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Awareness and Management of E-Waste by Librarians in University Libraries: an Exploratory Study

Okoro, Caroline Amarachi
Librarian, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria
Umebali, Catherine Oluchi
Librarian, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

Abstract:
The purpose of the study is to ascertain the level of awareness and management of Electronic waste by Nigerian librarians. Specifically, the study looked into the reason for the generation and growth of electronic waste in university libraries and also examined various ways electronic waste is being managed, challenges they face in this process and strategies that can be used in averting these challenges. The study gave a critical review of literature on electronic waste, which provides a clarification of the concepts related to the work. Furthermore, descriptive survey was adopted for the study; the population consists of 88 librarians in three Federal university libraries in Nigeria. Questionnaire was used in the collection of data from these libraries. Out of 103 questionnaires distributed to librarians 88 were returned and found usable for the study. The result of the study on the awareness of electronic waste among librarians showed that 9(10%) of librarians, are aware of some and 11(12%) are aware of many of them. However, the study revealed that 68(77%) of respondents are not aware of the toxic content of electronic waste. Meanwhile, 55(6.5%) of respondents chose dumping their obsolete electronic equipment permanently in a store, discarding them and collecting vital parts with 9(6.8%), and dismantling them and taking vital parts with 24(27.2%) as methods of disposing e-waste in libraries. Respondents with mean score of 3.46 indicated that lack of knowledge in e-waste management with mean score of 3.46 as major challenges associated with e-waste management in libraries. The strategies identified by respondents to avail these challenges include, organization of training sections on e-waste and management by university libraries for librarians, attendance of international conferences on e-waste management by librarians, provision of legal frame work in Nigeria that will contain roles expected by government to play on e-waste management in libraries. The implication is that if this is not done e-waste management in university libraries in Nigeria will remain a perpetual problem in university libraries in Nigeria. Also, librarians will remain victims of e-waste toxicity and health hazards. There should be more awareness on e-waste and its management in libraries. This will stand as a medium of overcoming the environmental challenges that emanates from electronic- waste in libraries. The originality of this study lies in the analysis in the knowledge of the toxicity of E-waste and its health hazards to individuals that handles it, especially in libraries. Its values relates to its contribution to literature on management of e-waste by librarians in university libraries with specific reference to environmental information in university libraries of developing countries.

Keywords: *University, libraries, E-Waste, Toxicology, Librarians, Awareness, Initiatives and Management.*

1. Introduction

Major objective of University libraries is to provide information resources in support of teaching, learning, research and community services that go on in the parent institution. The university library, remain a fulcrum upon which the goal of any academic institution revolves. Every academic community relies on the library, not just as an information custodian for its academic goals and objectives, but also as an organ for gathering and collecting information resources of all forms and kinds. The library assumes intellectual and physical controls of information resources, organizes them, manages them, and makes these resources available to users. The users of the library go on to consume information resources directly or indirectly to create more information through research and publications. Indeed, the library is so central to the institution's academic program in such a way, that without the library, the overall academic output will diminish in quality and may eventually be a mere sham (Edoka, 2001).

More recently, academic libraries have been experiencing paradigm shifts in their operations due to information explosion and information and communication technologies. Shifts from manual library services to digital services; shifts in order to accommodate diversities in knowledge and learning environment; shifts in order to stay tune with new sources of information; Shifts in the Provision

of up-to-date information resources, shifts in order to use technologies to face competition in the information world; shifts in professional flexibility and job performance; shifts in the usage of information and communication technologies to satisfy users information needs.

Information and communication technology (ICT) has become indispensable in libraries due to its myriad of benefits. According to Achuonge (2005) information and communication technology is the application of computers and telecommunication gadgets to process, store, retrieve, and send information of all kinds in whatever form or distance. He added that it encompasses modern technologies such as satellites, radio television video, tape recorders, compact discs, floppy diskettes, flash memory, CD-ROM, personal computer and other related electronic equipment so that the output generated can reach the overall benefit of mankind and in good time. Owen (2003) averred that it is the backbone of the knowledge economy. ICT in libraries is used as generic teams that include all electrical and electronic equipment for different information handling, services and purposes.

Currently, there exist millions of electrical and electronic equipment in libraries that are either purchased as first class ICT products or second hand ICT products. Electronic products such as computers and laptops, iPods, Walkman, GPS, Digital cameras, Video cameras, close circuit cameras, Routers, Switches, Hubs, Modems, Thin clients, Printers, Scanners, Photocopiers, projectors, Typewriters, Fax machines, Electronic white boards, new or used toners and ink cartridges, Mice, Keyboards, Network power cables, power strips, wires power supplies, AC adapters, Flat panel monitors, LDS, LCD TVs, Plasma led flat panel: Audio equipment: speakers, stereo, radio, turntables, VCRS, DVD players, Cable boxes, TiVo, DVR, Satellite receivers, etc. This is because information professionals are striving to be on the cutting edge in terms of competition and quality electronic services for users' satisfaction. As they do this, more electronic equipment is purchased and old or malfunctioning ones dumped as waste creating multitudinous e-waste stream in libraries.

Electronic waste growth in Nigerian university libraries is escalating at an ultra-high speed and as this speed is heightened, it's environmental and health impact in libraries is also heightened. This situation is worrisome. The health and environmental risk of e-waste due to poor management by librarians in university libraries in Nigeria is even of greater concern as most librarians lack knowledge of e-waste, its management initiatives, they lack policy guidelines and legal frame work on the disposition of e-waste in libraries. This lack, often leads to heaping and dumping of e-waste in various sections of the libraries hence, polluting library environment and creating health risk to librarians and their libraries at large. Also, unawareness of health risk of e-waste and inadequate information on the existing practices and strategies on its management has resulted in careless handling of obsolete ICT equipment by librarians. Most times, they do this without Personal Protection Equipment (PPE) such as protective gears, boots, gloves and masks. They are not even covered by any form of insurance or social security scheme. There is then need for librarians to be aware of e-waste and its deadly toxicology both on human and the environment. This awareness will help them to proactively seek knowledge on e-waste management. This knowledge will help them learn how to either eliminate, minimize human or environmental risk involve in e-waste. This exploratory study therefore seeks to know about the level of awareness and management of e-waste by librarians in university libraries in Nigeria.

The specific objectives of the study include:

i. T o explore if librarians in university libraries in Nigeria are aware of e-waste and its toxic content
ii. To examine methods use by university libraries in Nigeria in the management of E-waste
iii. Ascertain challenges they encounter in this process
iv. To find out strategies that can be used in averting these challenges

2. Review of Related Literatures

In every environment, there is a waste. Oxford English dictionary (2013) defined waste as materials that are no longer useful and need discarding or getting rid of. Pongracz and pohjola (1997) classified waste into four distinct categories: Non-wanted things created not intended, or not avoided, with no purpose; things that were given a finite purpose, thus destined to become useless after fulfilling it; things with well-defined purpose, but their performance ceased being acceptable due to a flaw in their structure or state and things with well-defined purpose, and acceptable performance, but their users failed to use them for their intended purpose. One of the fundamental problems that have arisen from the massive use of information and communication technologies in organizations and their environment is e-waste. E-waste has become a global issue of concern due to its toxic effects both on humans and the environment. The WEEE directive of the European Union (EU) (2002/96/EC) defined e-waste as electrical and electronic equipment (EEE) that are dependent of electricity currents or electromagnetic field in order to work properly, and equipment for generation, transfer and measurement of such currents and fields designed for use with a voltage rating not exceeding 1000 volts for alternating current and 1500 volts for direct current. PPCC (2006) describes it as unwanted electronic or electrical appliance that have been discarded by their original users such as old and outdated computers, laptops, televisions, cellular phones, Mp3 players, telecommunications equipments, keyboards, mouse, photocopiers typewriters etc. Davis & Heart (2008) and e-waste guide (2009) in their own assert that e-waste is obsolete, end-of-life or discarded appliances that use electricity. On the other hand, Peralta & Fontanos (2005) explained that e-wastes are "electronic products that no longer satisfy the needs of the initial purchaser". Defining e-waste is a bit complex as it involves all forms of electronic materials that fall in line with the nomenclature given by Pongracz and pojola (1997). For this reason, various organizations have come up with their own definitions. In the case of libraries, obsolete and unused ICT or electronic products which can no longer be used by librarians in the satisfaction of information needs of library users are considered as electronic waste.

E-waste concept came into light as far back as 1970's and 1980's following environmental degradation that resulted from hazardous waste imported to developing countries (Shinkuma and Huong, 2009). Since this period, there has been constant growth of e-waste

especially in developing countries and their libraries. Contributing to this discourse Widmer et al (2005) established that E -waste is one of the fastest growing waste streams in the world. In developed countries such as Europe historically, e-waste increases by 16-28% every five years, which is three times faster than average annual municipal solid waste generation. E-waste is growing as consumers in both developed and developing world buy new electronic products and discard the obsolete ones. According to studies by United Nations, anywhere, between 20 million and 50 million tons of e-waste are generated globally on amount growing at a rate nearly municipal solid waste streams (Schluep, *et al;* 2009). Bisschop (2012) assert that this constant growth of e-waste poses a threat to the environment and is also a major area of concern for the developing countries as most of the e-waste generated in developed countries is dumped in developing countries. These countries are economically challenged and lack the technology, infrastructure, tools, resources, knowledge skills and trained workforce for proper treatment and sound management of e-waste.

Although there are no statistical records to formerly show the number of e-waste that exists in most university libraries in Nigeria, it is a growing electronic phenomenon in educational institutions and as libraries are surrogate in the achievement of their institutional educational objectives they also join in this monumental growth. Besides, transformational changes due to globalization and knowledge revolution are now forcing libraries world over to constantly innovate and create new capabilities in order to face their new breeds of users in terms of electronic equipment and services. For this reason, increase in e-waste in libraries has been consistent. New electronic technologies are being employed in this process and old technology discarded. A major factor for discarding electronic products in libraries includes:

- short lifespan of these technologies
- lack of advance features on the old versions
- high cost of ICT products
- instability and malfunctioning of electrical and electronics equipment during use
- Competition among information providers.

According to Peeranart (2013) new technologies are rapidly superseding million of analogue appliances leading to their disposal in prescribed landfills despite potentially their adverse impacts on the environment. He went further to explain that the consistent advent of new designs, 'smart' functions and technology during the last 20ys is causing the obsolescence of many electronic items. The lifespan of many electronic goods has been substantially shortened due to advancement in electronics, attractive consumer designs and marketing and compatibility issues. Busheri(2010) reports that over 130 million of computers, monitors and televisions become obsolete annually and the annual number is growing in United States. Around 500 million computers become obsolete between 1997 and 2007 in the United States alone and 6010 million computers had been discarded in Japan by the end of December 2010. In china 5 million new computers and 10 million new televisions have been purchased every year since 2003 (Hicks et al., 2005).

Libraries because of these listed factors are force to always be in the new, as newer electronic gadgets and products are purchased for new electronic services obsolete once are discarded or dumped. More so, it is becoming easier and more convenient for libraries to change malfunctioning ICT equipment than to repair or fix them. This is because fixing electronic equipment is quite financially involving. Besides these reasons, Poor libraries that are financially incapacitated to meet up with newer ICT technologies and services, go for second hand electronic gadgets or even seek for foreign donors assistance in order to remain at the electronic cutting edge and this trend has remained unabated in Nigerian University Libraries. E-waste growth in libraries is escalating at an ultra-high speed, as this speed is heightened; it is also expedient that information scientist/professionals in university libraries in Nigeria be aware of e-waste and its deadly toxicology both on human and the environment. This awareness will help them have knowledge of e-waste that will further help them to proactively seek better ways of eliminating or managing e-waste in libraries.

2.1. E-Waste Toxicology

Research has shown that E-waste contain some reusable and valuable materials with high economic content but the fact remains that all electronics products contains hazardous and toxic substances in them, hence unsafe to the environment and humans. Hazardous waste is any solid, liquid, or gaseous waste materials that, if improperly managed or disposed of, may pose substantial hazards to human health and the environment. Every electronic organization in the world has had problems with managing hazardous wastes. Improper disposal of these waste streams in the past has created need for expensive clean-up operations. A waste is considered hazardous if it exhibits one or more of the following characteristics-ignitability, corrosivity, reactivity, and toxicity. Ignitable wastes can create fires under certain conditions: examples include liquids, such as solvents, that readily catch fire and friction-sensitive substances. Corrosive wastes include those that are acidic and those that are capable of corroding mental (such as tanks, containers, drums and barrels). Reactive wastes are unstable under normal conditions. They can create explosion, toxic fumes, gases, or vapors when mixed with water. Toxic wastes are harmful or fatal when ingested or absorbed. When they are disposed of on land, contaminated liquid may drain (Leach) from the waste and pollute ground water (Bhatia, 2011). MECPB (2009) revealed that Electronic waste contains about 1000 different substances which fall under hazardous and non-hazardous categories, which can cause widespread damage due to the use of toxic materials in the manufacture of electronic goods. Hazardous materials such as lead, mercury, and hexavalent, chromium in one form or the other are present in such waste primarily consisting of cathode ray tube (CRTs), Printed Assemblies, Capacitors, Mercury, Switches and relays, Batteries, Liquid crystal display (LCDs), Cartridges from photocopying machines, selenium drums (Photocopiers) and electrolytes (Kurian, 2007). Despite these toxic substances which pose both human and environmental threat, e-waste also contains non-hazardous substances with high economic values such as iron, aluminum, nicket, copper and some precious metals. The precious metals include; gold, silver and the platinum group metals (PGM) platinum, palladium podium, ruthenium, brachium and osmium. Amidst these economic values of e-waste, the overall health effects

on human are alarming. This includes: breathing difficulties, respiratory irritation, coughing, choking, pneumonia, tremors, neuropsychiatric problems, convulsions, coma and even death. (Yu, Weldford and Hills, 2006).

Toxin	Typical Sources	Effects on Humans
Mercury	Fluorescent lamps, LCD monitor, switches, flat panel screens.	Impairment of neurological development in fetuses and small children, tremors, emotional changes, cognition, monitor function, insomnia, headaches, changes in nervous response, kidney effects, respiratory failures, death
Lead	CRTs of TV, Computer monitor, circuit boards	probable human carcinogen, damage to brain and nervous systems, slow growth in children, hearing problems blindness, diarrhea, cognition, behavioral changes (e.g delinquent), physical disorder.
Chromium	Untreated and galvanized steel plates, decorator or harder for steel housings	Asthmatic bronchitis, skin infection, ulceration, respiratory irritation, perforated eardrums, kidney damage, liver damage, pulmonary congestion, duodenum, epigastria pain, erosion and decoration of the teeth, monitor function
BFR	Plastic casings boards	May increase cancer risk to digestive and lymph systems, endocrine disorder
Cadmium	Light- intensive resistors, as corrosion retardant, NI-CD battery	Inhalation due to proximity to hazardous dump can cause severe damage to the lungs, kidney damage, cognition

Table 1: Effects of E-waste on Humans (UNEP, 2007; MoEF, 2008; ENVIS, 2008; Pinto2008; osuagwu,2010; Chen etal, 2011)

A part from the hazardous effects on humans, It is discovered that E-waste leaches the soil due to the presences of mercury, cadmium, lead and phosphorous in it. E-waste can also cause uncontrolled fire risk, leading to toxic fumes. In addition, uncontrolled burning, disassembly and disposal of E-waste can cause a variety of environmental problems such as groundwater contamination, atmospheric pollution, and occupational and safety effects among those directly or indirectly involved in the processing of E-waste (Wikipedia, 2011a).

E-waste disposal, impact human in two ways which include; (a) food chain issues; contamination by toxic substances from disposal and primitive recycling processes that result in by-products entering the food chain and thus transferring to humans; and (b) direct on workers who labor in primitive recycling areas from their occupational exposure to toxic substances. In these respects, E-waste has become a global issue of concern. And it is worrisome to note that a lot of libraries and Information scientist especially in developing countries like Nigeria are still unaware of these inherent dangers in careless handling and dumping of e-waste in libraries. Therefore it is common to see decoupled ICT equipment heaped in digital sections of libraries, careless handling and dumping of e-waste information professionals without knowledge of their health implications. It is therefore pertinent to discuss ways of managing e-waste in Nigerian university libraries, particularly in healthier and safer ways, the focal point of which is reducing, reusing, and recycling (3Rs).

2.2. E-waste Initiatives and Awareness in Nigerian University Libraries

Chemical experts, information professional, international environmental agencies are now making global and concerted efforts via global initiatives, conventions and directives creating awareness of e-waste, its hazardous effects on human and the environment. Also restricting countries from the use of certain hazardous substances in electrical and electronic equipment in order to regulates the use of toxic substances in manufacturing them. According to Peer (2013) problems associated with e-waste have been challenged by authorities in a number of countries and steps were taken to alleviate them with the introduction of management tools and laws at the national and universal levels. Life Cycle Assessment (LCA), Material Flow Analysis (MFA), and Multi criteria Analysis (MCA) he explained are tools to mange e-waste problems and Extended Producer Responsibility (EPR) is the regulation of e-waste management at the national scale. They are now describing good or emergent practices, organizing discussions sessions, conventions, and conferences, workshops, developing informative websites on how e-waste could be managed or eliminated. Of major importance is the Basel Convention which entered into forces in 1992. The key objective of the Basel convention is on the control of Transboundry movements of hazardous wastes and their disposal. Also the convention was held to seek ways human health and the environment can be protected against adverse effects of hazardous wastes. The Basel Convention was adopted in 1989 and entered into force on May 5, 1992 and amended in 1995 (Terada, 2012; Ogungbuyi et al., 2012; Puckett et al., 2005). Another of such conventions is the Bamako Convention which was adopted on January 29, 1991 and entered into force on April 22, 1998. This Bamako Convention placed ban on the import and the control of transboundary movement and management of hazardous e-waste within Africa and unlike the Basel Convention, it articulated more specific and active guidelines for both sides of the e-waste trade. In March 2010, 33 African countries signed the Bamako Convention, while 24 of them ratified it (Terada, 2012). Nigeria signed the Bamako Convention in February 2008, but has not yet ratified it; while it not only signed but has also ratified the Basel Convention since May 24, 2004 (Terada, 2012; Puckett et al., 2005). Directives such as The European Union (EU) directives: Directive 2002/96/EC and Directive 2002/95/EC have also been put in place to prevent WEEE and reduce its effects on human and the environment. The Directive establishes producer responsibility whereby the producers have to finance the collection (from collection points), treatment, recovery and disposal of WEEEand among other things, it requires Member states to encourage producers and manufacturers to consider the dismantling and recovery of materials in their design of electrical and electronic equipment. On the other hand, Restriction of Hazardous Substances (RoHS) which is the Directive 2002/95/EC of the European Parliament and of the Council established on 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment) regulates the use of particular,toxic

substances (e.g.,lead, mercury, cadmium, and hexavalent chromium) in new electrical and electronic equipment. One of the aims of the RoHS Directive is to ban the following products from being placed on the EU market: "new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants" Adediran(2012). In this awareness approach, the focus is increasing attention to e-waste, its health effects on human, and ways e- wastes can be managed or controlled. These initiatives are in recognition of the fact that there is a large gap between developed and developing countries as regards to awareness and management of e-waste in terms of polices institutional frame work, infrastructural and legislation wise. There has not been any serious initiative in Nigeria as regards management of E-Waste. According to Adedirian (2012) there is a sizeable number of government agencies that should be directly or indirectly involved in E-Waste management in Nigeria. Among these agencies they mentioned are:

- Federal Environmental Protection Agency (FEPA)
- National Environmental Standards and Regulations Enforcement Agency (NESREA)
- National Emergency Management Agency (NEMA)
- National Space Research and Development Agency (NASRDA)
- Nigeria Customs Service (NCS)

According to them, these agencies have some institutional framework in place, but their effect is yet to be felt. This ineffectiveness also extends to Nigerian university libraries. There is therefore need for university libraries in Nigeria to partners with the Nigerian Library Registration Council of Nigeria (LRCN) to collaborate with environmental experts with good knowledge of e-waste to create this awareness and management in various libraries in Nigeria instead of relying on these national agencies. The focus here will be devising a national approach necessary to understand how to reduce, reuse and recycle e-waste to mitigate its health effects on librarians, library workers, users and library environment.

2.3. E-waste Management in Nigerian University Libraries

E-waste management consists of the effective recovery of all reusable materials from WEEE and the safe disposal of hazardous substances in them to prevent their contamination of the environment (Waste management, 2011). Anosike (2010) described it as the collection, transport, processing, recycling or disposal of waste usually produced by human activity. He further states that it is an effort to reduce the effects of e-waste materials on human health and the environment. And this has a very serious environmental and health implication. According to Opara (2013) the failure to effectively manage e-waste leads not only to adverse environmental impacts but also to the depletion of potential valuable resources base for secondary equipment. Therefore for an effective e- waste management in libraries, the '3Rs' reduce, re-use, and recycle must be properly addressed as the cornerstone of ICT waste minimization strategies in libraries.

2.4. E-Waste Management Strategies in Libraries

Management of e-waste in Nigerian university libraries has been observed to be poor. A lot of strategies have been suggested by authors about various ways e waste could be managed especially in organizations. Anosike (2010) has also suggested five strategies. These include:

1 Waste inventorisation: Waste inventorisation according to him is the keeping of record of types of waste generated, quantity generated at any given time and sources of the waste. This cataloguing of all waste types gives a quick insight on the magnitude of the waste problem at hand and possible solution to the waste problem. Libraries can on their own develop a database on e-waste available in various university libraries in Nigeria. This handy information will attract users of such e-waste and make them to come and purchase them for recycling. Although this process may require census of libraries in Nigeria and their e-waste use and categories.

2 Waste Characterization. Waste characterization checks the physio-chemical and toxicological properties of waste. The aim of waste characterization he said is to identify and define likely environmental and human health effects associated with exposures to a particular hazardous waste and formulate methods by which one can properly manage or prevent its effect(s). Libraries in Nigeria may lack the professional ability to do this single handedly; they can employ chemical professionals who can help them in achieving this. Because by knowing the composition of the library e-waste, it would be easier to manage them.

2.5. Minimization

Waste minimization and reduction for industries can be done during the production process; this helps solve a lot of waste management Problems that may come up later after product utilization. Utilization of materials is a better way of managing industrial waste. Waste minimization in libraries is therefore that process that can help reduce, recover and recycle e-waste to avoid them being heaped or littered in various libraries in Nigeria. Libraries can achieve this via two major options: Servicing of electronic and electrical equipment to enable them to optimally reduce e-waste and introducing recycling of e-waste back to production process instead of discarding them. In this case, libraries can send back end life of equipment to their manufacture as they may be in best position to know how to either recycle or dispose them. For example Dell as a company is taking back any computer regardless of maker, when a customer buys a Dell computer. Libraries can also contact online reliable recyclers such as: Electronic Recyclers Http://wwwelectronicrecyclers.com/, Green citizen http://www.greecitizen.com/, Green Disk http://www.greedisk.com/ and so many other online e-waste recyclers who have special facilities and technologies to take discarded electronics and recycle e-waste in a safe and environmentally friendly manner.

3. Methodology

The research design for this study is descriptive survey research. Descriptive survey according to Nwoagu (2006) involves a systematic and comprehensive collection of information about the opinions, attitudes, feelings, beliefs, and behavior of people. This method is used because the research is to elicit the opinions of librarians with professional qualifications (BLS, MLS, or PhD) on awareness and management of e-waste among librarians in university libraries in South Eastern Nigeria geopolitical zone (Enugu State, Abia State and Imo State. Accordingly, three (3) Federal Universities were used as samples. The universities selected are: University of Nigeria, Nsukka (UNN), Michael Okpara University of Agriculture Umudike (MOUAU) and Federal University of Technology Owerri (FUTO). The population of the study comprises 88 librarians in selected universities. A structured questionnaire which was divided into four sections was used as the instrument for data collection. Section A: comprise the socio-economic characteristics of respondents; Section B discusses the awareness of E-waste in Nigerian University Libraries; Section C discusses the Challenges of E-waste management in Nigerian University libraries; while section D discusses Strategies for Managing E-waste in Nigerian University Libraries. Out of the 100 questionnaire distributed only 88 were returned. Data collected were subjected to statistical analyses using mean scores, percentages and frequency tables.

3.1. Analysis and Interpretation of Data

S/N	Institution	No of Resp.	No of Questionnaires Returned	Percentage (%)
1	UNN	60	50	56.8
2	MOUAU	18	18	20.4
3	FUTO	25	20	22.7
	Total	**103**	**88**	**99.9**

Table 1: Distribution of the respondents by name of institution

From the table, above a total number of one hundred and three (103) questionnaires were distributed to the respondents but only eighty-eight (88) questionnaires were correctly filled and returned. This indicates a percentage of 99.9 which the researcher considers appropriate for use.

S/N	Male	Female	Total	Percentage (%)
1	19 (59.3%)	31 (56.3%)	50	56.8%
2	7 (21.8%)	11 (19.6%)	18	20.5%
3	6 (18.7%)	14 (25%)	20	22.7%
	32 (99.9%)	56 (99.9%)	88	100

Table 2: Distribution of Respondents by Gender

From the above table, the distribution of respondents by gender from the three Federal Institutions in Nigeria is 88. 32(99.9%) are male while 56 (99.9%) are female. This shows a 100% representation of respondents and it also implies that there are more female academic staff than male across the various Federal universities surveyed.

S/N	Qualification	No of Respondent	Percentage (%)
1	Bls	22	25%
2	MlS	44	50%
3	PhD	22	25%
	Total	**88**	**100%**

Table 3: Distribution based on Highest Librarianship Qualification

The table above shows the distribution of respondents by educational qualification 22 respondents, representing 25% has BLs, 44 representing 50% has MLs, while 22 of the respondents presenting 25% has PhD, with this, we can infer that majority of the respondents are qualified professionals.

S/N	Position	Respondents	Percentage (%)
1	Assistant Librarian	41	46%
2	Librarian II	16	18.1%
3	Librarian I	11	12.5%
4	Senior Librarian	16	18.1%
5	Deputy Librarian	3	3.4%
6	University Librarian	1	1%
	Total	**88**	**100%**

Table 4: Distribution based on Position in the Library

This table above shows that 41 respondents which represent 46% were assistant Librarian, 16 respondents with 18.1% were in the position of Librarian II, 11 respondents with 12.5% were in Librarian I, 16 with 18.1% were senior Librarian, 3 with 3.4% were deputy Librarians while 1 with1% is a university Librarian. This affirms that all the respondents are senior persons and at this level, must have had enough knowledge in ICT.

Awareness	UNN	MOUAU	FUTO	TOTAL	Percentage (%)
Not aware	40	14	14	68	77
Aware of some	5	2	2	9	10
Aware of Many	5	2	4	11	12
Total	**50**	**18**	**20**		**100.0**

Table 5: Distribution based on the awareness of toxic content of electronic waste in University Libraries

A cursory look at the above table, shows that 68 respondents which represents 77% are not aware of the toxic content of electronic waste, 9 respondents which represents 10% are aware of some while 11 respondents which represents 12% are aware of many of them. From this, we can infer that majority librarians are not aware of e-waste and its toxic content.

Also, out of the total population of 88, 76% agreed that their library sometimes discard e-waste. They gave reasons for discarding e-waste as follows:

S/N	Items	UNN	MOUAU	FUTO	Percentages
1	Life span completed	2	2	8	13.63%
2	Lack of advance features	-	1	-	1.1%
3	Moving to a new library	-	-	-	0
4	High repair cost or cannot be repaired	20	5	9	38.6%
5	Instability and malfunctioning during use	25	10	3	43.1%
6	Competition	3	-	-	3.4%
	Total	50	18	20	88

Table 6: Distribution based on the reasons for Discarding or Abandoning ICT equipment in Libraries

From the table above, it is clear that one of the major reasons why university libraries in Nigeria discard ICT equipment is due to instability and malfunctioning during use and high repair cost of ICT products as this is represented by 38.6% and 43.1% percent of respondents.

S/N	Methods	UNN	MOUAU	FUTO	Percentage%
1.	Dumping them permanently in a particular room in my library	40	10	5	62.5
2.	Discarding them into refuge bin	1	3	5	6.8
3.	Shredding them with shredding facilities	-	-	-	-
4.	Dismantling them and collecting vital parts	9	5	10	27.2
5.	Selling them to recovery corporation	-	-	-	-
6.	Handover to waste collectors	-	-	-	-
7.	Smelting them	-	-	-	-
8.	Donate them to other libraries, employees or friends	-	-	-	-
9.	Throwing them away to dumpsites	-	-	-	-
10.	Give them to recyclers	-	-	-	-
11.	Give them back to persons or companies that sold them to you	-	-	-	-

Table 7: Distribution based on methods of Disposing Unwanted ICT products or (EEE)

From the table above, 55 respondents with 62.5 percent from the three Federal university libraries chose dumping ICT waste permanently in a particular room in their library as a method of disposing ICT waste, 6 respondents with 6.8 percent chose discarding them into refuge bin, while 24 respondents with 27.2 percent chose dismantling them and collecting vital parts. Other options were not chosen at all. This might be as a result of not being aware of the health and environmental implications of such methods they use and also not being aware of other better methods of disposing electronic waste.

Also, based on the analysis, out of the total population of 88, 5% of respondents agree that e-waste and its health effects are well publicized in their libraries while 83 respondents which represent 94% disagree that e-waste and its health effects are not well publicized in their libraries. The implication is that a lot of librarians still lack this knowledge and need this awareness.

3.2. Section C: Challenges of E-Waste Management in Nigerian University Libraries

15	To what extent does the following, constitute barriers in e-waste management in your libraries	**Very high extent**	**Great extent**	**Little extent**	**Very little extent**	**Mean Score**
1	Lack of knowledge in e-waste management	33 (132)	45(180)	9 (18)	1(1)	3.76
2	Lack of skilled manpower in e-waste management	51(204)	30(90)	5(10)	2(1)	3.46
3	Lack of policy guidelines on the disposition of e-waste in libraries	47(188)	33(99)	7(14)	1(1)	3.43
4	Lack of legal frame work in Nigeria that spells roles of Nigerian government on e-waste management in libraries.	50(200)	26(78)	9(18)	1(1)	3.37
5	Lack of fund in getting facilities for e-waste management	42(168)	37(111)	7(14)	2(1)	3.34
6	Lack of principles, standards, compliance and enforcement of e-waste management in Nigerian university libraries by Nigerian Library Association.	38(152)	4(123)	7(14)	2(1)	3.29
7	Lack of incorporation of e-waste management course in the Library Information Science Curriculum.	40(160)	33(105)	10(20)	3(1)	3.25
8	unresponsive attitude of university librarians towards e-waste management	28(112)	34(102)	21(42)	5(1)	2.92
9	Lack of application of scientific knowledge about e-waste management in tertiary institutions in Nigeria.	38 (152)	33 (66)	16 (32)	2(1)	2.85

Table 8

From the table above table, it is clear that major challenges faced by librarians in university libraries in Nigeria in e-waste management are; Lack of knowledge in e-waste management with a mean score of 3.76, lack of skilled manpower in e-waste management with a 3.46, lack of policy guide line about e-waste in libraries with mean score of 3.43. Lack of legal frame work in Nigeria that spells roles of Nigerian government on e-waste management in libraries with 3.34, lack of fund in getting facilities for e-waste management with mean score of 3.34, lack of principles, standards, compliance and enforcement of e-waste management in Nigerian university libraries by Nigerian library association with mean score of 3.29, lack of incorporation of e-waste management course in the library information science curriculum with mean score of 3.25.

3.3. Section D: Strategies for Managing E-Waste in Nigeria University Libraries

16.	To what extent do you agree with the following strategies for managing e-waste in University Libraries	**Very high extent**	**Great extent**	**Little extent**	**Very little extent**	**Mean Score**
1	Annual conferences, educational sections and workshops should always be organized by librarians and e-waste effects on humans and environment discussed.	47 (188)	40 (120)	2 (0)	1 (1)	3.51
2	Training section on e-waste and management should always be organized in university libraries for information professionals to enable them gain skills and competences on e-waste management	48 (192)	36(108)	3 (6)	1 (1)	3.48
3	University librarians should always attend international conferences on e-waste management to enable the get full knowledge of it.	44 (176)	39 (117)	4(8)	1 (1)	3.43
4	Nigerian library Association should collaborate with chemical experts both National and International to brain storm on e-waste initiatives in order to set principles, standards, compliance and enforcement of e-waste management in Nigerian university libraries.	41 (164)	44 (132)	2 (4)	1 (1)	3.42
5	Nigerian government should release fund to University libraries in Nigeria for e-waste purpose.	45 (180)	47(141)	2 (4)	1 (1)	3.38
6	There should be a legal frame work in Nigeria that will contain roles expected by government to play on e-waste management in libraries.	38(152)	44(132)	2(4)	3(3)	3.35
7	A national approach should be taken by university libraries in Nigeria involving the Nigerian Libraries Association to strategically develop policies that can guide e-waste management in libraries	25 (100)	44 (141)	15 (30)	1 (1)	3.09
8	Tertiary institutions in Nigeria should promote the application of scientific knowledge about e-waste management in Nigerian Libraries.	32 (128)	47 (135)	15 (6)	3 (1)	3.06
9	E-waste and its management should be incorporated in Library and Information Science Curriculum	45(180)	40(1)	2(2)	1(1)	2.09

Table 9

Table 9 shows that Annual conferences, educational sections and workshops should always be organized by librarians and e-waste effects on humans and environment discussed with mean score of 3.51, Training section on e-waste and management should always be organized in university libraries for information professionals to enable them gain skills and competences on e-waste management with mean score of 3.48, University librarians should always attend international conferences on e-waste management to enable the get full knowledge of it with mean score of 3.43, Nigerian library Association should collaborate with chemical experts both National and International to brain storm on e-waste initiatives in order to set principles, standards, compliance and enforcement of e-waste management in Nigerian university libraries with mean score of 3.42, Nigerian government should release fund to University libraries in Nigeria for e-waste purpose with mean score of 3.38, There should be a legal frame work in Nigeria that will contain roles expected by government to play on e-waste management in libraries with mean score of 3.35, A national approach should be taken by university libraries in Nigeria involving the Nigerian Libraries Association to strategically develop policies that can guide e-waste management in libraries with mean score of 3.09, Tertiary institutions in Nigeria should promote the application of scientific knowledge about e-waste management in Nigerian Libraries with mean score of 3.06, E-waste and its management should be incorporated in Library and Information Science Curriculum with mean score of 2.09.

4. Conclusion

Arising from the study, the study therefore concluded that librarians in university libraries in Nigeria are not really aware of e-waste and its consequence health and environment risks. This unawareness leads to their poor management in various libraries. Based on the findings, the following recommendations are therefore made that:

- Annual conferences, educational sections and workshops should always be organized by librarians and e-waste effects on humans and environment discussed.
- Training section on e-waste and management should always be organized in university libraries for information professionals to enable them gain skills and competences on e-waste management.
- University librarians should always attend international conferences on e-waste management to enable the get full knowledge of it. Nigerian library Association should collaborate with chemical experts both National and International to brain storm on e-waste initiatives in order to set principles, standards, compliance and enforcement of e-waste management in Nigerian university libraries.
- A national approach should also be taken by university libraries in Nigeria involving the Nigerian Libraries Association to strategically develop policies that can guide e-waste management in libraries.
- Libraries in Nigeria should develop E-waste policies, institutional frameworks and legal frame work which will serve as a regulatory frame work of E-waste and its management in university libraries in Nigeria.
- Libraries should be stocked with books on e-waste and its management and make them available and accessible for use.

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