

*Full length research paper*

# Investigation of consumer behavior on discarding of their electrical/electronic waste: A case of Gaborone city

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**E-waste is growing at a precipitous rate in African cities in response economic growth and growth in city population which result to a steady rise in environmental degradation. The problem is compounded by the importation of second hand computer-wares and obsolete junk. The objective of this paper therefore was to investigate consumer behaviour on discarding their electrical/electronic waste. The study was based in Gaborone city. A questionnaire was administered to 200 different households randomly. The results indicate that most people are aware of e-waste and its dangers, but they do not know how to properly discard it, there is a need to educate people on how to manage e-waste, enact legislation on e-waste and motivate households to discard e-waste properly by having convenient arrangements of discarding e-waste.**

**Keywords:** E-waste; environment; post-Consumption-behaviour; e-waste-management; information technology

## INTRODUCTION

In the last decade, African cities have seen not only a rapid growth in city population but also higher economic growth resulting in superfluous waste generation, the technological development and the use of ICTs have resulted in high electronic waste, or e-waste generation. According to Panayotou (1993), at the low levels of economic development, both the quantity and the intensity of environmental degradation are limited to the impacts of subsistence economic activity on the resource base and thus limited to biodegradable wastes. However at higher levels of economic development, the underlying changes are towards information-based industries and services, making more use efficient technologies. This results in leveling-off and a steady decline in environmental degradation, as per the Kuznets and Murphy (1966), and Stern et al. (1996). Africa today, finds itself in an accelerated economic growth stage with an information technology based economy (Oshikoya and Nureldin, 2012), and thus a shift from biodegradable waste to e-waste. E-waste is therefore an emerging problem for African cities due to the insufficient funds, systems and

procedures (Widmer et al., 2005) needed to handle it. The issue of whether environmental degradation: (i) increases monotonically, (ii) decreases monotonically, or (iii) first increases and then declines along a country's development path, has critical implications for policy (Arrow et al., 1995). An increase of environmental degradation with economic growth calls for strict environmental regulations and intervention by the appropriate authorities to ensure the economic activity is within the ecological life-support system. In Botswana, research indicates that the total amount of solid waste disposed of at landfill sites was approximately 325,000 tonnes a year in 1998, excluding mining wastes. This amounts to about 0.67 kg per person per day (Kgathi, 2001). However this included both electronic waste and biodegrade waste. E-waste is growing at a rapid and high rate mainly because of importation of second-hand computer-wares (Nnorom and Osibanjo, 2008) and is the fastest growing portion of the municipal solid waste stream. According to Nnorom and Osibanjo (2008), about 25–75% of the imported second hand computer-wares in Nigeria were unusable junk that are non-functional or un-repairable. These amount to an importation of 15,000–45,000 tonnes of scrap recyclable electronic components, which may contain as much as 1000–3,600 tons of lead.

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The objective of this paper therefore was to investigate consumer behavior on discarding electrical/electronic waste and thus add to the literature on consumer behavior especially on post-consumption behaviour on electronics in Botswana and at the same time suggest necessary interventions.

### Consumer behavior on e-waste discarding

Post-purchase behavior involves all the consumers' activities and the experiences that follow the purchase. Usually, after making a purchase, consumers experience post-purchase dissonance. Unlike consumer packaged goods, which are impulse-buy, consumer electronic goods invoke more thought and involvement from the consumers before making a final purchase. These include cost of storage, replacement and residual value in case of resale, and the availability for the market after end of its life use (Bayus, 1991). The lifespan of the most electronic products has reduced to between six months and five years, on which the products breakdown or need replacement due to emergence of new advanced models making the current one obsolete.

Harrell and Mcconocha (1992), and Bianchi and Birtwistle (2012), noted that a comprehensive typology of disposal choices in the extended channel involves a combination of non-altruistic behaviors such as keeping, throwing away, selling/swapping as well as altruistic aspects such as giving away and donating. The following disposal options were identified:

**Keeping:** Chronic keepers sometimes referred as to 'pack rats' have a tendency to hoard items. This has been regarded as an example of obsessive-compulsive behavior largely governed by personality traits (Leitner, 1985) although no immediate disposal actually occurs, keeping may account for a considerable quantity of no longer used items. This constitutes potential waste of resources that could be utilized by secondary owners.

**Throwing away:** Discarding through garbage system or trashing usable items may be viewed as irresponsible behaviour, if however the owner of the good does not perceive value in it, s/he probably does not consider trashing it to be irresponsible. A consumer who chooses this option may not be aware of the societal effect.

**Trading in:** Extended channels of distribution provide numerous options for consumers who wish to move still useful but unwanted products to other consumers. The rationales consumers use in choosing disposal options, includes those resulting in redistribution (Harrell and Mcconocha, 1992). Recycling has become a huge business opportunity, especially in e-waste. Other methods include Selling/Swapping and giving away

Jean-Daniel et al. (2009), Nnorom and Osibanjo

(2008), Widmer et al. (2005), Kang and Schoenung (2006), Lee et al. (2007), noted that a large percentage of discarded e-waste in developed countries is exported to Asia and Africa. Unfortunately e-waste is often handled improperly, which often results in severe human exposure and environmental pollution. Indeed e-waste contains much toxic material such as lead, cadmium, mercury, barium, beryllium, hexavalent chromium and brominated flame-retardants. [www.ewaste.com](http://www.ewaste.com) (2007) elaborates on measures that can be taken to discard computer components properly after upgrading or where a customer opt to completely replace a computer. Apart from following the right disposal procedure, marketers have a duty to ensure consumers are not only aware but follow the right disposal for hazardous products thus ensuring green marketing. This creates customer satisfaction and build long-term profitable customer relationships which are some of the primary objectives firms try to achieve to sustain their businesses in the competitive business world. With an increase in the social and political pressures, many firms embraced green marketing strategies and exploited these environmental issues as a source of competitive advantage (Tan et al., 2010).

### Need for e-waste management

Electrical and electronic waste mainly comprises large household electronic equipment such as television sets, personal computers (PCs), refrigerators, cell phones, DVD/VHD machines, and electrical power saving bulbs among others (Wilkinson et al., 2001; Crowe et al., 2003; Darby and Obara 2004; Liu et al., 2005; Widmer et al., 2005; Kang and Schoenung 2006; Lee et al., 2007). Gaborone city being a fast growing city produces a large composite of electrical and electronic waste. It is estimated cumulatively that about 500 million PCs reached the end of their service lives between 1994 and 2003 thus becoming obsolete. 500 million PCs contain approximately 2,872,000t of plastics, 718,000t of lead, 1363t of cadmium and 287t of mercury. Botswana by 2005 had about 150,000 Pcs, all of which are obsolete to date. This indicates the fast growing waste stream is accelerating because the global market for PCs is far from saturation and the average lifespan of a PC is decreasing rapidly to 2 years in 2005 (Culver, 2005; O'Connell, 2002). Similar large quantities of electronics for all kinds of portable electronic devices such as PDAs, MP3 players, computer games, refrigerators, washing machines, televisions and peripherals add to the tonnage of electrical and electronic waste in Botswana.

A growing importance of (Information and communication Technology) ICT to the world economy has brought about a surge in demand for electronic equipment (Macauley et al., 2001 Widmer et al., 2005).

Waste from electrical and electronic equipment, is one of the priority streams in waste management because of its major challenges. It has in fact become an issue of concern to solid waste management professionals (Musson *et al.*, 2000). In Botswana the magnitude and flow of e-waste generation is not well known. And the behavior of the consumers in discarding the electrical and electronic waste is not well researched. In addition estimating the volume of e-waste in Botswana is challenging for two reasons, firstly from observation, there is no separate collection of e-waste in Gaborone and second there is no clear data and literature on the quantity generated and disposed of each year and consumer behavior on e-waste disposal resulting to the extent of environmental risk.

### **Challenges, dangers and opportunities in e-waste management in Botswana**

Disposal of obsolete products is becoming a daunting task by Consumers first, due to space and financial constraints. The cumulative effect of electronic waste is compounded in the short life cycle and span of the electronic products and the availability of affordable imported electronic goods in Botswana, which makes it economical for consumers to replace an item rather than to repair. Mmereki *et al.* (2012), and Bogale (2012), indicated that in developing countries like Botswana, solid waste management is becoming a daunting task, including collection and disposal that is complicated by the invasion of e-waste particularly computer waste. (Taye and Kanda, 2011). In most developing or transitional countries, regulators and policy makers have not yet taken the matter seriously on the different critical elements such as collection, treatment, disposal and recycling of e-waste.

Mmereki *et al.* (2012), Junbeum Kim *et al.* (2008), Khetriwal, *et al.* (2009), Nnorom and Osibanjo (2008), noted that countries across the globe are becoming aware of the e-waste problems and some have enacted and implemented special laws and directives for the management of these products and their end of life or end of use and to regulate the employment of hazardous materials in these products. However this is limited by the financial and technological knowhow. Generally the e-waste recycling industry in Botswana is relatively invisible and underdeveloped compared with other neighboring countries like South Africa. This is probably due to the fact that the e-waste stream is still nascent in the country, which limits the economic base available for profitable recycling. In addition this is exacerbated by the absence of e-waste policies in the country.

Each year the world disposes of between twenty and fifty million metric tons of e-waste. E-waste originates from three general categories (a) Individual and small businesses (b) Large Businesses, institution and

governments (C) original equipment manufacturers. They end up in three destinations being landfill, storage or a recycler's door step. By contrast developing countries without viable landfills or recycling apparatuses simply dump e-waste out in the open, (Bogale, 2012).

Bogale (2012), noted that Botswana being a semi-arid country, makes it critical for the protection of natural resources such as ground water for the continuing health and prosperity of the country. Uncontrolled dumping of waste will inevitably lead to the deterioration of drinking water quality and may also contribute to toxic substances entering the food chain and the spread of infectious diseases. Many of the chemicals present in electronic devices are environmentally persistent, meaning they remain in the environment for long periods of time once released. Electronic products contain lead primarily in two forms; metallic lead in electrical solder on printed circuit boards, and lead oxide used in CRTs. Lead exposure may lead to damage to the central and peripheral nervous, blood, reproductive, circulatory and endocrine systems and kidney damage. Mercury is another highly toxic element of e-waste. Mercury is used in light bulbs, flat screen displays, and older types of laptop batteries, switches, relays and cellular phones. High level of mercury exposure can lead to brain and kidney damage as well as damage to the central nervous system. When mercury in electronic devices meets water, either through leaching from landfills or simply throwing electronic devices into bodies of water, it becomes methylated or highly toxic methyl-mercury. Methyl-mercury builds up in fish, shell fish and animals that eat fish. As a result methyl mercury becomes more concentrated as it travels up the food chain where ultimately humans consume it. Like lead, methyl mercury is particularly hazardous to fetuses, infants and children because their bodies are still developing.

There is a significant volume of e-waste generated every day in African cities that have both toxic and valuable materials in them. The fraction including iron, copper, aluminium, gold and other metals in e-waste is over 60%, while pollutants comprise 2.70%. This problem can also be viewed as a business opportunity and as a source of employment for the large population in African cities (Widmer *et al.*, 2005).

Again the growing importance of ICT to the world economy has brought about a surge in demand for electronic equipment (Macauley *et al.*, 2001 Widmer *et al.*, 2005). Waste from electrical and electronic equipment, is one of the priority streams in waste management because of its major challenges. It has in fact become an issue of concern to solid waste management professionals (Musson *et al.*, 2000). In Botswana the magnitude and flow of e-waste generation is not well known. And the behavior of the consumers in discarding the electrical and electronic waste is not well researched. In addition estimating the volume of e-waste in Botswana is challenging for 2 reasons, firstly from

**Table 1.** Household e-waste categories

	CELLPHONE	COMPUTERS	IPADS(%)	FRIDGES(%)	WASHING MACHINE(%)	TV AND RADIOS(%)	LIGHT BULBS(%)	ELECTRONIC KETTLES(%)	IRON BOX(%)	D VIDEO GAMES(%)	ELECTRONIC TOYS(%)
<b>Non</b>	18.9	43.2	68.5	31.5	56.8	11.7	10.8	14.4	37.8	49.5	45
<b>Atleast one</b>	27	29.7	26.1	29.7	24.3	23.4	12.6	16.2	14.4	20.7	20.7
<b>Atleast 2</b>	16.2	9.9	0	13.5	8.1	13.5	2.7	15.3	9	11.7	3.6
<b>Atleast 3</b>	10.8	7.2	4.5	11.7	4.5	15.3	8.1	11.7	4.5	7.2	6.3
<b>Atleast 4</b>	8.1	5.4	0	5.4	3.6	9	8.1	9.9	8.1	1.8	7.2
<b>More than 5</b>	18.9	4.5	0.9	8.1	2.7	27	57.7	32.4	26.1	9	17.1
<b>Total</b>	100	100	100	100	100	100	100	100	100	100	100

observation, there is no separate collection of e-waste in Gaborone thus there is no clear data and literature on the quantity generated and disposed of each year and consumer behavior on e-waste disposal resulting to the extent of environmental risk.

## MATERIALS AND METHODS

The intention of the study was to find out the discarding behavior of the households in Botswana. However due to limitations, the study was based in Gaborone city and questionnaires were administered to 200 different households randomly. Interviews were conducted to find out the policies and measures adopted by the city council and other Government organizations dealing with environment issues in Botswana.

The researcher used several tools to organize, describe and analyze data and followed the procedure below. Data collected through questionnaires was mainly quantitative and data collected through personal interviews was mainly qualitative. About 11% of people aged below 21 years answered the questionnaire followed by at least 40% of the people aged between 21-25; while 25% of the respondents were aged ranging 25-30 and 38% were above 35 but below 60 years. This sample was targeted mainly due to high usage of technology;

### E-waste

Majority of respondents should have discarded an electronic device at some point in life. The most e-waste comprised of the energy saver light bulbs followed by Tv/radio and cellphones with more than 80% of the

respondents indicating they had discarded at least once. I-pad was the least discarded item mainly due to the fact they are new in the market. However we noted that about 4.5% of the respondents had discarded about three times. It was noted that electric light bulbs are the most discarded followed by electric kettles. Energy saver light bulbs carry a lot of dangerous chemicals such as mercury and it's very critical for them to be well disposed to save the environment. The results suggest that the majority of respondents should have owned an electronic device at some point in life, this is not surprising as bulbs are used every day and they die and get replaced more often than a lot of other electrical gadgets as noted in table 1.

64% of the respondents were aware of the dangers of e-waste and that they are supposed to discard it safely while 34% were not aware. About 2% indicated that did not care. This is a good sign as even though people are aware of the e-waste they may not know why it is important to discard it in a safe way, and what it does and its danger to the society. Most of the respondents indicated they discarded their e-waste by donating, followed by dustbins, giving out as toys to children and just keeping in the garage. Recycling and trading back were the least used method of discarding electronic waste (See table 2).

Although the respondents indicated that they gave out most the waste as toys, donated or threw in the dust bins, it evidenced that they were aware of the need to safely discard the e-waste in methods that would not harm the environment.

The table 3 indicates that respondent were aware that e-waste is not just waste and thus some waste need to be properly disposed with a mean square of 3.275 and sig of 0.671 on anova. At the same time it indicated that most customers had thought about it (4.017 and sig 0.609) at the same time.

**Table 2.** Methods used to discard e-waste

Method used to Discard Used Electronic Waste	Mean
By Donating	4.03(1.245)
Recycling	2.41(1.837)
By Garbage Bin	3.68(1.154)
Trading Back	2.81(1.23)
Selling	2.63(1.307)
Garage Or Basement	3.56(1.129)
Throwing To Dumping Site	3.38(1.373)
Giving Out As Toys	3.85(1.820)
I Try To Repair Used Electronic Waste	3.31(1.985)

**Table 3.** Perception on e-waste disposal

E-waste disposal opinions	Sum of Squares	Mean Square	F	Sig.
Waste is waste	3.275	1.637	.401	.671
I never thought about it	4.017	2.009	.499	.609
The city council is not keen on waste separation	6.228	3.114	.927	.399
Too much work without any reward	10.349	5.174	1.127	.328
Even if i know where i can drop the electronic waste, i have no time to go there,	7.016	3.508	.786	.458
I think electronic waste should be arranged for continence collection by manufactures for recycling	14.864	7.432	1.759	.177
I think public collection point should be arranged for electronic waste	12.590	6.295	1.150	.320
I think electronic waste should be taken back to the retailer/shop	11.262	5.631	1.106	.334
I think i should have electronic waste picked at my house by the city council	5.587	2.793	.472	.625
I think consumers should be educated on electronic waste	16.421	8.211	2.154	.121

Majority of the respondent indicated that consumers should be educated on e-waste (0.121) and that arrangement should be made for proper collection and disposal of the waste (0.177) at the convenience of the households. The respondents indicated some of the reasons they did not properly discard the e-waste in the correct manner were:

- Lack of collection point for electronic waste
- Perception that it was too much work without any reward
- perception that it is the responsibility of the city council to do waste separation
- expectation that retailers should allow for trading back or safe disposal of the e-waste
- Incontinence and lack of time to transport the e-waste to the safe disposal site.

The research indicates that the department of Waste management does not have facilities of e-waste management or policies of place to separate electronic waste from other waste. Everything is taken as one. It

also indicated that currently there is no legislation in place that controls the movement of waste locally as noted by Mmereki et al. (2012). The challenge that Botswana still has is the cost of transporting waste. However it was noted that Botswana government is drafting a waste management act that will encompass electronic waste and equipment management

### Conclusion

The research indicates that, households are aware of the dangers of e-waste but they do not know what to manage it. There is no proper policy in Botswana guiding how to dispose electronic waste. Due to the unavailability of necessary logistics, it is very difficult for consumers to rightly dispose e-waste. The City Council has not put mechanism in place to ensure that waste is separated. At the same time the recycling aspect has not been well embraced as a business venture in Botswana. Solid waste from the commercial sector also contributes significantly to the amount of landfilled e-waste where the

annual flow of discarded electronic products from industries and institutions appear more or less prominent.

The research indicates a variety of challenges and strengths to e-waste management in Botswana, demonstrating the need for considerations on how to improve e-waste disposal and especially sensitizing households on waste separation. Short and long term strategies on how to tackle e-waste need to be developed as the current situation poses a danger to the society and children which end up inhaling all the dangerous chemicals found in this waste.

## Recommendations

The best method to dispose waste is to have different e-waste bins in designated areas strategically located within the estates in which households can dispose the unwanted e-waste for weekly collection. At the same sanitary engineers should be motivated to check at points of collection and could assist households in education, motivation and sensitization on waste separation. Botswana needs to come up with legislation that will regulate the discarding of waste especially electronic waste. If Botswana could benchmark with other countries that already have legislation in place it would benefit the society as a whole. Strict measures should be put in place to encourage people to follow the rules. Finally certain disposition rationales should naturally be linked to specific disposition tendencies. Countries should take waste management serious for the sake of the society and its environment

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