

Utilization and management of electronic goods by different households in Cagayan de Oro City, Philippines

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Abstract. Electronic device purchases in the Philippines are increasing due to the thriving economic situation in the country. People are buying more electrical and electronic equipment (EEE) because these are made affordable and upgraded in a fast pace. Maximum utilization of EEE leads to the increasing number of e-wastes which contain hazardous materials that may occupy huge space in the landfills. Yet, there is no such specific law on e-waste available in our country today. This study was conducted in Cagayan de Oro which is considered as one of the most progressive cities in the Philippines. The objective of this paper was to determine the amount of e-wastes generated and the management practices by the households. Only households that were willing to be interviewed and participated were considered for the study. The information on knowledge level, attitude, practice on use, EEE disposal and the quantity of e-waste generated were collected using a survey questionnaire. To guarantee the high response rate, interviews were also employed. The finding shows that mobile phones and chargers were the most utilized equipment and the most e-waste generated among the EEE's. The preferred methods of e-waste disposal by the households were the following: sell to scrap dealers, keep at home or repair. Most of the households do not know where and how to dispose in a proper manner. Moreover, there is no collection mechanism in the area. Therefore, public awareness and proper management of e-wastes are necessary to minimize disposal to landfills and prevent the adverse effects of these substances to human society and to the environment.

Key Words: e-waste, management, disposal, WEEE, EEE.

Introduction. The numerous technological advances through cutting edge research and development in the electronic industry have brought various electronic devices in the global market. As technology develops rapidly at the global environment, the well-being of humanity has improved accordingly over time. Although technology has affected society and its surroundings in a number of ways, it is apparent that technology has helped develop the economy and has allowed the rise in the quality of life (Wang 2008).

Households have become heavily dependent on the use of appliances like televisions, DVD players, washing machines, refrigerators, and microwave ovens, among others, making life easier and comfortable. In terms of communication, people use cellular phones and telephones to communicate amidst the distance, while others conveniently use computers with internet connection to transfer and receive information and share their knowledge with the rest of the world.

Although electronic devices and other gadgets have been essential to humanity, people fail to consider the effects of electronic wastes once they become obsolete and eventually damaged. In this regard, household electronic wastes (e-wastes) management is becoming a major problem. E-wastes occupy substantial space in the landfill and are not biodegradable. Besides, they also contain toxic and hazardous wastes which may contaminate surface and groundwater (Widmer et al 2005). Moreover, only a few are aware of the dangers of electronic wastes and government agencies do not have official

records or information available on domestic generation, collection and disposal of e-wastes in the country. Additionally, there is no specific law on e-waste which is available in our country today. According to Mañalac (2008) major problems on finding a suitable location for the disposal of e-wastes have been experienced.

Material and Method. This study was conducted on January 2011 in Cagayan de Oro City, which is considered as one of the most progressive cities in the Philippines. The target populations in this study were the households, which were the consumers of electrical and electronic equipment and at the same time who were considered as contributors in generating e-wastes. They were selected as respondents because they are the ones who store, exchange, repair, sell, refurbish or dispose these products when they are no longer usable. The respondents would be any member of the family as long as he or she had the knowledge about the electronic goods that they are utilizing as well as the management practices they apply on e-wastes. But only households that were willing to be interviewed and participated were considered. The information on knowledge level, attitude, practice on use, EEE disposal and the quantity of e-waste generated were collected using a survey questionnaire. To guarantee a high response rate, interviews were also employed.

Results and Discussion

Current use of electrical and electronic equipment. Figure 1 shows that the mostly used electrical and electronic equipment are those that are usually found in the households such as mobile phones (23.6%), mobile phone chargers (18.7%), electric fans (10.5%), televisions (8.5%), DVD/VCR/CD players (6.9%), iron (6.1%), refrigerators (5.2%), washing machines (4.1%), personal computers (2.2%), heaters (2.1%), mp3s (1.9%), cameras (1.6%), and air conditioners (1.2%).

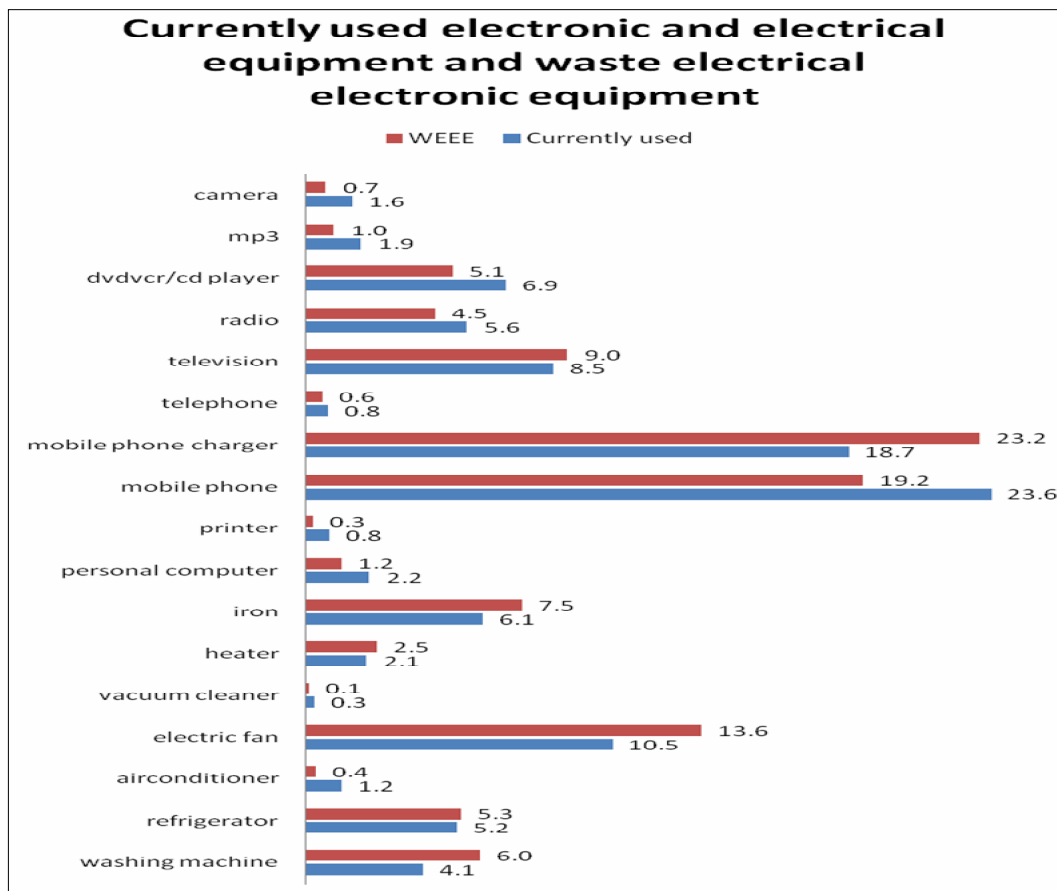


Figure 1. Currently used electrical and electronic equipment shown in blue color and electrical electronic waste shown in red color (in percentage).

The study revealed that the most utilized electrical and electronic equipment by the respondents are those related to telecommunications such as mobile phones. The market trend and demand for mobile phones and their chargers are both increasing since many upgraded gadgets offered in the market come at affordable prices. Because of these, people are persuaded to buy even if their gadgets are still functioning. Some respondents utilized gadgets which are related to entertainment such as televisions and DVD players. In addition, appliances which provide convenience and comfort in doing household chores like washing machine, air conditioners, and electric fans are likewise used in the households. Although consumers purchased these products to satisfy their needs and wants, these products would eventually become obsolete and be disposed. In this regard, proper e-waste management and disposal become essential.

Status of waste electrical and electronic equipment (WEEE) or e-wastes. Figure 1 shows the status of wastes in the electrical and electronic equipment or e-waste generated by the respondents. As observed, most of the e-wastes generated were mobile phone chargers (23.2%), mobile phones (19.2%), electric fans (13.6%), televisions (9.0%), iron (7.5%), washing machines (6.0%), refrigerators (5.3%) and DVD/CD players (5.1%), respectively. These electrical and electronic equipments are most commonly found in the households. Mobile phone chargers have the highest e-waste generated in terms of number even though mobile phones were the most generated EEE. The reason would be that the mobile phone chargers have shorter life spans compared to the mobile phones. Additionally, many mobile phone chargers could be used for six to twelve months and after that they were disposed and replaced with new ones despite the quality and durability of the product. Majority of the respondents are able to own more than one type of electrical and electronic equipment or multiple units of the same type of equipment because of their affordable prices. In this regard, the usefulness of the old gadgets had become shorter in favor of the new ones. It can be assumed that the disposal of electronic products is fundamentally driven by the production of new ones.

On the other hand, televisions, washing machines and refrigerators have longer life spans, but comprise the highest generated e-wastes in terms of volume since they are considered as bulky wastes. Increased demand and use of electrical and electronic equipment on a daily basis in the households indirectly resulted to the increase in the generation of e-wastes.

The accumulation of e-wastes in the waste stream is continuously increasing. These rapidly growing e-waste streams present additional difficulties because a wide range of hazardous chemicals are used in electrical and electronic devices (Widmer et al 2005). This would generate more toxic substances from e-waste which pose hazard to human health and environment (Deng et al 2007). As a result, there is a need for proper management and disposal of household e-wastes in Cagayan de Oro.

Estimation of e-waste potential per year. The estimation of the total WEEE potential for one year in the different households of Cagayan de Oro City was calculated through the consumption and use method of (Bureau B&G 1993). The average weight, life span, penetration rate of equipment and the total number of households are the parameters needed for this method. Penetration rate, average weight, average life span of EEE were obtained from related studies as shown below Table 1, while the total number of households in Cagayan de Oro City was obtained from the National Statistics Office (NSO 2007). Table 1 shows the annual e-wastes generated by the households in Cagayan de Oro City totaled to 1,165,885.81 kgs or 1,165.89 tons. It is projected that in five years time e-waste generation in Cagayan de Oro City will have reached 5,829,429.05 kgs or 5,829.42905 tons.

Table 1

Estimation of WEEE

Type of EEE	Average weight (kg)	Lifespan (Isn)	Penetration rate (rn)	Total households hh ¹⁰	WEEE generated/year (kg/yr)
Mobile Phones	0.1 ¹	5.0 ²	91.00% ⁸	120,414	2,191.53
DVD	5.0 ⁷	3.0 ¹¹	96.20% ⁸	120,414	193,063.78
Laptop/Notebook PCs	3.5 ⁴	3.0 ³	27.40% ⁸	120,414	38492.34
Desktop PCs	27.2 ²	10.0 ²	56.80% ⁸	120,414	184,666.91
Digital camera	0.3 ¹¹	2.7 ⁶	67.60% ⁸	120,414	9,044.43
Refrigerators	30.0 ²	10.0 ²	97.00% ⁸	120,414	350,404.74
Microwaves	15.0 ⁷	9.0 ⁵	56.40% ⁸	120,414	113,189.16
Air conditioners	20.0 ¹¹	10.0 ⁵	56.20% ⁸	120,414	135,345.34
Television (CRT)	24.0 ²	15.0 ²	72.4% ⁹	120,414	139,487.58
TOTAL					1,165,885.81

¹Prasanna et al (2007); ²Sañez (2010); ³Strother et al (2012); ⁴Mmereki et al (2012); ⁵Appliance Magazine (2005); ⁶Graham (2007); ⁷Huisman et al (2008); ⁸HAKUHODO Global Habit Survey (2008); ⁹ITU World Telecommunication (2010); ¹⁰National Statistics Office (2007); ¹¹Estimate based on the actual equipment.

Electronic waste management practices. Figure 2 shows the most preferred methods of e-waste disposal by Cagayan de Oro residents. Majority of the respondents managed their e-wastes by selling them to scrap dealers (25.5%), keep them at home (25.5%), or have them repaired (24.5%).

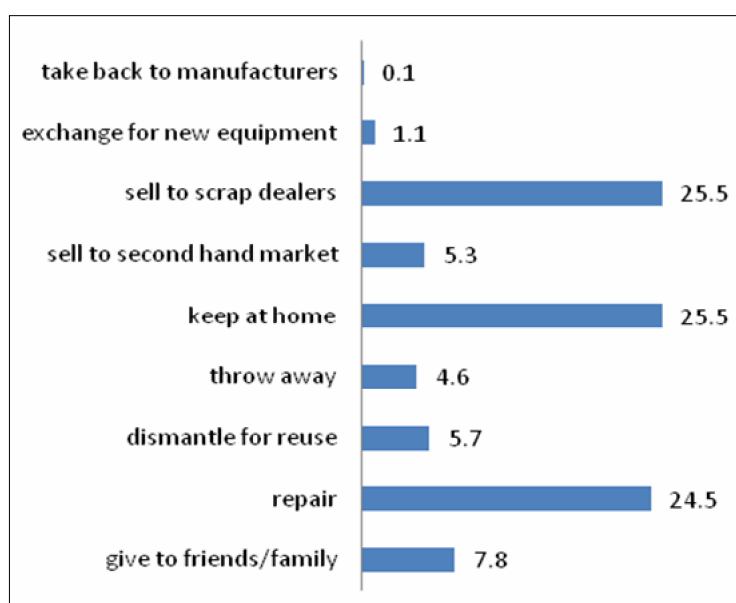


Figure 2. Disposal methods of electronic wastes (in percentage).

Storing was the most common practice in managing e-wastes of most residents. E-wastes such as televisions, refrigerators, washing machines and mobile phones were the most outdated electronic products that were stored in their homes. They kept them for one to three years before they would dispose them because they do not know where and how to dispose them since there was no collection facility in the area for these products. Respondents made an initiative on how they could make obsolete electronic products become usable while they are stored in their households. Damaged refrigerators were reused as a cabinet for stockpiling of cleaned clothes. They were also utilized as garbage bins. Moreover, damaged washing machines were reused for storing dirty clothes. However, most of the respondents stored their equipment in their homes for decoration

purposes and for sentimental reason attached to them. Some households also place these products in the backyard waiting for a scrap dealer to collect and buy them. On the contrary, some people did not have a desire to store their obsolete electronic products in their homes because they occupy more space and are already useless. They preferred to give them to their relatives and friends, but some people preferred to repair the equipment and utilize them again. In this way, obsolete electronic products would become usable and their life spans extended thus preventing them from being disposed to the landfill.

However, majority of them were sold to scrap dealers. The respondents think that it is better to sell these equipments rather than throw them away because they could earn extra money. In this manner, it could be a good practice of properly managing e-waste since the valuable materials were extracted and become raw materials for the manufacture of new products. But people employed in extracting valuable materials should wear personal protective equipment (PPE) in handling manually the electronic equipment. Additionally, recycling e-waste through dismantling and getting all the valuable materials such as plastics and metals are also considered as a good practice. This minimizes the accumulation of e-wastes in the waste stream. However, there are problems encountered in doing these practices since the country do not have sufficient capability and available technology in treating all the hazardous parts from dismantling, extracting and repair of EEE. The least options practiced by respondents for the disposal of these e-wastes were throwing (4.6%) as household wastes outside their premises or directly to the landfill, exchange them for new equipment (1.1%) or take them back to the manufacturers (0.1%). The reason for this is that these people do not have the knowledge on how and where to dispose their e-wastes.

One of the environmental concerns in many developing countries as urbanization continues to take place is the management of electronic wastes. Utilizing and managing their electronic equipment will depend on the attitudes and practices of different people (Kalana 2010).

Figure 3 shows the reasons for the disposal of e-wastes. Most of the respondents disposed their EEE because they were malfunctioning or there were technical problems when using the items (36%). The next reason was the equipments were outdated (27.4%) and people wanted to keep with the latest trends (24.6%). Furthermore, new products offer better features and more fashionable designs with affordable prices in the market. Unfortunately, some respondents (5%) favored to buy new products since they are cheaper than to repair the old ones (6.0%).

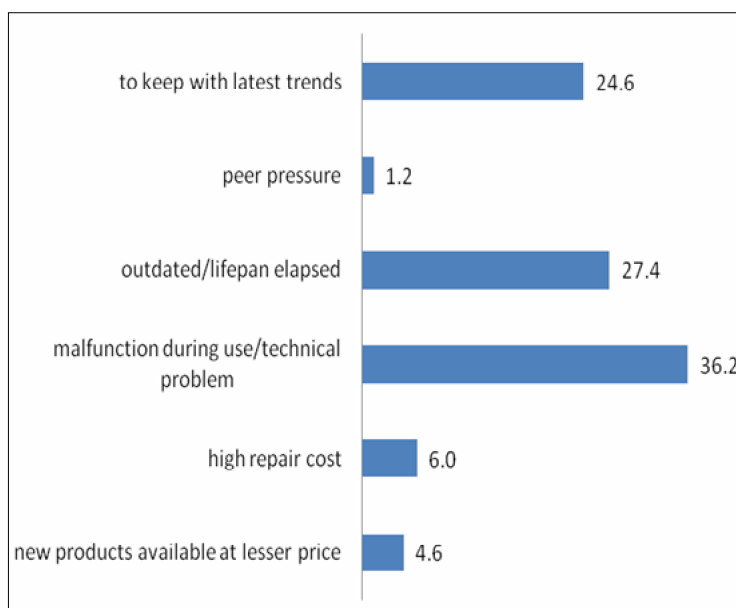


Figure 3. Reasons for disposal of electronic wastes (in percentage).

These reasons would affect the life spans of all consumer electronic products because of the utilization of the new ones even though that the equipment were still functional. However, William et al (2008) reported that the purchase of new equipment is driven not due to breakage of the electronic equipment but by the desire to update new software or other functionality. According to Kalana (2010), it is often much cheaper and more convenient to buy a new machine to accommodate newer generation of technology than it is to upgrade an outdated machine. These are the factors why the life spans of electronic equipment became shorter and shorter with the passing of time.

Level of awareness and knowledge on e-waste. Figure 4 indicates that majority of the respondents had a good knowledge (60.9%) on e-wastes. They had knowledge about e-wastes and their impact to the environment and to the human health. However, they do not know where and how to dispose the e-waste since there is no existing facility for collection or drop-off of e-wastes in the vicinity. The respondents kept their obsolete EEE or sell them to the scrap dealers in order to earn extra money rather than throwing them away to the trash bins.

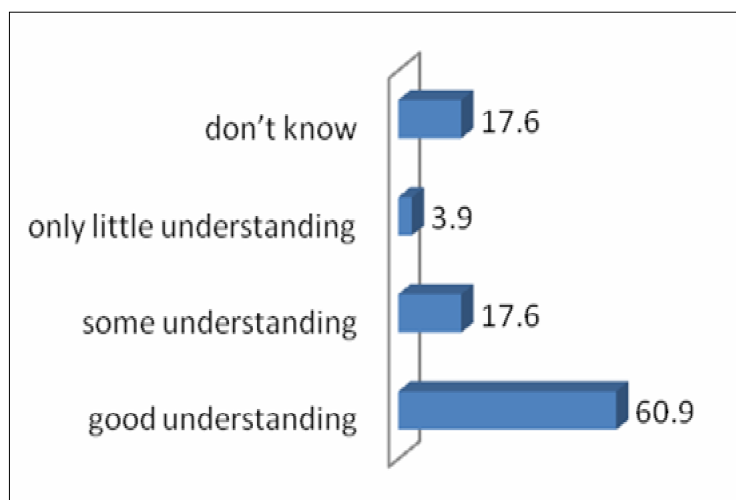


Figure 4. Level of awareness and knowledge on e-waste (in percentage).

Figure 5 reveals that 44% of the respondents were definitely happy to utilize the collection or drop off area if present in their vicinity, 42% would probably use it, and the remaining 14% were not using the services offered in collecting waste electrical and electronic equipment. Currently, there is no structured mechanism on how to handle the e-waste practices in the households of Cagayan de Oro City.

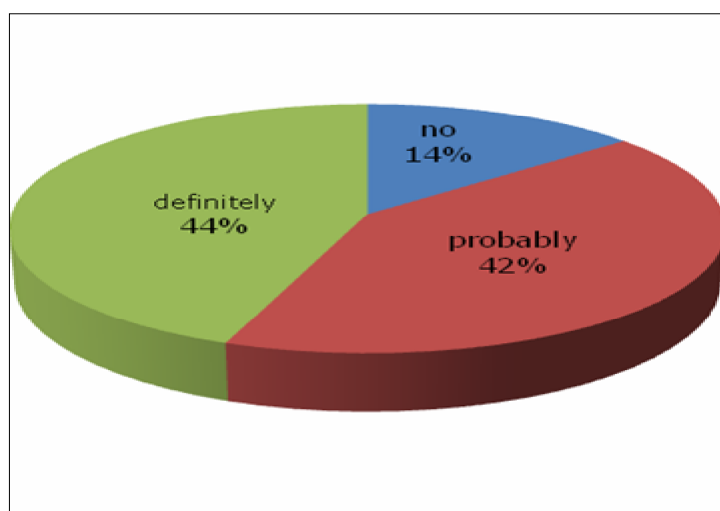


Figure 5. Use of collection/drop-off facility if present.

Regulations and legislations on e-waste. A number of different legislative measures has been formulated to deal with the growing problem of e-wastes worldwide. These legislations include take-back manufacturing, imposing recycling fees, disposing e-wastes properly, and many others. The legislation that controls the transboundary movement of e-wastes among countries is the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. This is the most comprehensive global environmental agreement on hazardous and other wastes. It aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movement, and disposal of hazardous and other wastes. This convention was established to prevent the dumping of hazardous wastes from first-world to developing countries (UNEP 2011).

The European Union enacted the Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) Directives, which require electronic manufacturers to manage their own e-wastes and reduce their use of toxic chemicals. The WEEE Directive aims to prevent the generation of electrical and electronic wastes and to promote re-use, recycle and other forms of recovery in order to reduce the quantity of wastes discarded. It also takes a stand for the restrictions of the use of certain hazardous substances in electrical and electronic equipment.

With this global framework, it is aimed that e-wastes will be managed and controlled in each country. The European Union has complied with these terms of having a clear policy on electronic waste recycling and regulation of waste shipment. As a signatory to the Basel Convention, the Philippines legislated at least two laws: Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 (RA 6969) and the Philippine Clean Air Act of 1999 (RA 8749). Both laws protect the Philippine environment against toxic wastes. The former covers protection from toxic, hazardous and nuclear wastes including those coming from other countries.

However, despite the existence of these laws, the government has inked a deal with Japan via the Japanese-Philippines Economic Partnership Agreement (JPEPA), which covers among others legalization of trade in hazardous and toxic waste, touted to be a violation of not only the Philippine laws but also of the Basel Agreement, to which both countries are signatories. Electronic wastes may not be explicitly covered by the agreement thus far but it just sets the precedent for future trade in e-waste.

Also, there are no specific legal frameworks that address the e-wastes in the Philippines. The Ecological Solid Waste Management Act of 2000 (also known as RA 9003) is the only law that classifies consumer electronics and white goods as special wastes requiring separate handling from residential and commercial wastes. However, RA 9003 has no clear guidelines that have been set on how to handle special wastes. Additionally, the Toxic Substances and Hazardous and Nuclear Wastes Control Act (RA 6969) has not provided explicit provisions for e-wastes management.

Conclusions. Among the electrical and electronic equipment, mobile phones and their chargers are the most utilized in terms of their quantities. In the same way, the most prevalent e-wastes generated by the different households in Cagayan de Oro City. In terms of volume, televisions and refrigerators get the large amounts of e-waste generated. When these EEE reach their life spans, most of the households do not know where and how to dispose their e-waste in a proper manner, the reason being that there is no collection mechanism in the area. Likewise, they also do not have sufficient knowledge about the consequences if these e-wastes are not properly managed. The preferred methods of e-waste disposal were: sell to scrap dealers, keep them at home or repair to extend the service life of these equipments. Proper management of e-wastes by the households is necessary to minimize if not prevent the release of toxic substances from e-wastes and their adverse effects to human health and the environment. To do this, waste management hierarchy should be implemented such as reducing/replacing toxic with non-toxic substances in the production of electrical and electronic equipment. Reuse of the e-wastes is a good practice in managing e-wastes since it extends the life spans of these products and at the same time abstaining from disposing them directly into the landfill. Moreover, recycling of e-wastes is essential since valuable materials are

extracted thus conserving valuable natural resources. Lastly, public education and awareness is needed to ensure all actors (producers and consumers and government) know their roles and responsibilities through crafting of relevant e-waste management policies, application of best available technology and active participation in proper e-waste management and disposal.

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ANNEX 1

UTILIZATION AND MANAGEMENT OF ELECTRONIC GOODS BY DIFFERENT HOUSEHOLDS IN CAGAYAN DE ORO CITY

I. RESPONDENTS PERSONAL INFORMATION

Name of the Respondent (optional): _____

Address: _____

Civil Status: _____ Age: _____ Gender: _____

Number of Family Members: _____ Monthly Income _____

II. ELECTRICAL AND ELECTRONIC EQUIPMENT

<i>Electrical and Electronic Equipment</i>	<i>Currently Used EEE (number of units)</i>	<i>Waste Electrical Electronic Equipment (number of unit)</i>	<i>Average Lifespan of EEE (in years)</i>
Washing Machine			
Refrigerator			
Air-conditioner			
Electric Fan			
Vacuum cleaner			
Heater			
Irons			
Personal Computer, what type of PC is it?			
<ul style="list-style-type: none"> • Desktop w/ CRT display • Desktop w/ LCD display • Notebook/Laptop 			
Printer			
Mobile Phone			
Mobile Phone charger			
Telephone			
Television			
<ul style="list-style-type: none"> • Black and White • Colored CRT • LCD 			
Radio			
DVD/VCR/CD player			
Mp3s/Mp4s/IPods			
Camera			
Other, please specify			

How did you acquire these equipment? Brand-new Second-hand

Bought
 Given
 Others, Please specify

How many electronic devices (such as those listed above) has your household purchased in the past 12 months?

- None
- 1-3
- 4-7
- 8-10
- More than 10

And what are these?

Of the new electronic products, how many of these items were purchased to replace older equipment of the same type?

- None
- 1-3
- 4-7
- 8-10
- More than 10

How likely is your household to replace any existing electronic items within 12 months?

- Not at all likely
- Somewhat likely
- Highly likely

III. ELECTRONIC WASTE MANAGEMENT PRACTICES

How did you discard your Waste Electrical and Electronic Equipment?

- Give to friends/family
- Repair; where?
- Dismantled for re-use
- Thrown away with domestic waste
- Kept at home
- Sold it in second hand market; where?
- Sold it to a scrap dealer; where?
- Exchanged for a new equipment
- Take back to manufacture, where?
- Others (please specify).....

What are the reasons for e-waste disposal?

- New products with more features are available at a lesser price
- High repair cost
- Malfunction during use or technical problem
- Outdated or Lifespan elapsed
- Peer Pressure
- To keep with latest trends

Does your household have any stored unused electronic equipment?

- Yes
- No

If you answered yes to Question above, approximately how many items would your household have in storage?

- 1-3
- 4-7
- 8-10
- More than 10

And what are these?

How many years will you store this electronic goods before you dispose or sell it?

- 1-3
- 4-7
- 8-10
- 11-13
- 14-16
- More than 17 years

What are the reasons/factors in storing e-wastes in the households?

- They preferred to wait the lifespan of the e-waste
- Do not know where and how to dispose of e-waste in a proper manner
- No efficient take-back scheme for consumers

Level of awareness and knowledge about the e-waste problem

- Good Understanding
- Some Understanding
- Only Brief Understanding
- Don't know

DO you have any programs in your district for the collection or drop-off of discarded electronic products?

- Yes
- No

If any collection or drop-off facilities existed, do you think you would use them?

- No, not at all
- Probably
- Definitely

This is the end of questionnaire.
Thank you for taking the time to complete this survey!