Study of Domestic Management of Electronic waste (E-waste) in Sungguminasa City, Gowa District

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Abstract: ***E-waste is the impact that results from the massive use of electronic goods in the information technology era. The increasing use of electronic goods results in greater electronic waste. The problem of garbage that has not been fully resolved is now increasing with the problem of electronic waste. This study aimed to identify the problems of domestic electronic waste in Sungguminasa City, Gowa Regency in 14 sub-districts of SombaOpu District, Gowa City with a population of 157,448 or about 1.67% of the total population of the Province of South Sulawesi. The research method was direct survey by observing and interviews in the form of e-waste characteristic data retrieval, measurement of e-waste, waste generation potential and analyzing disposal methods and potential economic value of e-waste recycling. From the results of the study, it was found that from 37 types of electronic goods, three devices refrigerators, computers and television with percentage of 17%, 14% and 26% respectively were the common wasted devices. The potential of e-waste generation in SombaOpu District as a whole obtained from 14 villages was 801 838.9 kg / year or 801.8 tons / year. The most widely applied processing method for e-waste was modification, repaired and stored with 55%, 19% and 17% respectively, while the least used e-waste processing method is disposed of at a percentage of 9%. The results of the potential analysis of the economic value of e-waste recycling from 3 electronic items that are quite high had a value of each refrigerator of Rp. 1657807, computer Rp. 2327121, and television Rp. 3625178.***

Keywords:E-waste, SombaOpu District, and e-waste management

I. INTRODUCTION

The rapid development of the electronic technology industry not only offers a variety of product choices but also a choice of prices. This provides an opportunity for the community to have electronic items in their homes as well as encourages the development of the electronic industry in Indonesia to be very fast. The growth acceleration is combined with products that are rapidly obsolete because newer generation products have appeared again. Therefore, the increasing use of electronic goods results in greater electronic waste. Waste can be characterized as being dangerous if it has one of the properties such as flammable, corrosive, reactive, and toxic (Alumur and Kara, 2007; Breivik et al., 2014 &Sthiannopkao and Wong, 2013).

Pariatamby and Victor (2012) examined the policy trends of e-waste management in Asia and deduced that e-waste management in Asia appeared to be promising as long as there is a change of perception e-waste perception as a potential opportunity for sustainable national green growth strategy instead of e-waste perception as an environmental problem. In a study of waste management practice by households in Shah Alam, Selangor, Malaysia by Kalana (2010), she found that 48% of the residents preferred to keep the electronic while another 37% chose to sell those items to second-hand equipment stores. Furthermore, majority of the households had no knowledge on where and how to dispose of electronic waste in a proper manner, thence eventually they disposed these together with other household wastes. However, in Indonesia there are no specific definitions or regulations related to e-waste. E-waste in Indonesia is classified as toxic and hazardous (B3) waste (Widyarsana, Winarsih, Damanhuri, and Padmi, 2010). E-waste in the Sungguminasa City of Gowa Regency is arguably not too popular among the community especially at the household scale considering there are no policies on how to treat e-waste. Plus there is lack of public understanding about the danger caused by this e-waste if it is not managed properly. Hence, based on the description above, this study intended to scrutinize the domestic electronic waste (e-waste) management in Sungguminasa City of Gowa District.

II. METHODOLOGY

This research was carried out in the district of SombaOpu, Gowa City which consist of 14 villages namely Pandang -andang, Sungguminasa, Batangkaluku, Kalegowa, Bontoramba, Mawang, Romangpolong, Bonto-bontoa, Tamarunang, Katangka, Tombolo, Paccinongan, Samata, Tompobalang for 1 month in March 2017. The population in this study was a household resident in SombaOpuSubdistrict which was obtained from 100 houses. In determining the number of representative research samples a statistical approach is used using the Slovin method. The primary data needed in this study were taken by questionnaires and direct interviews with related parties. In the preparation of questionnaires carried out with the stages of determining variables and designing questionnaires.

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From the formulation of existing problems, the research variables can be determined, including variables relating to electronic goods and variables related to public knowledge about electronic waste treatment methods and methods of disposal carried out by the community against electronic waste. In this study secondary data collection was collected in the form of documents from the Central Statistics Agency of Gowa Regency. These data included the form of administration of the research location and population data. The type of question is adjusted to the formulation of the research problem which is to identify the type and amount of electronic goods owned and the method of electronic waste disposal with the chosen answer questions. Data analysis techniques used are quantitative data analysis methods. Primary and secondary data that has been collected are analysed using descriptive analysis. The results obtained were analysed and presented in table form using Excel software.

III. RESULTS AND DISCUSSION

Characteristics of E-Waste in SombaOpu District

Based on the results from 100 questionnaires distributed in the study area, a percentage was obtained for each type and number of electronic items owned by the community in SombaOpu District. From the research conducted, the type and number of electronic items that are most commonly owned by the community are those used for daily needs with a percentage of more than 50%. The percentage can be seen in Figure 1. As shown in Figure 1, the main electronic goods owned by the people in SombaOpuSubdistrict are types of electronic items such as energy saving lamps (78%), handphones (52%), fans (31%), laptops (26%), televisions (26%), air conditioners (20%), irons (19%), refrigerators and blenders (17%), rice cookers (16%), computers (14%), dispensers and mixers (13%), printers (11 %) and others (10%). The total number of electronic goods which is more than 50% is 797 units.

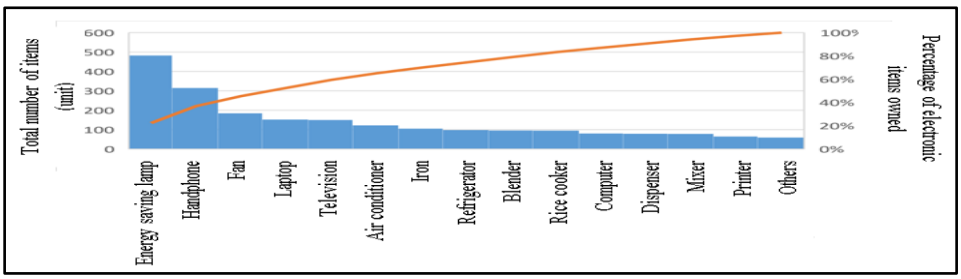

Fig. 1 Percentage of types and amount of electronic items

Potential for E-Waste Emergence in SombaOpu District

The potential for E-waste generated by each village in SombaOpu sub-district

The results of the calculation of the potential e-waste generated in SombaOpu District can be seen in Table 1. Based on the data in Table 1, it can be seen that the potential for e-waste generation in SombaOpu District in 2016 was 801.8388 kg / year. The potential for e-waste generation is mostly in Paccinongan Village, which is 133.3597 kg / year, while the lowest is in Bontoramba Village which is 35.2861 kg / year.

Table. 1 Potential of e-waste generation for each village in SombaOpu District

Village	Potential generation of e-waste			e-waste (kg/year)
	High	Medium	Low	
Pandang -pandang	12.4847	24.8829	11.2154	48.5830
Sungguminasa	11.3554	15.8356	17.5625	44.7535
Batangkaluku	12.4600	22.5345	28.0747	63.0692
Kalegowa	5.4201	28.2935	2.2394	35.9530
Bontoramba	4.1057	22.5101	8.6703	35.2861
Mawang	6.839	19.4256	9.5731	35.8377
Romangpolong	13.3042	21.6208	11.1572	46.0822
Bonto – bontoa	26.4599	18.4369	22.7582	67.6550
Tamarunang	15.3452	22.4696	24.7078	62.5226
Katangka	10.7623	19.6751	23.2154	53.6528
Tombolo	11.9345	21.4921	32.8878	66.3144
Paccinongan	93.8985	4.9672	34.494	133.3597
Samata	11.318	32.5365	6.5016	50.3561
Tompobalang	13.648	36.8037	7.9618	58.4135
Total	**249.3355**	**311.4841**	**241.0192**	**801.8388**

projection of E-Waste Generation Potential

The e-waste generation projection is an estimate of the amount of e-waste at a certain time and is used as a reference capacity
for the design of waste processing units for a certain period. In this study, waste generation projections are carried out until 2025. Calculation of projections is based on projected population using Least Square Regression method. The e-waste generation projection is obtained by multiplying the average e-waste generation generated by each person with the population of the study area as presented in Table 2. The average e-waste generation for each person in the study area is 28.7 kg / person. Based on Table 2, it can be seen that the potential for e-waste generation generated by the community in SombaOpu District in 2025 is 1066.5490 kg / year or 2.92205 kg / day.

Table. 2 Projected potential e-waste generation in SombaOpu District for 2016-2025

Year	Total population	Average e-waste generation	Potential e-waste generation (kg/year)
2016	32	28.7	918.8305
2017	33		934.1850
2018	33		949.7978
2019	34		965.6402
2020	34		981.7696
2021	35		998.1860
2022	35		1014.8320
2023	36		1031.7940
2024	37		1049.0140
2025	37		1066.5490

Household E-Waste Disposal in SombaOpu District

The 4 disposal categories referred to are described as follows.
1. Discarded (disposed of with other solid waste)
2. Repaired (Replacing damaged electronic components so they can be reused)
3. Modified (damaged electronic goods, used not according to their functions, for example refrigerators are made into tables or wardrobes)
4. Stored (damaged electronic items, stored in a warehouse or in a room and not used anymore)
Observations and interviews were conducted on 100 household respondents in the study area regarding the e-waste treatment methods they practice. The results can be seen in Table 3. With reference to Table 3, it can be seen that the most applied method of e-waste disposal is modifying with a percentage of 55%, while the smallest e-waste disposal method is discard at a percentage of 9%. This shows that there is still a lack of public knowledge regarding e-waste in the study. There are still many people in the study area who prefer to take advantage of e-waste that is owned with a different function from its previous function. Most electronic users store their electronic items and equipment, both unused and those that have been damaged for several years before selling or disposing of them.

Table. 3 E-waste disposal method in SombaOpu District

Village	Disposal method			
	Modified	Repaired	Discarded	Stored
Pandang - pandang	4	0	0	1
Sungguminasa	4	3	2	3
Batangkaluku	4	1	0	0
Kalegowa	1	1	0	0
Bontoramba	3	1	0	1
Mawang	1	3	0	0
Romangpolong	3	0	0	0
Bonto – bontoa	7	1	2	1
Tamarunang	5	2	0	1
Katangka	3	0	0	1
Tombolo	2	4	2	4
Paccinongan	12	1	2	2
Samata	2	1	1	2
Tompobalang	4	1	0	1
Total	55	19	9	17

Analysis of E-Waste Recycling Potential in Gowa City

Composition and Potential of E-Waste Recycling

The composition and recycling potential of e-waste are specific to each application. Parts or materials found in e-waste can be divided widely into the following six categories:
• Iron and steel, used for casings and frames
• Non-ferrous metals, especially copper used in cables, and aluminum
• Glass used for screens, windows
• Plastics are used as casings, cables and circuit boards
• Electronic components (LEDs, capacitors, ICs, semi-conductors, inductors, resistors etc.)
• Others (rubber, wood, ceramics etc.)
The electronic items chosen are 3 electronic items that have a large potential generation in the SombaOpu sub-district, namely refrigerators, computers and televisions. Composition and recycling potential of the 3 electronic items can be seen in Table 4.

Table.4 Composition of refrigerators, computers and television

Items	Average weight (kg)	Iron (kg)	Metal (kg)	Glass (kg)	Plastic (kg)	Electronic components (kg)	Others (kg)
Refrigerator	48.0	30.91	2.88	0.67	6.24	0.10	7.20
Computer	29.6	5.92	7.10	4.44	6.81	5.12	0.23
Television	36.2	1.92	1.95	22.44	8.29	0.33	1.27

Potential Economic Value of E-Waste Recycling

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Potential economic value of e-waste recycling for refrigerator, computer and televiosn in Gowa City is tabulated as shown in Table 5. Based on Table 5 if the e-waste is managed properly, it can be seen that the potential economic value of e-waste recycling from the 3 electronic items obtained the selling value of each of the refrigerator Rp. 5878350, computer Rp. 4325900, and television Rp. 5325050. Electronic components appeared to have a higher resale value followed by metal, glass, iron and lastly plastic with selling value of Rp. 30000, Rp. 13500, Rp. 6500, Rp. 3050 and Rp.1500 respectively. The selling value data from 5 component categories was acquired from the results of interviews with the collectors of used goods revealed that by implementing e-waste management accordingly, it could lead to considerable economic potential.

Table. 5 Potential economic value of refrigerator, computer and television recycling (based on estimated value at Gowa city)

Item	Category	Weight (kg/year)	Selling value (Rp./kg)	Economy value (Rp.)
Refrigerator	Iron	9.0	3050	27450
	Metal	289.7	13500	3910950
	Glass	27.0	6500	175500
	Plastic	6.3	1500	9450
	Electronic component (per unit)	58.5	30000	1755000
			Total	5878350
Computer	Iron	13.0	3050	39650
	Metal	75.3	13500	1016550
	Glass	90.3	6500	586950
	Plastic	56.5	1500	84750
	Electronic component (per unit)	86.6	30000	2598000
			Total	4325900
Television	Iron	16.0	3050	48800
	Metal	31.5	13500	425250
	Glass	32.1	6500	208650
	Plastic	368.9	1500	553350
	Electronic component (per unit)	136.3	30000	4089000
			Total	5325050

IV. CONCLUSION

1. The results of the identification of 37 types of electronic items found in Somba Opu Subdistrict, Gowa showed that the number of electronic items obtained by Somba Opu Subdistrict were electronic items such as 78% energy saving lamps, 52% mobile phones, 31% fans, 26% laptops , air conditioner 20%, iron 19%, and blender, 17%, rice cookers 16%, dispensers and mixers 13%, printers 11% and others 10%. Refrigerators, computers and televisions were highly used with percentages of 17%, 14% and 26% respectively. The potential for e-waste generation in the Somba Opu District as a whole was obtained from 14 villages at 801,838.9 kg / year or 801.8 tons / year.
2. The method of disposing e-waste that is widely applied is modification with a percentage of 55% and then repaired for 19% and stored with 17%, while the least used e-waste processing method is discarded with 9%.
3. The e-waste generation obtained from 3 electronic items (refrigerators, computers and televisions) has considerable economic value potential by recycling the e-waste component. The results of the analysis of the potential economic value of e-waste recycling from 3 electronic items each amounting to refrigerator Rp. 5878350, computer Rp. 4325900, and television Rp. 5325050.

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