E-waste Management Practices: A Case of Itahari Sub-Metropolitan City, Nepal

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Abstract

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The fast deterioration of electronic gadgets is being caused by the highly competitive electronic market and the rising purchasing patterns of consumers. It can be difficult to handle electronics when their useful lives are ending and when they are replaced or thrown away for various reasons over time. This research aims to comprehend the viewpoint of electronics consumers regarding managing their electronic waste, with a particular focus on Itahari Sub-Metropolitan City's ward no. 05. The factors found in the literature were used to create questionnaires. The questions were created using various sources, including socioeconomic and demographic data, information on E-waste generation and disposal practices, consumer intentions toward E-waste management, and awareness levels. The study's findings demonstrated that while consumers were aware of the issues surrounding E-waste, they lacked a significant amount of knowledge regarding formal recycling centers and other strategies for managing waste. Additionally, it was seen that most respondents were either willing to sell their televisions and desktop computers to scrap traders or wanted to repair them. For instance, the majority of participants reported never receiving any E-waste management training, but many also claimed they would be prepared to pay the E-waste handling organization to participate in E-waste management programs and hence, Itahari Sub-Metropolitan is advised to undertake community-based initiatives to improve E-waste management programs.

Keywords: E-waste, awareness, disposal, household, E-waste management

Introduction

Any electronic product that has reached the end of its useful life cycle, or one that contains electrical components, is called electronic waste, or E-waste (Sthiannopkao & Wong, 2013). People start their day with an alarm from their cell phone and end their day with refreshments by watching TV, laptops, or mobiles. People from a variety of professions—including police officers, housekeepers, students, and medical professionals—use advanced electronic devices nearly nonstop to simplify and speed up their work performance. In addition, high-tech devices are used by physicians, engineers, and security specialists to save lives (Widmer et al., 2005). Electronic materials have, during their working lives, become essential to human existence (Narasimha et al., 2019; Sawhney et al., 2008) while that have ended their lives become a huge challenge to their management.

The rapid growth of E-gadgets in every aspect of society could eventually result in an awful situation. It has been predicted that if E-waste is not adequately managed, catastrophic events could soon occur throughout the world. The IT boom has resulted in a significant environmental hazard in the form of electronic waste. 50 million metric tons or the Plateaus of E-waste are disposed of yearly (Vanessa et al., 2020), and a significant portion of this is disposed of in less developed and emerging nations by unlawful traveling across borders. An estimated 20–50 million tons of E-waste are disposed of annually worldwide, with about 12 million tons coming from Asian nations (Greenpeace International, 2005). If we continue with our reckless consumption, the UN estimates that by 2050, we might generate 120 million tons of electronic garbage. Considering populated China and India, the total absolute volume of E-waste generated is enormous, even though the per capita production is estimated to be less than 1 kg annually (Widmer et al., 2005). Developed and industrialized countries are the primary producers of E-waste. With 3.16 million tons of E-waste produced in 2008, the US is currently the world's largest producer of E-waste (Hossain et al., 2015).

There are very few government laws and funds on how to deal with hazardous E-waste, especially in developing countries like Nepal (Parajuly et al., 2018).In nations such as Nepal where non-formal recycling practices are common, the absence of

knowledge about the current system inhibits progress. Unofficial recycling network in Kathmandu, which employs over 10,000 people to handle the recyclable materials found in different waste streams, such as waste made of electronics (E-waste) (Parajuly et al., 2018). The Environment Protection Act of 2018 is the only law the government uses to deal with environmental issues, but it doesn't address E-waste management strategies. However, technology is developing exponentially, making new devices smaller, faster, and easier to use (Khatri, 2019). The fast growth of electronic devices across all spheres of society could potentially result in devastating scenarios (Nepal Telecommunications Authority, 2017). According to estimates, if the E-waste is not properly managed, Nepal may soon experience major disasters (Giri & Adhikari, 2020).

Picture 1. *Workers belonging to Enviro Care dump waste collected from Itahari Sub-Metropolitan City in Bajhgara Community Forest, Sunsari in this recent picture (2023). Photo: Rohit Rai/Republica*

The main reason E-waste is deemed harmful is because it contains various toxic chemicals (Perkins et al., 2014). These waste products contain high concentrations of concentrated lead, cadmium, and beryllium, which are not recyclable. Burning these waste materials can release harmful chemicals into the air and cause health risks. In given picture 1 taken in Bajhgara Community Forest, Sunsari, workers from Enviro Care are seen disposing of rubbish collected from Itahari Sub-Metropolitan City. Picture

1 shows there are no proper rules and regulations regarding waste management and the effects of this waste on human health and the environment. As a result, it appears that the Itahari Sub-Metropolitan City needs to manage its E-waste properly. The purpose of this paper is to explore Itahari's present E-waste practices in Itahari Sub-Metropolitan city, Nepal. The findings of the study will facilitate the local government to make policies for E-waste management and streamline the practices.

Literature Review

To properly plan for E-waste management, the first step is estimating the amount of E-waste generated (Alavi et al., 2015). Appliances that exchange temperatures, such as refrigerators, air conditioners, and freezers; huge appliances including photocopiers, washing machines, and dishwashing machines; screens from computers, laptops, and televisions; lighting fixtures like light-emitting diode (LED) and fluorescent lamps; tiny appliances including video cameras, radios, and microwave ovens; Telephones, cell phones, and electronic toys are some major examples for the source of E-waste (Miner et al., 2020). Even though Nepal is among the least developed nations in terms of electrical and electronic equipment, Nepal imports high-tech devices from developed countries and uses them without properly considering how their use will affect socio-economic values, health, and the environment, as well as how they are managed after use (Giri & Adhikari, 2020). Another urgent problem in emerging nations is informal recycling. The most economically developed nations, like the United States, Japan, and the European Union, have enacted strict laws and policies for the handling of E-waste (Sawhney et al., 2008; Ababio, 2012). Additionally, E-waste management has been incorporated into national development policies by economically developing nations like China and India (Joseph 2007; Chen et al., 2015; Karmacharya et al., 2015). The disposal methods used differ depending on the kinds of stakeholders producing E-waste. Manufacturers, home users, businesses, institutions, and electronic repair shops are the actual stakeholders in E-waste in Nepal; these groups may account for 50% or more of all E-gadget stocks. All of this E-waste is gathered from customers by scrap dealers, sellers, and scavengers (Giri & Adhikari, 2020). In a similar vein, the municipality is one of the parties involved in an official waste disposal action plan (Parajuly, 2017).

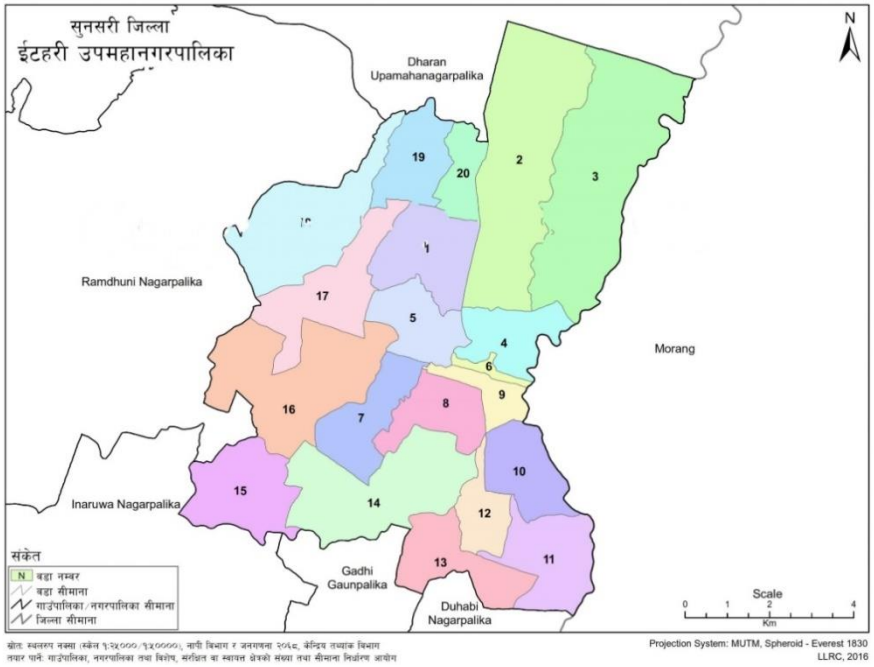
The municipalities of Nepal support household customers' garbage disposal in their metropolitan areas. It gathers all rubbish from various locations in an utterly haphazard manner and then disposes of it in landfills (Giri & Adhikari, 2020). In the case of Itahari, the sub-Metropolitan City Authority uses employees and vehicles to gather all the solid rubbish and E-waste from every home and deposit it at a location situated in Sunsari district's Itahari Ward Number 10, Dumartakka, this landfill site covers an area of more than 3.5 bighas (https://english.ratopati.com/story/15555). The effects of E-waste on the environment have been the subject of numerous research (Khatri, 2019). Numerous metals, many of which are hazardous to people and ecosystems, are found in electrical and electronic products. These various metal ions make up more than 60% of E-waste, of which 2.7% are hazardous metals (Widmer et al., 2005). Because these wastes contain dangerous compounds such as aluminum (Al), arsenic (As), bismuth (Bi), cadmium (Cd), chromium (Cr), mercury (Hg), nickel (Ni), lead (Pb), and antimony (Sb), correct handling (collection, storage, recycling, and disposal) is essential (Khatri, 2019). The Department of Environment reported in 2017 that 17,730 metric tons of E-waste were collected in that year (The Himalayan Times, 2017). Due to a lack of conscious knowledge about E-waste management, Nepal is going to have a difficult time shortly since this type of waste cannot be managed at disposal sites because it is too unsafe (Tuladhar, 1996; Khatri, 2019). Despite all significance of E-waste knowledge for the effective management of this waste stream has been highlighted via many studies (Khatri, 2019; Giri & Adhikari, 2020). This research will be the first in Itahari, one of Nepal's developing towns, where no prior research has been done, and hence will provide the ground reality regarding E-waste management and practices in this area.

Methods

Study Area

The study area is Itahari Sub-Metropolitan City's Ward No. 05 since there are 20 Wards in this city, among which ward 5 has the highest population, i.e., 21,233 (Census, 2078). Some of the most noteworthy places of this ward are *Janta Basti, Pachrukhi, Kavyabatika, and Tulasa Tol*. It is situated at the city's historic and old college, i.e., Janta Multiple Campus, and many more places such as Khadyagodam, FPAN (Family

Planning Association of Nepal), Ananda Rice Mill, Mokshya Rehabilitation Centre, and Samata Niketan.



Picture 2. *Itahari Sub-Metropolitan City is located in Sunsari District, Koshi Province in Nepal. Key information: Number of Wards: 20, Geographical Area: 93.78 Sq KM, Population: 197,241 (2021 census).*

Materials and Methods

Since there hasn't been any previous research or survey on E-waste in Itahari, this study aims to look at the practices surrounding E-waste and base the investigation on a real-world problem. Only quantitative data were collected for the study. A survey was conducted in the research area using questionnaires to gather quantitative data. The survey was conducted in many locations in Ward 5, including Tulasha Tol, Pachrukhi, Kavya Batika, and many more.

216 samples—based on residential, commercial, and institutional buildings—were gathered from the study region. Three components make up the structured questionnaire's design: demographic component; the people's awareness and behavior regarding E-waste consumption; and the willingness of the people to adopt E-waste

collection and management system. To ascertain the validity of the questions and the amount of time required for each survey, the questionnaires were pretested among friends and family before doing the field research. Data from a survey, a literature review, and field observations were combined to validate the study. The primary data collected from the questionnaire has been saved in MS Excel (Version 2013) for additional analysis and coding.

Results and Discussion

The questionnaire study provided results categorized into three areas: demographic data, consumer behavior, and awareness evaluation (Saidan & Tarawneh, 2013).

Demographic and Socio-economic Characteristics of Respondents

Table 1

Demographic profile of respondents

Variables	Frequency	Proportion
Age		
15-25	97	44.91%
26-35	42	19.44%
36-45	50	23.15%
46-55	19	8.80%
Above 55	08	3.70%
Gender		
Male	99	45.83%
Female	117	54.17%
Academic qualification		
Never schooled	4	1.85%
Basic level (1-8)	17	7.87%
Secondary level	127	58.80%
Bachelors	51	23.61%
Masters	17	7.87%

Of the 216 participants, 44.91% belonged to the age group of 15 to 25. Women comprised the largest percentage (54.17%), followed by men (45.83%). A smaller

percentage of respondents (1.85%) had never attended school, compared to 58.80% who had finished secondary education (*Table 1*).

In a similar vein, the majority of responders (44.44%) were students. Regarding family size, 52.31% of respondents reported that they had 1 to 4 individuals, while almost 31.41% said their monthly household income was more than Rs 50000 (Table 2).

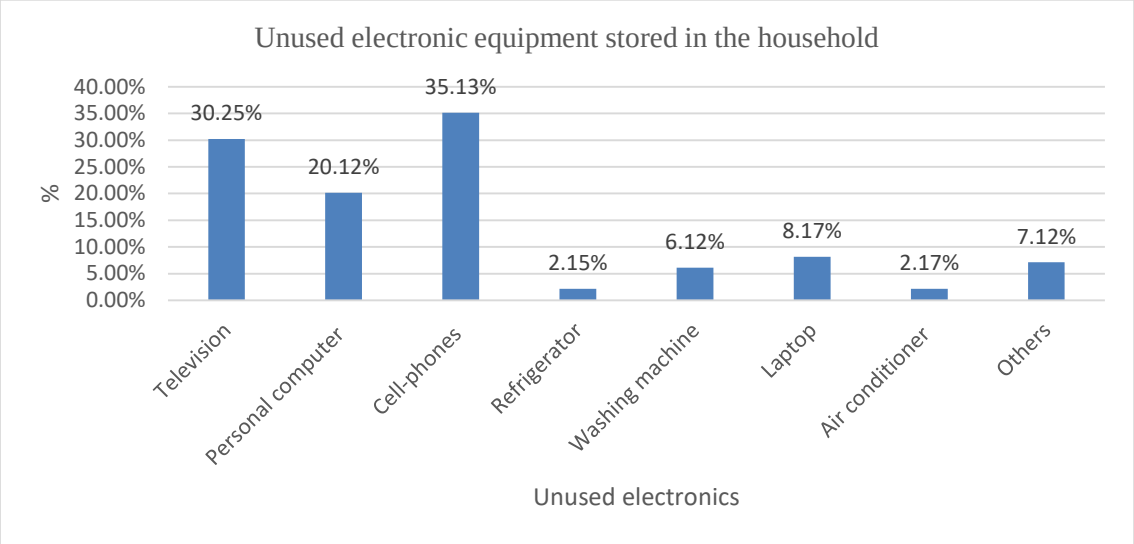
Table 2

Socio-economic features of respondents

Variables	Frequency	Proportion
Occupation		
Farming	18	8.33%
Business	57	26.39%
Service	19	8.80%
Housewife	26	12.04%
Student	96	44.44%
Family size		
1-4	113	52.31%
4-8	97	44.91%
More than 8	6	2.78%
HH income		
>10000	28	12.50%
10000-25000	54	25.00%
26000-50000	64	29.63%
<50000	70	32.41%

Analysis of the Generation of E-waste by Source

Data on various electronic devices left unused in the homes was gathered (Graph 1). In general, the equipment included in this study was determined to be just as frequent as E-waste through a literature review. On the list, cell phones accounted for 35.13% of the most underutilized equipment, followed by TVs (30.25%) and personal computers (20.12%). Of the respondents, 8.17% reported having underused laptops, while 6.12% reported having unused washing machines at home. The lowest percentage of respondents—2.15%—have refrigerators that are not in use. The data shows people have a lot of E-waste stored at home due to a lack of knowledge and a place to discard that waste.

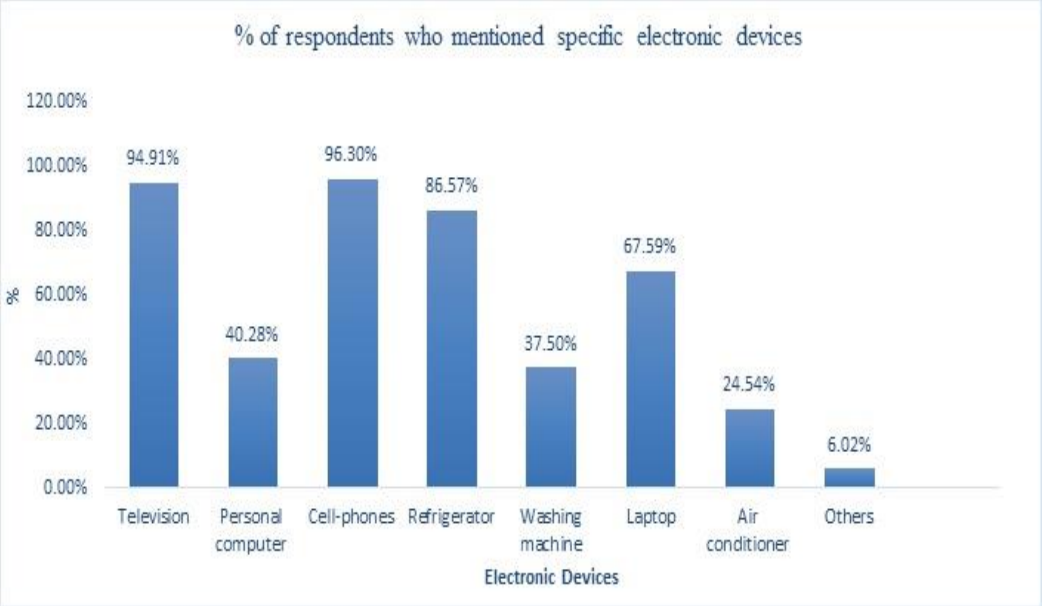


Graph 1

Graph showing the percentage of unused electronics

Knowledge and Awareness of Electronic Wastes

The proportions of various electronic device types utilized by family members are shown in Graph 2. My study shows both television sets (94.91%) and cell phones (96.30%) are used by the majority of respondents. This finding can relate to the study of Okoye and Odoh (2014) which finds that these days among the most common and essential electronic items in homes are cellphones. Additionally, almost equal numbers of respondents reported having an Iron (89.81%), refrigerator (86.57%), and laptop (67.59%). Although several electronic items in our study were least mentioned by the respondents, an Indian study found that rising economic growth can be attributed to higher purchasing of electronic devices (Nethaji et al., 2017). Such devices are Personal computers (40.28%), washing machines (37.50%), air conditioners (24.54%), and others (6.02%). No matter what kind of electronics are purchased for the home, at some point their useful lives will come to an end, making it necessary to throw them away (Miner et al., 2020).



Graph 2

Electronic devices mentioned by respondents.

Table 3 shows that 61.11% (n = 132) of respondents stated they had not received comprehensive education on how to handle and dispose of E-waste while 54.63% (n = 118) of respondents are aware of E-waste. Many developing nations, like Nepal and others, lack the institutional support and resources necessary to expand the transmission of relevant knowledge on E-waste. As a result, many citizens do not receive education on E-waste handling guidelines (Giri & Adhikari, 2020),(Khatri, 2019). Despite these drawbacks, a large number of respondents stated that they are prepared to contribute to environmental harm caused by this waste (87.04%; n = 188) because they are aware of the toxicity or harmfulness (79.63%; n = 172) of this waste stream and the inherent health risks (64.82%; n = 140) associated with unsafe disposal practices. Comparatively, another study carried out in the Kathmandu Metropolitan likewise revealed comparatively higher awareness levels of E-waste among households (Dotel & Singh, n.d.). As a result, 78.70% (n = 170) of respondents in the current study felt that E-waste sorting is necessary.

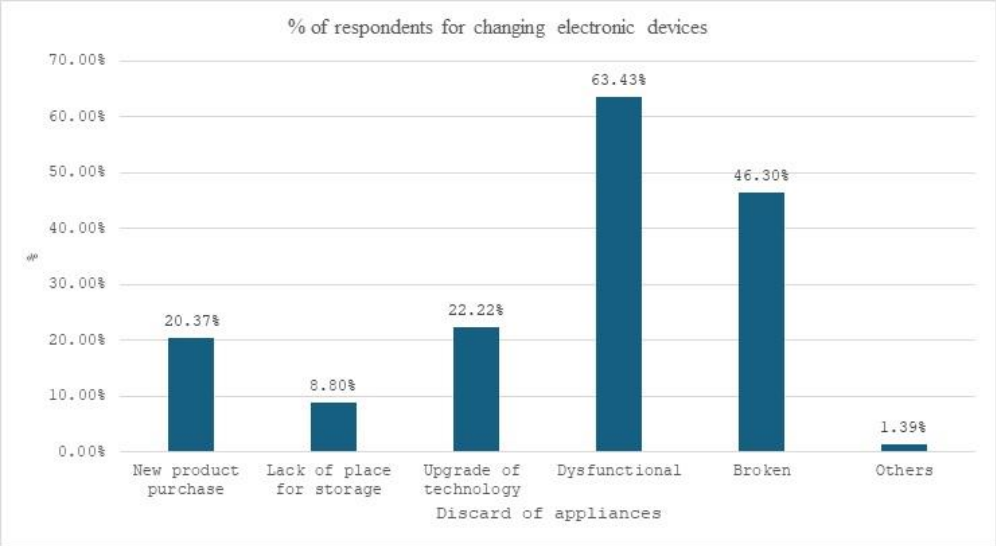
Table 3

Statements measuring respondents' knowledge and awareness of E-waste (n = 216)

Statements Estimating E-waste Awareness and Knowledge	Yes (%)	No (%)	I don't know (%)	No opinion (%)
Do you know that electronic products that are not used are considered as E-waste?	54.63	24.54	13.89	6.94
Is there any hazardous material in E-waste?	58.80	11.57	25.46	4.17
Are you aware that improper disposal of E-waste leads to health and environmental degradation?	79.63	9.72	8.33	2.31
Do you know improper E-waste disposal can enter the food cycle through crops and plants?	49.54	23.15	22.22	5.09
Are you aware that unsafe manual dismantling of E-waste affects worker health?	64.82	16.67	18.98	3.24
Do you believe that you should contribute to preventing environmental damage?	87.04	6.02	3.24	3.70
Have you received education on E-waste?	Yes (%)	61.11	10.19	2.78
Do you think sorting E-waste is important for improving waste management?	54.63	7.87	8.80	4.63

Discard the method of e-waste

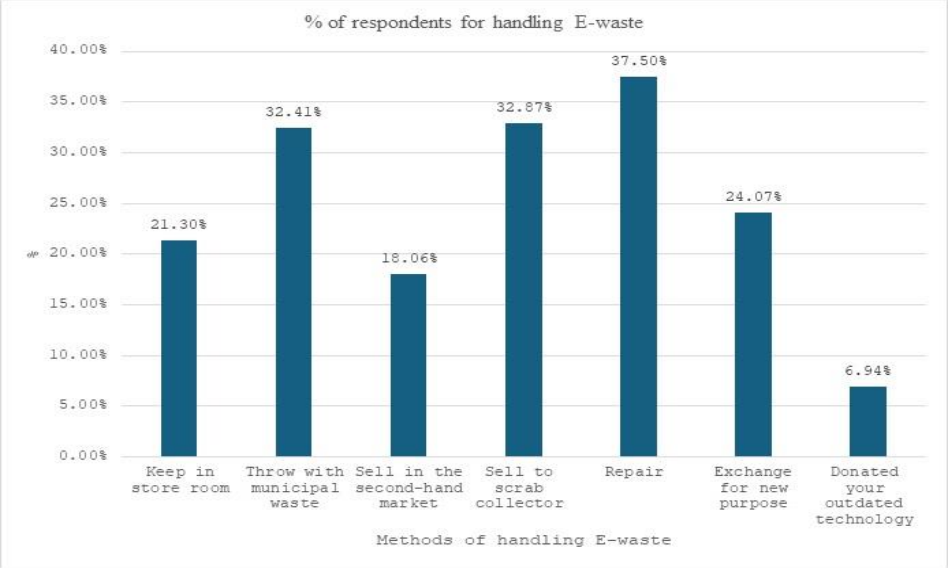
Information is obtained about different electronic gadgets and how individuals dispose of them. The purpose of the questionnaire is to observe the procedures for disposing of electrical appliances. The majority of respondents (63.43%) and (46.30%) respectively used to trash appliances because they were broken or dysfunctional (Figure 3). Data shows that 8.80% of the people of Itahari lack adequate space for storing outdated appliances. Low responses were obtained when asked whether they would purchase new items (20.37%) or upgrade their technology (22.22%) (Graph 3).



Graph 3

Percentage of unused electronics

The many approaches to managing and getting rid of E-waste in the research area are shown in Graph 4. About the same proportion of respondents either throw their E-waste with municipal rubbish (32.4%), sell it to a scrap collector (32.87%, n = 71), or fix it (37.50%, n = 81). Nevertheless, Figure 4 additionally demonstrates that 21.30% of the waste (n = 46) is stored in a store room. Moreover, E-waste is donated to those in need to a lesser extent (6.94%, n = 15). This adds to the local air pollution around homes, or put another way, 18.06%, n = 39, of people sell their E-waste in the second-hand market, and 24.07%, n = 52, of people swap it for new purposes.



Graph 4

Management and disposal of E-waste.

Willingness of Households to Take Part in Waste Management

Table 3

Statements measuring respondents' Willingness to participate in E-waste management (n = 216)

Estimating Public Opinion/Application Regarding E-waste Management	Yes (%)	No (%)	I don't know (%)	No opinion (%)
Knowledge of regulations/ laws that manage E-waste	22.69	28.24	43.06	6.02
Awareness of the economic benefits of recycling E-waste	62.96	20.83	12.50	3.70
Knowledge of national policy regulations that manage E-waste	44.91	26.39	17.13	11.57
Willingness to participate in E-waste recycling	81.02	9.72	4.17	5.09
Willingness to pay for the organization that manages your E-waste	47.69	37.96	6.94	7.41
Willingness to buy refurbished electronics from the second-hand market	56.02	29.63	9.72	4.63

Table 3 displays the results of the individual's willingness to take part in the management of E-waste. The many statements (Table 3) given to the respondents during the survey were used to determine this willingness. Data shows that respondents are aware of the economic benefits of recycling E-waste (62.96%, n = 136) so Responses expressed a strong desire to take part in the recycling of E-waste (81.02%; n = 175). With such recycling behavior, the local municipalities may locate E-waste recycling regions that can be further utilized, depending on their level of dedication and willingness. This would improve E-waste collection rates and recycling efficacy in the research area. However, the results of Dotel and Singh, n.d. are linked to the observed desire to recycle for the disposal of E-waste. A significant portion of participants, specifically 43.06%; n = 96, expressed a lack of knowledge of local rules and regulations about the handling of E-waste whereas 44.91%; n = 97, of participants are aware of national policy that manages E-waste. While 29.63%; n = 64, of respondents said they were unwilling to buy, 56.02%; n = 121, of respondents said they would be prepared to purchase devices from the second-hand market (Dotel and Singh, n.d.) Nonetheless, quite a few of the respondents (47.69%; n = 103) whose monthly income is more than 50000 thousand expressed a readiness to pay for appropriate E-waste disposal (Ananno et al., 2021).

Conclusions and Recommendations

In Itahari Sub-Metropolitan City Ward 05, research revealed household awareness of E-waste and the respondents' willingness to participate in its management. For the safe disposal, reuse, and recycling of E-waste and to reduce exposure to possible hazardous components, E-waste understanding and awareness regarding the substance is necessary. Most of the respondents seemed to lack broad knowledge and suitable guidance on the safe handling and management of electronic waste, and the respondents' level of awareness regarding E-waste was relatively high. It is essential to train the households regarding the safe disposal of e-waste as the majority of participants reported that they had never received any training on managing E-waste. In light of this shortcoming, community-based efforts to raise E-waste management programs are suggested to Itahari Sub-Metropolitan.

The primary causes cited by respondents for purchasing additional electronic gadgets were malfunctions with current models, technological advancements, and the release of newer models. Customers send their E-waste to scrap dealers (Bisschop, 2017). Even though they were unaware of the official E-waste recycling locations, they decreased the amount of rubbish that is dumped in landfills. According to the respondents, improper disposal of E-waste with municipal waste has resulted in several environmental issues, the most significant of which are the adverse impacts on aesthetics and ambient air quality as well as inadequate municipal management to handle this waste stream.

It becomes apparent that there is a lack of knowledge in the subject area of sustainable E-waste management techniques in the study area. Despite being an outcome of industrialization and urbanization, E-waste is not given the same priority in urban planning efforts as other environmental issues in general. To further understand the practices of electronic waste production and disposal, specific investigations in other metropolitan areas should be conducted in addition to this study. More research on the topic of public involvement in developing effective E-waste management solutions on a broader scale is necessary to bridge the knowledge gap.

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Conflicts of Interest

The author declares no conflict of interest in publishing this research.

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