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Public Perception of Electronic Waste as an Increase in Environmental Awareness

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Abstract: ***Electronic waste management has been a problem for a quite long time. Referring to Government Regulation No. 27 of 2020, it is important to provide education on the management of electronic waste generated by households. Specific waste is classified as B3 waste which requires special management. This study focuses on the management of electronic waste generated by households in Malang City. The flow of waste from households was measured from the disposal, repair, or donation process using questionnaires and interviews. This study involved electronic waste collectors participating in the survey on electronic waste collection. Demographically, educational background and household income do not influence the reduction of electronic waste accumulation by the type of waste disposed of and the treatment.***
Keywords: Electronic waste, household, electronic waste education, B3 specific waste, electronic waste collectors

I. INTRODUCTION

Advanced technological development influences the accumulation of electronic waste. Besides offering convenience in daily activities, technological development affects the environment due to its electronic waste. The Ministry of Environment and Forestry (KLHK) reported that electronic waste in Indonesia reached 2 million tons in 2021. The annual report by the United Nations from the 2020 Global E-Waste highlighted that electronic waste reached 53 million tonnes. The volume of electronic waste is estimated to increase to 74 million tons in 2030. A report by United Nations University entitled "The Global E-Waste Monitor" stated that electronic waste is all electronic devices with unused parts disposed of without the intention of recycling. Types of electronic waste include laptops, computers, televisions, smartphones, refrigerators, fans, and others. Based on the Government Regulation No. 27 of 2020 with the reference to Specific Waste Management (PPPSS) [1], electronic waste is electronic devices operated using batteries or electricity that are not used anymore. Article 2 paragraph (4) in Law No. 18 of 2008 states that specific waste is waste containing B3 (Hazardous Toxic Materials) [2]. B3 is a concentration that is, directly and indirectly, toxic to the environment and health. In Indonesia, electronic waste is generated from domestic consumption, namely the use of electronic devices on a household scale [3]. Besides, this country does not have special regulations governing electronic waste and the public knowledge of electronic waste is still limited. Thus, most people still mix electronic waste with other domestic waste [4]. They sell electronic waste generated from domestic consumption to electronic waste collectors in their surrounding area. Meanwhile, if the device can still be repaired, it will be sent to electronic service business [5]. Malang City Government does not have proper regulations [6] for managing the electronic waste generated by the community in this city. This study focuses on the identification of the basic flow of processing and reuse of electronic waste components [7]. The problem in this study is the management of small-scale waste processing by selling, repairing, and donating used electronic devices. This study aims to determine household electronic waste processing based on demographic data of the Malang City community with low, medium, and high-income conditions.

II. METHODS

This study used a descriptive qualitative approach with a case study design [8]. The material was in the form of samples from interviews and observations on households, electronics waste collectors, and electronics service business in Malang City. This case study [9] aims to identify the basic processing of electronic waste. This study was conducted in Dinoyo and Ketawang Gede Subdistricts, Malang City from May to June 2023. Data were collected from the results of surveys, interviews, and questionnaires which were distributed to households, electronic waste collectors, and electronic service business. Questionnaire data were analyzed descriptively to get an overview of the number, type, and condition of electronic waste generated by household respondents and the waste treatment carried out by the electronic waste collectors and electronic service business. Interviews data obtained from the electronic waste collector and electronic service business were used to identify electronic waste management models and select materials that still have economic value. Recycling method and Extended Procedure Responsibility (EPR) models can reduce electronic waste. This model gives responsibility to the community in minimizing electronic waste.

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The goal of the Extended Producer Responsibility (EPR) is recovery and recycling processes. Data were collected by distributing questionnaires and interviews with the respondents. This study involved 30 respondents [10] grouped based on demographic conditions. Demographic data covered age, occupation, last education, monthly income, types of electronic waste, and its treatment. Data from the electronic waste collectors focus on the management of used waste. Data from electronic service business focus on the sorting of repaired electronic devices and components for repairing electronic devices. In the questionnaire, respondents were divided into three levels based on demographic data [11].

III. ANALYSIS AND DISCUSSION

This study involved 30 respondents. The distribution of the characteristics of the respondents is presented in Table 1 below.

TABLE I
DEMOGRAPHIC DISTRIBUTION OF RESPONDENTS

Variable	N	%
Sex		
a. Male	22	0.73
b. Female	8	0.26
Age		
a. 18-25 years	7	0.23
b. 26-36 years	8	0.26
c. 37-45 years	6	0.2
d. > 45 years	9	0.3
Education		
a. Elementary School	7	0.23
b. Junior High School	9	0.3
c. Senior High School	8	0.26
d. Diploma	3	0.1
e. University	3	0.1
Occupation		
a. Self-employed	9	0.3
b. Merchant	6	0.2
c. Laborer	7	0.23
d. Housewife	5	0.26
e. Civil servant	3	0.1
Income		
a. < Rp 500,000	8	0.26
b. Rp 500,000 – Rp 1 million	17	0.56
c. > Rp 1 million	5	0.16

Based on Table 1, most respondents (0.56%) have an income of Rp 500,000 – Rp 1 million. Self-employed respondents have the highest value than other types of work, namely (0.3%). Based on the results of the questionnaire, the type of waste owned by respondents and the waste management is presented in Fig 1 below.

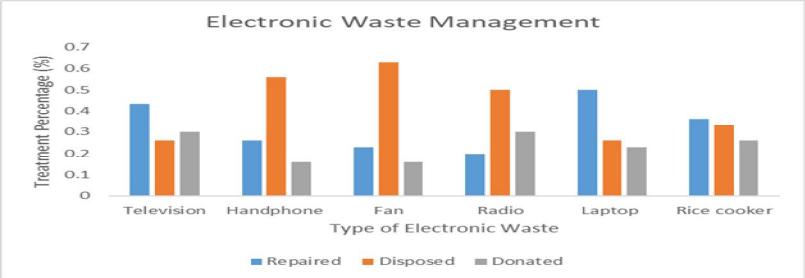


Fig 1. Electronic waste management

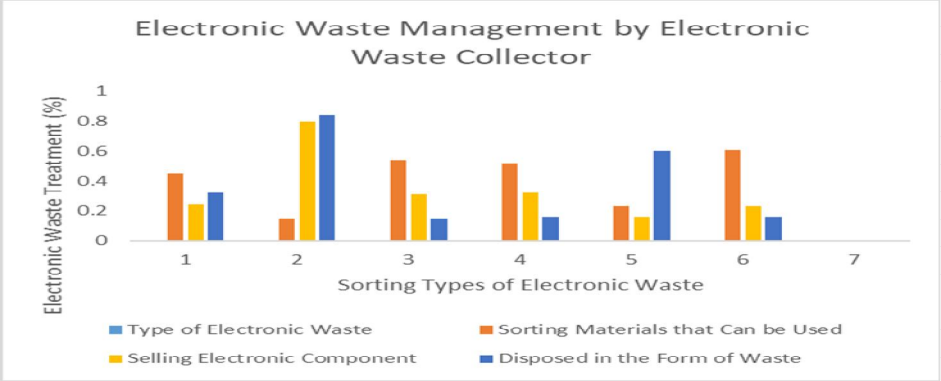


Fig 2. Electronic waste management by electronic waste collector

Based on the figure above, the electronic waste treatment between respondents and electronic waste collectors depends on the type of electronic waste. Education and occupation do not greatly affect the treatment of electronic waste. The determination of the type of waste that will be repaired or donated is based on the condition of the electronic device. The number of electronic waste disposed is not greatly influenced by the income of the respondent but the type of waste owned is in accordance with the occupation. Another influencing factor is the location of the electronic waste collectors, namely indirectly from the public and scavengers. The electronics service business only takes some components for repairs (20%) due to lower prices. Some components can still be used for repair, especially tube televisions. Based on the identification, electronic waste that can be reused is LED TV screens, components from tube TV, battery, and keyboard of handphone and laptops. The PCB waste from computer or handphone motherboards can be recycled into miniature replicas of art such as insects and robots [12] as stated by Sadah et al (2015). The treatment of electronic waste through art integration can provide functional value. Meanwhile, plastic material from electronic waste can be processed into household appliances as proposed by Budiyantoro (2023). Based on the results of the study, it can be said that the disposed amount of electronic waste will be low with the sorting of components that can be recycled. The extended producer responsibility (EPR) model was carried out under the Government Regulation No. 81 of 2012 as a derivative of Law No. 18 of 2008. However, this Government Regulation is intended for household waste management and the like. The Regional Regulation of Malang City concerning waste management specifically in Article 1 point 11 states that specific waste due to its nature, concentration, and/or volume requires special management.

IV. CONCLUSIONS

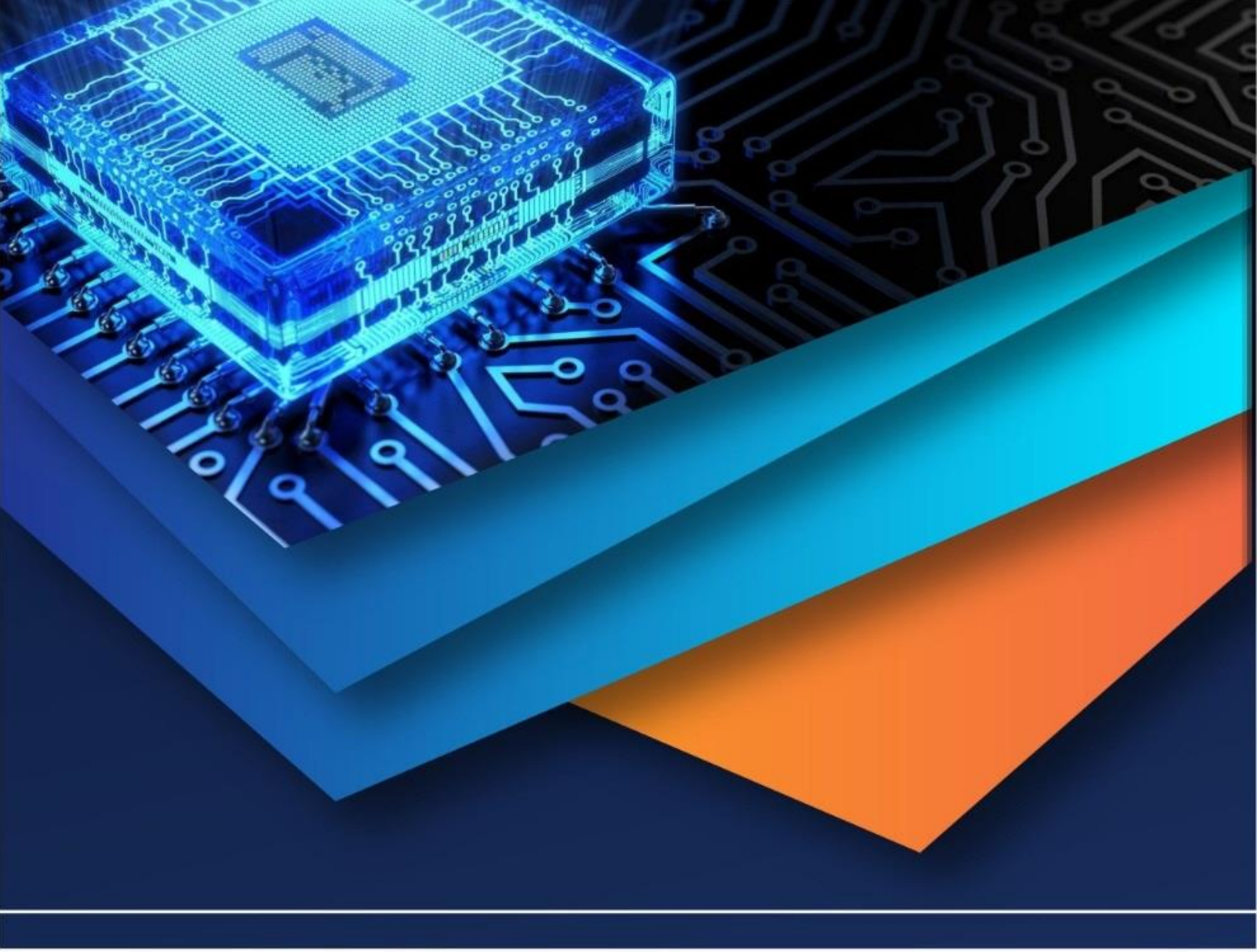
Population growth and lifestyle changes require diverse electronic devices increasing the amount of electronic waste. Electronic waste is specific waste (B3) that can pollute the environment. Thus, it is important to provide education about the dangers of disposal of mixed electronic waste and domestic waste. The utilization of electronic waste at household levels and electronic waste collectors is different but has the same treatment, namely to reduce electronic waste. Education and income affect the type of waste generated to be managed to reduce electronic waste disposal.

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