

Managing E-waste in The Kathmandu Metropolitan City: A Case of Ward No. 22

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Abstract

The competitive electronic market and the growing consumer buying behavior are leading to the rapid obsolescence of electronic devices. The handling of electronics at the end of its useful life after these devices are replaced or discarded for various reasons over time presents a challenging situation. The main objective of this study is to understand the perspective of electronics consumers in managing their e-waste, taking the case of ward no.22 of Kathmandu Metropolitan City. Semi-structured questionnaires were developed using the variables identified in the literature. The questions were developed based on various grounds of information regarding demographic information, socioeconomic information, e-waste generation and disposal practice, awareness level, and consumer intentions toward e-waste management. The findings of the study showed that although consumers were aware of the problems of e-waste, there was a major lack of knowledge on its management methods, including the awareness of existence of formal recycling centers. Furthermore, it was also found that most respondents were inclined to repairing and selling their e-waste such as desktops and television to scrap dealers. But the scrap dealers do not follow scientific procedures of e-waste handling which harms the ecology. Therefore, awareness efforts are essential to prevent the effects of inappropriate e-waste disposal.

Keywords

E-waste generation, method of disposal, awareness level. e-waste management

1. Introduction

Electronic waste (e-waste), also known as waste electrical and electronic equipment (WEEE), is one of the fastest-growing waste streams in the major cities of developing countries due to urbanization [1]. Electronic waste is largely the outcome of the IT boom causing a serious threat to ecology. About 50 million metric tonnes of e-waste are discarded annually [2] and a major share of this is dumped in less-developed and developing countries, through illegal trans boundary movements. The annual worldwide e-waste generation is estimated to increase by over 30% if this trend keeps on continuing. According to the UN research, if we continue to consume carelessly like this, we may produce 120 million tons of electronic waste by 2050.

As of 2012, Asia accounted for 26.69 million tons of electrical and electronic equipment on the market, which increased from almost 20.62 million tons in 2005 [3]. Electronics that have been used and

abandoned from throughout the world are being dumped in Asia. Concerns regarding the feasibility of current waste infrastructure to handle the rising volume of e-waste in Asia are mounting, especially because electronics contain several harmful components such as mercury, lead, arsenic, and beryllium. When these end up in landfill, chemicals can leach into the soil, air, and nearby watersheds.

In Nepal, the use of modern technology such as information technology (IT) industries is growing at fast pace [4] but there is lack of management options of e-waste. The most serious problem with e-waste in Nepal is that the government lacks legislation or regulations about how to properly handle harmful e-waste. The Environment Protection Act of 2018 is the only law the government use to address matters relating to the environment; nevertheless, it makes no mention of e-waste management strategy. In 2017, only Kathmandu dumped around 18,000 metric tons of e-waste. Households is found to be the major source of waste electrical and electronic equipment

because of the introduction of new technology every week and consumers frequent desire to purchase new appliances for a better lifestyle.

2. Research Objectives

The main objective of this research is to study the e-waste management in different land use zones of ward number 22. The specific objectives include:

- i) To study the e-waste generation depending on the source.
- ii) To identify the disposal practice of e-waste in the study area.
- iii) To understand the level of awareness of the public regarding e-waste.
- iv) To find possible ways to reduce e-waste going to landfills.

3. Study Area



Figure 1: Study Area

The study area is Kathmandu Metropolitan City's Ward No. 22 which was formed by connecting two previous wards (ward no 22 and ward no. 24). It is situated close to the country's administrative hub. Some of Ward No. 22's most noteworthy monuments include the Dharahara tower, Sundhara water spouts, Sankata, and Rana Mukteshwar temples, while the New Road highlights its commercial and financial aspects. It is situated in the city's historic center, close to important consumer routes for electronic marketplaces such as Newroad, Khichapokhari, Dharmapath, Bhotebahal, Tebahal, and others.

4. Methodology

The objective of this study is based on a real-world problem, hence a pragmatic paradigm with mixed methods is adopted to guide it. The ontological claim of this study is that the majority of e-waste is handled by the informal sector, which generally burns it along with other solid wastes or dumps it in landfills rather than following proper disposal procedures.

Both qualitative and quantitative data were collected for the study. To gather qualitative data, observation, map and document collection, and key informant interviews were performed with representatives from the Environment Management Department, the Kathmandu Metropolitan City Office, the ward office, and several recycling centers. For quantitative data, a survey using semi-structured questionnaires was carried out in the study area starting at Bhotebahal, the ward's southern boundary, moving on to Tebahal, Pyukha, and then the northern boundary of Watu.

Table 1: Framework for Data collection

Objectives	Literature Review	Data Sources
1) To study the e-waste generation depending on the source.	Types of e-waste generation in different land use zones	Map study / satellite image / observations
2) To identify the disposal practice of e-waste in the study area.	E-waste collections and transportation practices Methods of e-waste disposal Socio Economic benefits of recycling	Individual HH survey Municipality KII Formal and informal recyclers KII Literature Review
3) To understand the level of awareness of the public regarding e-waste.	Roles of various stakeholders in e-waste handling Attitude and behaviour related to household level e waste segregation Knowledge and Perceptions on e-waste handling Effects of e-waste on health and environment	Individual HH survey Municipality KII E Goods Repair shops KII Recyclers KII
4) To find possible ways to reduce e-waste going to landfills.	Existing legal and policy framework in e-waste management International Convention Scientific disposal system E-waste management strategies National and international Case studies	Literature Review Literature Case studies

Purposeful sampling is adopted to select respondents who are most likely to provide reliable and insightful data. 112 samples from the study area based on

residential, commercial, and institutional buildings were collected until the saturation point was reached. The questions were based on a variety of factors, including background data, demographics, the development and disposal of e-waste, and consumer awareness levels. Before doing the field research, the questionnaires were pretested among friends and family to determine the viability of the questions and the length of time needed for each survey. The responses were subsequently added to the Kobo toolbox to gather the purpose of gathering data. To validate the study, data from a literature review, questionnaire survey, key informant interviews, and field observation were triangulated.

5. Description and Analysis

5.1 Demographic and Socioeconomic Characteristics of Respondents

Table 2: Demographic Profile of Respondents

Variables	Frequency	Proportion
Age		
0-20	4	4%
20-40	72	64%
40-60	32	28%
60 above	4	4%
Gender		
Male	76	68%
Female	36	32%
Education		
Secondary	20	18%
Higher Secondary	20	18%
Bachelors	60	53%
Masters	12	11%

Out of the 112 respondents, 64% of respondents were in the 20 to 40 age category. The highest percentage 68% were men while 32% were women. 53% respondents were graduates while fewer respondents had completed masters degree (Table 2).

Similarly, most (46%) of respondents were involved in business. Regarding family size, 71% stated of having 4 to 8 members in their family and nearly 53% of the respondents earned total household incomes between Rs 25000 to Rs 50000 monthly (Table 3).

Table 3: Socio-economic Character of Respondents

Variables	Frequency	Proportion
Occupation		
Business	52	46%
Service	28	25%
Student	20	18%
Others	12	11%
Family Size		
0 to 4	28	25%
4 to 8	80	71%
More than 8	4	4%
Total HH Income		
<25000	12	11%
25000-50000	60	53%
>50000	40	36%

5.2 Analysis of E-waste Generation Depending on Source

5.2.1 Unused electronic equipment stored in the household

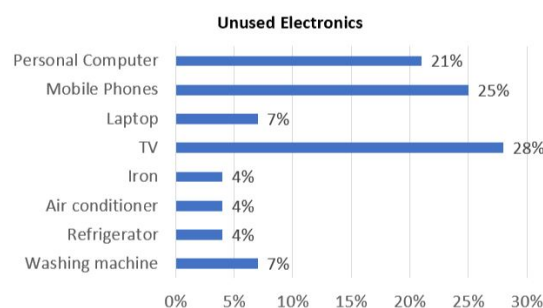


Figure 2: Chart showing percentage of unused electronics

The information regarding different unused e-waste equipment in the households were collected. The list of items used were from the classification given by the United Nations Global Monitor [5]. From the six categories, equipment that was found to be common during literature study was included here. The most unused equipment under the list were TV (28%) and mobile phones (25%) followed by personal computer (21%). 7% respondents stated of having unused laptop while other 7% respondents have unused washing machine in their household (Figure 2).

5.2.2 Annual E-waste Generation Depending on Source

Depending on source, 80% of 1kg to 3kg of e-waste is generated annually by residential source only and rest 20% by commercial source. In 3kg to 5 kg category, majority (46%) of e-waste is generated by commercial source which is followed by residential and then institutional. Also, in 5kg to 7kg category, majority (46%) of e-waste is generated by commercial source which is followed by residential then institutional (Figure 3).

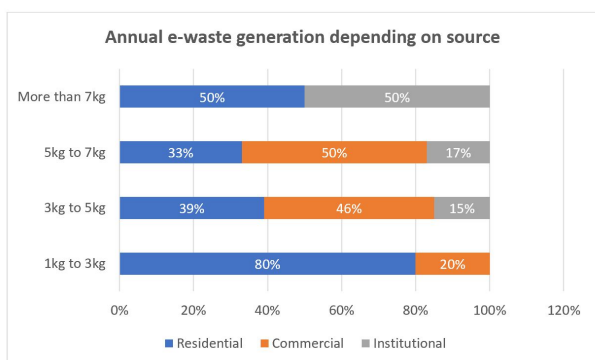


Figure 3: Chart showing annual e-waste generation depending on source

5.2.3 Interview Analysis

As per Bhuwan Chalise, e-waste researcher from Doko recyclers “E-waste generated in residential source is occasional as high volumes of string lights are disposed during the festive season such as Deepawali and wedding months.” Ronish Shakya, general manager of Blue waste to value claims that “More than 60% of e-waste includes mainly of household sources.”

5.3 Analysis of E-waste Disposal Practice

5.3.1 Reason for discarding electrical equipments

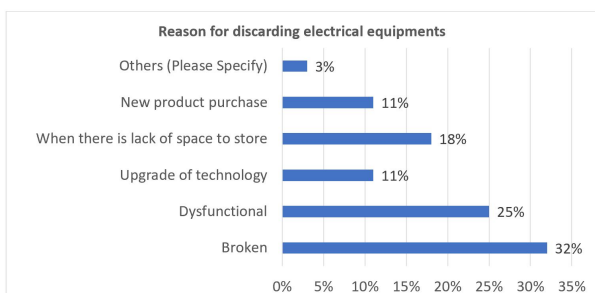


Figure 4: Chart showing reason for discarding electrical equipment

During the survey, the respondents were asked for reasons behind not using the equipment in which 32% of respondents stated that of equipment being broken while 25% of respondents mentioned dysfunctional. 18% respondents stated that they had no place to store. 15% of respondents said that the old equipment was functional but outdated, and the other 11% of respondents said they had bought new devices (Figure 4).

5.3.2 Methods followed for e-waste disposal

Majority of respondents 25% disposed their e-waste by repairing them and 25% respondents sold them as scrap. 21% Respondents were also selling in second hand market if their electronic device were functional, 11% respondents stored their electronics in their home if it is large equipment and only 7% donated their outdated technology to needy (Figure 5).



Figure 5: Chart showing method followed for e-waste disposal

5.3.3 Interview Analysis

The perception of ward chairman differs from that of respondents as he stated that “Except for batteries, e-waste is disposed along with municipal waste”. In the study area, it is evident from the observation that, the local repairing shops in the Newroad area openly dispose their electronic waste nearby their shops which gives the unpleasant appearance. Shankar Agrawal, repair shop owner stated that “Inappropriate disposal of electronic waste once which can no longer be repaired poses serious risk to environment”.

5.4 Analysis of Awareness level of Public Regarding the E-waste

5.4.1 Awareness of E-waste Problem

For e-waste problem, the majority of respondents, i.e. 40% were highly aware that electronics generate e-waste when not used and dumped aside. Also, 54%

were highly aware that environmental degradation occurs through e-waste and 43% respondents were highly aware of the fact that e-waste toxins enter the food cycle through leaching in crops and plants. 39% were highly about e-waste affecting worker health. Therefore, the results showed high awareness on e-waste problems (Figure 6).

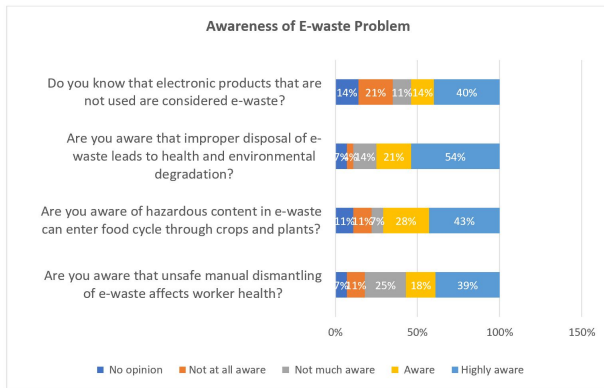


Figure 6: Chart showing awareness of e-waste problem

5.4.2 Awareness of E-waste Problem

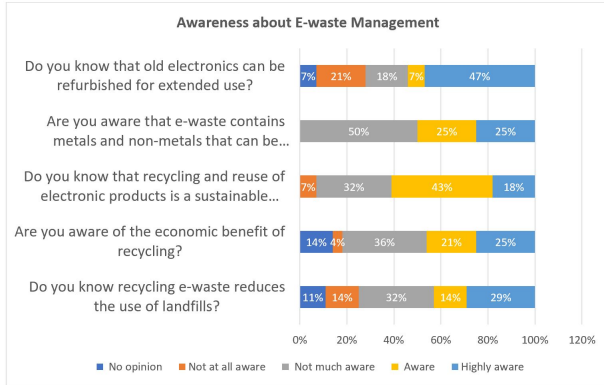


Figure 7: Chart showing awareness of e-waste management

For e-waste management, 47% respondent stated of having good awareness of the old electronic product can be refurbished for extended use. 50% respondents were not much aware that metal and other useful resources can be generated from used e-waste devices. 43% respondents were aware that recycling is a sustainable solution for managing e-waste. 36% were not much aware of the economic benefit of recycling such as discounted prices for new electronics from their discarded electronics and only 32% were not much aware that recycling e-waste reduces the use of

landfills. Therefore, the results showed consumers are not much aware on e-waste management methods (Figure 7).

5.4.3 Willingness of People Regarding E-waste Management

Study claims that customer willingness to recycle is influenced by two factors: first, ease of access to and understanding of available resources and services; and second, comfort [6]. 60% of respondents are willing to participate in e-waste recycling while 47% of respondents expressed their willingness to pay for environmentally sound, healthy, and safe e-waste recycling. 47% of respondents were also willing to buy electronics from the second-hand market while other 46% of respondents were unwilling to buy. However, the rating was very positive but we need to emphasize on efficient ways of recycling of e-waste (Figure 8).

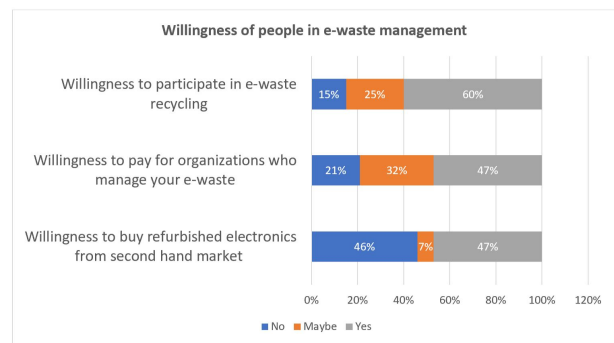


Figure 8: Chart showing willingness of people in e-waste management

5.4.4 Interview Analysis

According to Jenisha Maharjan of Doko Recyclers, “when awareness programs were held in schools, the proportion of parents who came to recycle also increased”. People were unaware of the number of recycling companies processing e-waste in Nepal prior to this campaign.

5.5 Analysis of Possible Ways to Reduce E-waste Going to Landfills

In the study area, most respondents stated of repairing their electronics and using till the end of its life (Figure 5). Selling to scrap dealers was also practiced in the study area which contributes in reducing the volume going to landfills (Figure 5).The case study of Hewlett-Packard e-waste management in South Africa

promotes e-waste to art by recycling electronics that are no longer in use. This helps to reduce e-waste and provides value to the waste.

5.5.1 Interview Analysis

Sarita Rai, Chief of the Environment Management Department said that, “there is a need for appropriate sustainable e-waste management solutions such as policy formulation, which must occur before the e-waste problem becomes difficult to manage just like in the case of other waste streams.”

6. Discussion

According to the survey, residential sources account for a greater percentage of unused electronic equipment than institutional or commercial sources, which is consistent with the statements of recycling companies. It is because electronic devices are affordable and enable people to complete their task in half the time. The fact that new technological advancements are released every week, whether they be in the form of smartphones or kitchenware, is another factor. When a new model is released, people just store the old equipment in a house corner or discard it. It shows that e-waste in households is increasing. More e-waste is generated from houses includes TV due to introduction of new technology. Studies also found the increase in trend of buying more household electronics in the form of smartphones or kitchenware.

Three major factors affect respondents decision to switch to new electronic devices include when device is damaged, dysfunctional, or there isn't enough room to store e-waste. Due to the absence of a door-to-door collection program in the study area, electronic waste is likely being stored at home. In the study area, the most popular e-waste disposal technique involves repairing and selling the e-waste as scrap. According to a study by [7], repair shops have up to 50% of the entire collections of e-waste, which are sold to scrap dealers.

The study discovered that, the respondents had high degree of awareness of hazardous substance, potential threats to the environment and human health from improper disposal, and the existence of valuable metals in electronic equipment, despite they lack knowledge about e-waste management strategies. The

less awareness of e-waste management is due to having less idea of recycling centers which is one of the effective ways of treating e-waste. The level of willingness in e-waste management was also found positive in the survey. The finding from this study also found that those who had higher degree have more knowledge on e-waste and understand the importance of environmental protection.

There are several possible ways to reduce e-waste but e-waste is observed differently in different countries one approach cannot be effective in influencing how people dispose of their electronics. However, people can practice responsible consumption and production by participating in recycling activities. Nepal does not have a specific legislation on e-waste, but the environment protection act has initiated the polluters pay principle, which is a good step toward sustainability.

7. Conclusion

In this study, e-waste generation and disposal, awareness of consumers, and possible ways to reduce e-waste in ward no. 22 of Kathmandu Metropolitan City were investigated. From the findings of our survey, the following conclusions are derived.

Unused electronic devices mentioned by most households included TV (28%), mobile phones (25%) followed by a personal computer (21%). Also, the majority of unused electronics come from residential sources than institutional and commercial sources due to availability of electronics at cheaper rates. When studying the reason for discarding their e-waste, it was found that the majority of people only discard their devices when the equipment was broken and could not be repaired. Though consumers were not much aware of the formal e-waste recycling centers, they sent their e-waste to scrap dealers which also help in reducing the waste going to landfills.

Inadequate public awareness is linked to irresponsible e-waste disposal practices, hence raising public awareness and encouraging public participation is essential for the success of initiatives to reduce electronic waste [8]. The study's findings revealed that, despite consumers' awareness of the issues with e-waste, there is a serious lack of information about e-waste management, particularly about the existence of formal recycling facilities.

It is found that there is a gap in knowledge regarding sustainable e-waste management methods in the study area. Also, the problems and consequences of e-waste were not mentioned in urban planning documents like National Urban Development Strategy (2017) either. These prevented to include e-waste issues into urban planning efforts. Even though, e-waste is a result of urbanization and industrialization, it is not taken as topic of major concern in urban planning efforts compared to other general environmental challenges. In addition to this study, focused research should be done in other similar urban areas to understand the practice of e-waste generation and disposal. To fill the knowledge gap, further research on study of public participation in creating efficient e-waste management solutions on a larger scale should be done.

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