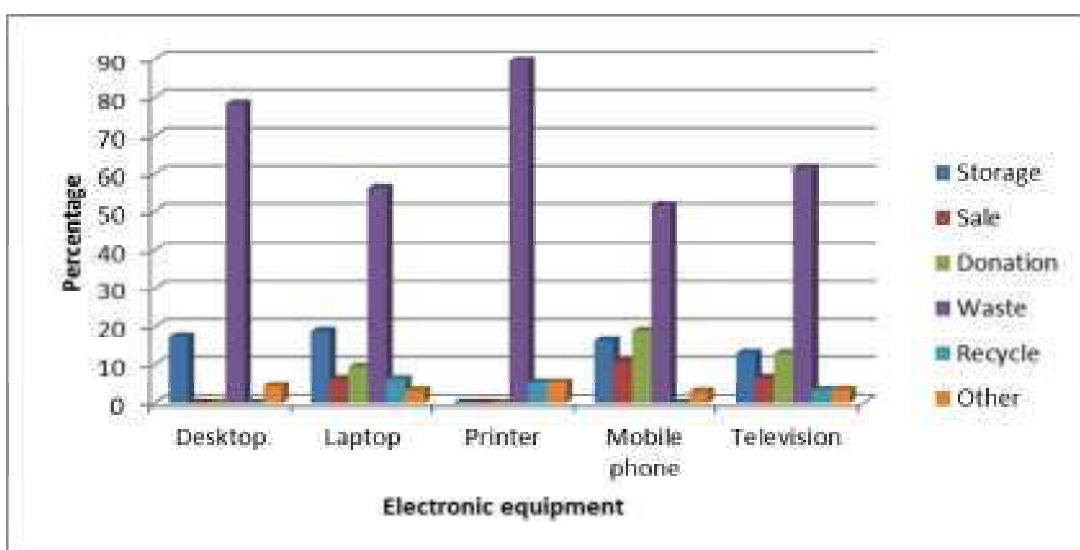


Figure 10: Fate of obsolete electronic equipment in households in Abuja.

Table 3: Out-of-use electronic equipment in the study areas

Description	Out-of-use Electronic Equipment (%)		
	Lagos	Kaduna	Abuja
Desktop computers	18.4	23.0	14.3
Laptop computers	15.9	6.8	11.5
Printers	13.7	15.4	5.0
Mobile phones	24.3	15.2	14.5
Televisions	42.1	32.1	16.9

CONCLUSION

This study has revealed that households in Nigeria acquire new as well as used or secondhand electronic equipments. The study has also shown that televisions and mobile phones are the most common electronic equipment in possession of the households and hence are expected to form the bulk of e-waste to be generated from the households. The lifespan of electronic equipment studied ranged from 2.5-5.5 years although this may be extended through re-use by the initial

owner or by a second user. The most preferred end-of-life options for electronic equipment by households in Lagos and Kaduna are storage and sales while disposal with general wastes is the dominant management option practiced in Abuja. This situation calls for the creation of awareness on hazards of improper e-waste disposal, establishment of e-waste collection schemes, recycling centers as well as other necessary schemes to tackle the problem of the present as well as expected growth in e-waste generation in Nigeria.

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