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# STUDY OF ELECTRONIC WASTE INVENTORY SYSTEM (E-WASTE) FROM HOUSE HOLD IN PAMENGKANG VILLAGE

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***Abstract*** *E-waste* is all objects included in a wide variety of electronic devices and their developments ranging from large household electronic equipment such as refrigerators, air conditioners, cell phones, stereo systems, and other consumptive electronic devices, to computers that are discarded by their owners. This study aims to determine the potential amount of used electronic goods (*E-Waste*), the amount of electronic waste generation, electronic waste management and the potential value of electronic waste recycling generated by the community which if not managed will cause a negative impact on the environment and public health of Pamengkang Village, Kramatwatu District. The type of research used is descriptive and qualitative research with research techniques using surveys. This research uses literature and field research such as interviews, observations and questionnaires. with a sample of 32 respondents, the sampling technique using *quota sampling*. research data processing was carried out using SPSS tools. Data were analyzed using univariate analysis. The results of the univariate analysis showed that the most electronic waste generated by the community was a TV as many as 7 (21.9%) and a fan as many as 7 (21.9%) and for the management of electronic waste the most done by respondents, namely electronic waste management by storing 23 (71.9%). As for the highest recycling value of electronic waste in Pamengkang Village, namely electronic materials at a price of Rp. 30,000, -.

**Keywords: Inventory, Electronic Waste (*E-Waste*), Waste Stream, Amount of Generation, Management and *Recycling***

**Abstrak** E-waste adalah seluruh benda yang termasuk dalam berbagai macam perangkat elektronik dan perkembangannya mulai dari peralatan elektronik rumah tangga berukuran besar seperti lemari es, AC, telepon seluler, sistem stereo, dan perangkat elektronik konsumtif lainnya, hingga komputer yang dibuang oleh pemiliknya. . Penelitian ini bertujuan untuk mengetahui potensi jumlah barang elektronik bekas (E-Waste), jumlah timbulan sampah elektronik, pengelolaan sampah elektronik dan nilai potensi daur ulang sampah elektronik yang dihasilkan oleh masyarakat yang apabila tidak dikelola akan menimbulkan dampak negatif bagi masyarakat. lingkungan hidup dan kesehatan masyarakat Desa Pamengkang Kecamatan Kramatwatu. Jenis penelitian yang digunakan adalah penelitian deskriptif dan kualitatif dengan teknik penelitian menggunakan survei. Penelitian ini menggunakan penelitian kepustakaan dan lapangan seperti wawancara, observasi dan kuesioner. dengan sampel sebanyak 32 responden, teknik pengambilan sampel menggunakan kuota sampling. pengolahan data penelitian dilakukan dengan menggunakan alat SPSS. Data dianalisis menggunakan analisis univariat. Hasil analisis univariat menunjukkan bahwa sampah elektronik yang paling banyak dihasilkan oleh masyarakat adalah TV sebanyak 7 (21,9%) dan kipas angin sebanyak 7 (21,9%) dan untuk pengelolaan sampah elektronik paling banyak dilakukan oleh responden. yaitu pengelolaan sampah elektronik dengan cara menyimpan 23 (71,9%). Adapun nilai daur ulang sampah elektronik tertinggi di Desa Pamengkang yaitu bahan elektronik dengan harga Rp. 30.000,-.

**Kata kunci : Inventarisasi, Sampah Elektronik (E-Waste), Pembuangan Sampah, Jumlah Timbulan, Pengelolaan dan Daur Ulang**

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## Introduction

The use of electronic equipment will increase along with the increase in population and the development of electronic equipment technology. This increase results in an increase in e-waste as well. E-waste is becoming one of the fastest growing waste streams in the world both in terms of quantity and toxicity and is growing at a rate of 3-5 percent per year or about three times faster than normal household waste generation (Schwarzer, 2005).

Data released by the *United Nations University* together with the *International Telecommunication Union* (ITU) and the *International Solid Waste Association* (ISWA) in their research, *The Global E-Waste Monitor 2017 Quantities, Flows and Resources*, said that electronic waste generated by the Indonesian population was estimated at 1.274 million tons or an average of 4.9 kilograms per capita throughout 2016. (Electroniques, 2004). However, only a small portion is recycled and according to research from the *United Nations University*, on a global scale. By 2018, it is estimated that the amount of e-waste will continue to grow, reaching 49.8 million tons, with a growth rate of 4%-5%. The consumptive attitude of society towards the use of electronic goods has resulted in an increase in the amount of e-waste generated (Chung et al., 2011).

In Indonesia, electronic waste (*e-waste*) is classified into hazardous and toxic waste (B3) and refers to Government Regulation No. 101/2014 on the Management of Toxic and Hazardous Waste due to its content. However, this regulation only regulates in general and does not specifically regulate the definition, criteria or flow of e-waste management. This classification is due to the content in e-waste, for example, heavy metals such as cadmium, chromium, lead, mercury, nickel, selenium, and other heavy metals. Heavy metals and compounds present in e-waste can endanger health because they are toxic, carcinogenic (causing cancer) and mutagenic (causing congenital defects). Public awareness of the problem of *e-waste* in Indonesia is relatively underdeveloped. From the results of research in developing countries including Indonesia, *E-Waste is* not found in waste landfills. According to Astuti (2011) in the developing countries of Indonesia, there is a high amount of repair and reuse activities of used electronic goods. Repair shops can be found in the *secondhand* sector. Workers in these shops look for broken or unused components and replace them with new, locally made components. Uncontrolled reuse by the informal sector can have health and environmental impacts. Whereas in Rahmadani (2019) also mentioned that typical *E-Waste recycling* in Indonesia is backyard *recycling*, which is carried out by the informal sector, generally by unskilled workers using methods that endanger human health and pollute the environment.

Based on the description above, research is needed related to the study of electronic waste inventory systems *(E-Waste)* from the household sector with research locations in Pamengkang Village, Kramatwatu District, Serang Regency**.** This research aims to determine the electronic waste management inventory system with data on electronic waste flow patterns, amount and potential generation, and to determine the potential for recycling electronic waste from households.

## Research methods

This research was conducted descriptively and qualitatively. Descriptive research is used to explain the potential amount of used electronic goods (*E-waste*) in the community which if not managed will cause negative impacts on the environment and public health. While qualitatively this research explains that the characteristics of people & apos;s behavior in consuming used electronic goods (*E-waste*) influence the flow of material.

UJoST
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Vol. 2 No. 2 (2023)

The variables that are important in this research are the population, the amount of used electrical goods (*E-Waste*), the type of electronic goods, the number and weight of each electronic goods and the average age of each electronic goods. In addition, through the interview process, *customer behavior* and *customer characteristics* can be identified. Indicators of this community behavior are determining needs or problems, searching for information, evaluating alternatives, buying decisions and post-purchase behavior.

This research was conducted in November 2022 - February 2023 on housewives in Pamengkang Village RT 02 RW 03 Pamengkang Village, Kramatwatu District, Serang-Banten. The population in this study were 126 respondents and the sample in this study were 32 respondents. The method used for data collection in this study was using questionnaires and direct interviews with housewives in Pamengkang Village. The sampling technique was carried out by means of a *simple random sampling* technique, namely random or random sampling (Sugiono, 2016). Data processing in this study used the SPSS application to obtain results from respondents & apos; answers using univariate analysis. In this study there are two types of data needed, namely primary data and secondary data. Primary data is obtained from direct interviews with respondents, while secondary data is obtained from *text books*, journal reviews and previous research.

## Result and Discussion

### A. Univariate Analysis

Table. 1 Frequency Distribution of E-Waste Inventory System *(E-Waste)* from Households in Pamengkang Village, Kramatwatu District, Serang Regency

| Variables | Frequency | Percentage |
|---|---|---|
| **TV** | | |
| None | 25 | 78,1% |
| Available | 7 | 21,9% |
| Total | 32 | 100% |
| | | |
| ***Mobile*** | **Frequency** | **Percentage** |
| None | 26 | 81,3% |
| There is | 6 | 18,8% |
| Total | 32 | 100% |
| | | |
| **Fan** | **Frequency** | **Percentage** |
| None | 25 | 78,1% |
| Available | 7 | 21,9% |
| Total | 32 | 100% |

UJoST
e-ISSN: 2962-9179
Universal Journal of Science and Technology
Vol. 2 No. 2 (2023)

| Iron | Frequency | Percentage |
|---|---|---|
| None | 27 | 84,4% |
| There is | 5 | 15,6% |
| Total | 32 | 100% |

| *Rice Cooker* | Frequency | Percentage |
|---|---|---|
| None | 29 | 90,6% |
| Available | 3 | 9,4% |
| Total | 32 | 100% |

| Refrigerator | Frequency | Percentage |
|---|---|---|
| None | 31 | 96,9% |
| There is | 1 | 3,1% |
| Total | 32 | 100% |

| *AC* | Frequency | Percentage |
|---|---|---|
| None | 27 | 84,4% |
| Available | 5 | 15,6% |
| Total | 32 | 100% |

| *DVD/VCD* | Frequency | Percentage |
|---|---|---|
| None | 28 | 90,3% |
| There is | 3 | 9,7% |
| Total | 32 | 100% |

| Washing Machine | Frequency | Percentage |
|---|---|---|
| None | 29 | 90,6% |
| Available | 3 | 9,4% |
| Total | 32 | 100% |

| Laptop | Frequency | Percentage |
|---|---|---|
| None | 29 | 90,6% |
| There is | 3 | 9,4% |
| Total | 32 | 100% |

| *Mouse* | Frequency | Percentage |
|---|---|---|
| None | 30 | 93,8% |
| Available | 2 | 6,3% |
| Total | 32 | 100% |

UJoST
e-ISSN: 2962-9179
Universal Journal of Science and Technology
Vol. 2 No. 2 (2023)

| Computer | Frequency | Percentage |
|---|---|---|
| None | 29 | 90,6% |
| There is | 3 | 9,4% |
| Total | 32 | 100% |

| Dispenser | Frequency | Percentage |
|---|---|---|
| None | 29 | 90,6% |
| Available | 3 | 9,4% |
| Total | 32 | 100% |

| Blender | Frequency | Percentage |
|---|---|---|
| None | 28 | 87,5% |
| There is | 4 | 12,5% |
| Total | 32 | 100% |

| Printer | Frequency | Percentage |
|---|---|---|
| None | 28 | 87,5% |
| Available | 4 | 12,5% |
| Total | 32 | 100% |

| *Telephone* | Frequency | Percentage |
|---|---|---|
| None | 30 | 93,8% |
| There is | 2 | 6,3% |
| Total | 32 | 100% |

| *Microwave* | Frequency | Percentage |
|---|---|---|
| None | 29 | 90,6% |
| Available | 3 | 9,4% |
| Total | 32 | 100% |

| Camera | Frequency | Percentage |
|---|---|---|
| None | 29 | 90,6% |
| Available | 3 | 9,4% |
| Total | 32 | 100% |

| Radio | Frequency | Percentage |
|---|---|---|
| None | 29 | 90,6% |
| There is | 3 | 9,4% |

UJoST
e-ISSN: 2962-9179
Universal Journal of Science and Technology
Vol. 2 No. 2 (2023)

| | | |
|---|---|---|
| Total | 32 | 100% |

| **Lights** | **Frequency** | **Percentage** |
|---|---|---|
| None | 27 | 84,4% |
| Available | 5 | 15,6% |
| Total | 32 | 100% |

| **Vacuum Cleaner** | **Frequency** | **Percentage** |
|---|---|---|
| None | 31 | 96,9% |
| There is | 1 | 3,1% |
| Total | 32 | 100% |

| **Hairdryer** | **Frequency** | **Percentage** |
|---|---|---|
| None | 31 | 96,9% |
| Available | 1 | 3,1% |
| Total | 32 | 100% |

| ***Mixer*** | **Frequency** | **Percentage** |
|---|---|---|
| None | 31 | 96,9% |
| There is | 1 | 3,1% |
| Total | 32 | 100% |

*Source: Primery Data, 2023*

Table 2. E-waste management after disuse from households in Pamengkang Village, Kramatwatu Sub-district, Serang Regency

| **Variables** | **Frequency** | **Percentage** |
|---|---|---|
| **Transferred** | | |
| No | 31 | 96,9% |
| Yes | 1 | 3,1% |
| Total | 32 | 100% |
| | | |
| **Fixed** | **Frequency** | **Percentage** |
| No | 24 | 75,0% |
| Yes | 8 | 25,0% |
| Total | 32 | 100% |
| | | |
| **For sale** | **Frequency** | **Percentage** |
| No | 25 | 78,1% |
| Yes | 7 | 21,9% |
| Total | 32 | 100% |

UJoST
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Universal Journal of Science and Technology
Vol. 2 No. 2 (2023)

| | | |
|---|---|---|
| **Discarded** | **Frequency** | **Percentage** |
| No | 27 | 84,4% |
| Yes | 5 | 15,6% |
| Total | 32 | 100% |
| | | |
| **Saved** | **Frequency** | **Percentage** |
| No | 9 | 28,1% |
| Yes | 23 | 71,9% |
| Total | 32 | 100% |

*Source: Primery Data, 2023*

The discussion in this study explains what types of *e-waste are* owned by respondents, how much *e-waste* waste is generated and how *e-waste is* managed.

Waste generation in landfills is a problem in itself such as problems with health, pollution and the beauty of the environment. Waste generation continues to increase along with population growth, not only in terms of quantity, but the quality or composition of waste is also increasingly diverse due to changes in people & apos;s lifestyles and economic growth. The volume of waste generation also causes problems in various aspects such as environmental, social and economic. In addition to causing environmental pollution, accumulated waste also increases the production of methane gas from waste (Yusuff et al., 2021).

Based on data from the Environmental Service of Serang Regency, the population of Serang Regency in 2021 reached 1,622,630 people. If it is assumed that each person produces 2.25 liters of waste/person/day, then the waste generation in Serang Regency reaches 3,650.92 m3 of waste every day. The amount of waste handled in Serang Regency has only reached 8.2%. (Dinas Lingkungan Hidup Kabupaten Serang, 2022).

Based on data from the Central Bureau of Statistics of Serang Regency, the total population of Pamengkang Village in 2021 is 5059 people. According to Environmental Agency of Serang Regency (2022) in SNI 3242, 2008, the unit of waste generation is 2.25 liters/person/day. From these data, it can be calculated that the potential result of household waste generated in Pamengkang Village in 2021 is 11.38 m3 / day. Meanwhile, the hazardous waste generated is 0.099 kg/person/day from the household waste generated (SNI 19-3694-1994).

Data released by the *United Nations University* together with the *International Telecommunication Union* (ITU) and the *International Solid Waste Association* (ISWA) in their research, The Global E-Waste Monitor 2017 Quantities, Flows and Resources, said that electronic waste generated by the Indonesian population was estimated at 1.274 million tons or an average of 4.9 kilograms per capita throughout 2016. But only a small portion is recycled. And based on research from the *United Nations University*, on a global scale, in 2018 it is estimated that the amount of electronic waste will continue to grow to 49.8 million tons, with a growth rate of 4%-5%. When viewed from the population of Pamengkang village, it can be estimated that the estimated waste generation in 2023 is 20.18 kg / KK.year. The consumptive attitude of people towards the use of electronic goods has resulted in an increase in the amount of electronic waste generated. (Cui & Zhang, 2008). The source of *e-waste* in Indonesia comes from domestic consumption, namely the large use of electronic devices at the household scale. Currently, in addition to the absence of specific regulations governing electronic waste in

Indonesia, the knowledge of the Indonesian people about electronic waste is still very minimal both in terms of impact and management so that most electronic waste is still combined with other domestic waste.

Based on the results of the questionnaire distribution, the electronic goods owned by each house in Pamengkang Village are refrigerator, washing machine, iron, blender, fan, *rice cooker,* mobile phone, television, lamp, air conditioner, *microwave*, *hairdryer*, *mixer, vacuum cleaner,* printer, landline, camera, laptop, mouse, computer, dispenser, radio, *microwave* and *hairdryer*.

The problem of e-waste management for countries with few industries that do not have proper waste management infrastructure is also increasingly pressing. Informal recyclers, operating under substandard working conditions, are major players in many developing countries. The infamous e-waste specialty recycling sites in Agbogbloshie, Ghana and Guiyu, China are extreme examples of improper e-waste recycling resulting in severe air, water, and soil pollution (Rahman, 2022).

According to the provisions of PPPSS, Electronic Waste is a specific type of waste that contains Hazardous and Toxic Materials (B3), which are harmful to humans and the environment if not managed properly. Explicitly, the provisions of PPPSS have defined Hazardous and Toxic Substances, hereinafter abbreviated as B3, as substances, energy and/or other components that due to their nature, concentration and/or amount, either directly or indirectly, can pollute and/or damage the environment, and/or endanger the environment, health, and the survival of humans and other living things.

Currently, according to the 2020 Global E-Waste Monitor annual report released by the United Nations (UN), the amount of electronic waste in 2019 reached 53 million tons. It is predicted that the amount of e-waste will reach 74 million tons by 2030, and jump again to 120 million tons by 2050. Ironically, only 17.4% of this e-waste, which contains a mixture of hazardous substances and valuable materials, can be collected, processed and recycled properly. (Forti et al., 2020).

Meanwhile, Indonesia, according to the UN, produced around 1.6 million tons (1,618) of e-waste in 2019. According to the Directorate General of Waste Management, Hazardous Waste and Toxic Substances (Ditjen PSLB3), Ministry of Environment and Forestry (KLHK), it is estimated that e-waste generation in 2021 will reach 2 million tons.

The volume or amount of e-waste generated has been increasing rapidly, which is exacerbated by illegal exports and inappropriate donations of electronic equipment, especially computers, from developed to developing countries. At least 25% of e-waste is recycled in formal recycling centers with adequate worker protection. The health consequences of direct exposure during recycling and indirect exposure through environmental contamination are potentially severe, yet still poorly studied. Although policy frameworks aimed at protecting vulnerable communities are in place, they are not effectively implemented. (Rahman, 2022).

Based on questionnaire data that has been conducted on 32 respondents, the results show that the method of electronic waste management in Pamengkang Village, namely as many as 3.1% of respondents convert electronic goods that cannot be used, 25% of respondents repair damaged electronic goods, 15.6% dispose of electronic goods that cannot be used and 71.9% of houses store electronic goods that cannot be used.

## Conclusion

Based on the results of the research that has been carried out, several things can be concluded, namely:

1. The estimated amount of electronic waste generation from households in Pamengkang Village in 2023 is 20.18 kg/KK.year. Based on the results of the questionnaire distribution, the electronic goods owned by each house in Pamengkang Village are refrigerator, washing machine, iron, blender, fan, *rice cooker,* cellphone, television, lamp, air conditioner, *microwave*, *hairdryer*, *mixer, vacuum cleaner,* printer, landline, camera, laptop, mouse, computer, dispenser, radio, *microwave* and *hairdryer*.
2. The methods used to manage e-waste from households in Pamengkang Village are 3.1% converted, 25% repaired, 15.6% disposed and 71.9% stored.

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