

## **ELECTRONIC WASTE AWARENESS AND MANAGEMENT IN THE MUNICIPALITY OF TUBURAN, CEBU**

Bajao NA, Pepino M, Celeste N, Sarucam J, Brigoli HC and Pontillas PC  
Cebu Technology University-Tuburan Campus

### **ABSTRACT**

The world is now facing the great effect of the rapid growth of information technology. The electronic waste or E-waste has been the major contributor of solid waste throughout the globe that had caused the contamination of the global environment. Thus, this study assessed the electronic waste in the Municipality of Tuburan Cebu. Questionnaires were distributed to the 13 barangays in the municipality of Tuburan with simple questions answerable by “Yes” or “No”. There were 1,115 respondents (families) over 13 barangays in Tuburan, Cebu. Results showed that more than half of the respondents still need complete awareness about electronic waste, its composition, proper handling, and its effects to the environment. An alarming value shows that 721 or 64.66 percent of the 1,115 respondents said that there are no waste collectors in their area. This simply means that more than 50 percent of the total number of respondents would end up throwing and dumping their waste including E-waste; anywhere or in the open landfill. It shows that respondents need complete awareness about E-waste; particularly, the nature of electronic waste, proper handling, and the negative effects to the environment and their effects to the human health and other living animals. The absence of waste collectors in most barangays has created big impact to the surroundings already. Moreover, some respondents have thought that these E-wastes just mean nothing to the waste collectors. Waste collectors must be strictly assigned by the LGU to some specific areas to closely monitor and confine the waste disposal of each household. It will also be good if a separate collector for E-waste can be provided in each locality.

Keywords: waste collectors, health impact, dumping, barangays, waste disposal

### **INTRODUCTION**

The Philippines has been known as the texting capital of the world and with it comes much of the electronic devices used for texting. The mobile market in the Philippines grew 26 percent more in 2008, with mobile penetration reaching nearly 80 percent (or 72 million subscribers) by March 2009. Since fixed line teledensity stands at less than 5 percent, and as the growth of fixed-line subscribers remains sluggish, it only means that more and more people are using mobile phones. As such, the country has a huge potential of generating a lot of electronic waste, or E-waste. These also include other electric and electronic equipment (EEE), such as laptops, computers, and many others. Mercury is contained in many; EEE, along with other hazardous chemicals, and while developed countries are on the way of phasing out mercury due to

environmental awareness, or at least minimize it or use alternatives; EEE producers in developing countries do little to minimize mercury amount (Nixon, Saphores, Oguseitan and Shapiro, 2004).

The implementing rules and regulations of Republic Act 9003 (Philippine Ecological Solid Waste Management Act of 2000) mentioned electronic waste a part of the “special wastes” as follows: *"Special wastes" shall refer to household hazardous wastes such as paints, thinners, household batteries, lead-acid batteries, spray canisters and the like. These include wastes from residential and commercial sources that comprise of bulky wastes, consumer electronics, white goods, yard wastes that are collected separately, batteries, oil, and tires. These wastes are usually handled separately from other residential and commercial wastes.* (<http://www.elaw.org/node/2376>)

The mention of separate handling of “special wastes” did not specify the proper disposal method to be implemented by the Philippine government. Hence, there is a present void in the information dissemination as far as waste from EEE is concerned. Improper disposal of EEE can release mercury contained therein into the environment. One such example is when obsolete EEE is disposed of into landfills, or incinerated. The unfortunate result is this: "Once mercury is released into the environment, it remains there permanently, changing its chemical forms depending on the environment. Mercury cannot be converted to a mercury compound. Thus, it can be hypothesized that mercury released from informal recycling sectors in an environmentally unsound manner is diffused throughout the environment. If people inhale mercury vapor, approximately 80 percent of it crosses the alveolar membrane and is rapidly absorbed into the blood (Honda and Li, 2008).

In the Philippines, Envirocycle business development officer David Thomas Carman shares that the most discarded electronic equipment, in terms of volume, are cathode ray tubes (CRT) of old TVs and computer monitors. As CRTs are becoming obsolete, more and more are discarded, and thus will become environmental hazards, if not handled properly (<http://www.envirocycle-inc.com/news.php>). While groups that support e-waste management do exist, they do not focus intensively on the subject, and embrace the entire eco-waste management.

Thus, the study was conducted to assess the awareness and management of the people in the Municipality of Tuburan, particularly in the identified Barangays of Alegria, Colonia, Jagbuaya, Molobolo, Putat, and Tominjao regarding proper management of e-waste.

## **MATERIALS AND METHODS**

Household survey was conducted to gather data regarding the responses on awareness on the waste management of electronic equipment and other gadgets in the various barangays in the Municipality of Tuburan, Cebu. This municipality was chosen as the location of the research for the researchers' convenience in conducting survey to the respondents. In contrast, an online survey of 100 people was also conducted to supplement the household survey using the same questionnaire. On and off-line survey were made to compare the e-wastes from respondents who are technology oriented in comparison with those who are not. The survey asked the respondents about their overview regarding electronic wastes and their awareness regarding the hazardous

fractions of the electronic equipment and gadgets that they have, and how they dispose (or intend to dispose) these electronic gadgets after the respective life span. Selective sampling or convenience sampling was used since the respondents were chosen based on the availability of the electronic gadgets in their household for the accessibility of the survey interview. In the online survey, the respondents were made to select among the options provided in the questionnaire.

In first part of the questionnaire, the respondents answered either “Yes” or “No” based on their awareness on electronic wastes. The second part solicited data on what electronic equipment and gadgets are present in their households including the number of these product and how long have they been used, as well as, the current condition of the products. The third part was on how these products are being disposed after their usage.

Following the results of the actual survey, the researchers decided to move out of the locality and looked into the responses of people who are experts on technology. An online questionnaire was promoted via the social media, as shown in Figure 1. The online survey reached out to people who are more exposed to technology, being users of the internet and computers which are the most commonly used electronic gadgets. Through this survey, the researchers were able to know the percentage of “technology savy” people who have knowledge in electronic wastes, how to dispose them properly and how to handle them well. This online questionnaire made the respondents answer the questions regarding electronic wastes, similar to the questions asked to the respondents who were actually visited in their houses.

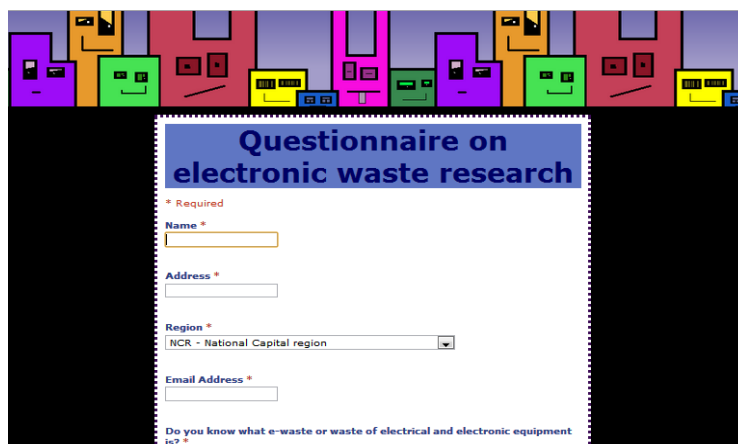
The image shows a screenshot of a web-based questionnaire. At the top, there is a decorative header with colorful, pixelated icons of electronic devices like a laptop, a smartphone, and a tablet. Below this, the title 'Questionnaire on electronic waste research' is displayed in a blue box. The form itself is white and contains several input fields: 'Name \*', 'Address \*', 'Region \*' (which is a dropdown menu currently showing 'NCR - National Capital region'), and 'Email Address \*'. Each field is preceded by a red asterisk and the word 'Required'. At the bottom of the form, there is a question: 'Do you know what e-waste or waste of electrical and electronic equipment is? \*'.

Figure 1. Screenshot of the Questionnaire Translated Into an Online Form

## RESULTS AND DISCUSSION

### Awareness

The actual survey was conducted in the 13 barangays which were identified based on the accessibility of the researchers. Results of the study revealed that the identified communities need the electronic waste awareness program. As shown in Figure 2, the awareness of each household on electronic waste in the offline survey shows that 67 percent and 58 percent of the

respondents are already aware of electronic wastes and the hazards of improper disposal of these wastes, respectively. Similarly, it can be seen that 65 percent of the respondents stated that there are waste collectors in their area. Moreover, 19 percent of the offline respondents disclosed that the waste collectors include electronic wastes in collecting other household wastes, 16 percent stated that waste collectors do not accept electronic wastes together with the rest of the household wastes. Sixty-five percent of the total offline respondents stated that there is no regular waste collection in their area.

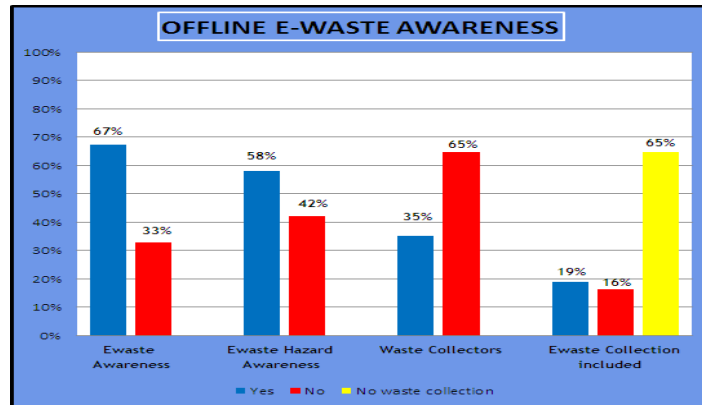


Figure 2. E-waste Awareness by Offline Respondents

Figure 3 shows the summary of awareness on electronic wastes by online respondents. It can be seen that as far as awareness of the electronic wastes and its hazards are concerned, 83 percent and 77 percent of online and offline respondents answered positively. This simply shows that despite the difference in the household financial status, most of the respondents said that they are aware of the presence of electronic wastes in their households as well as the health hazards that come with it. It also shows that 65 percent of the offline respondents revealed that there is no regular waste collection in their area, as compared to the 11 percent of the online respondents.

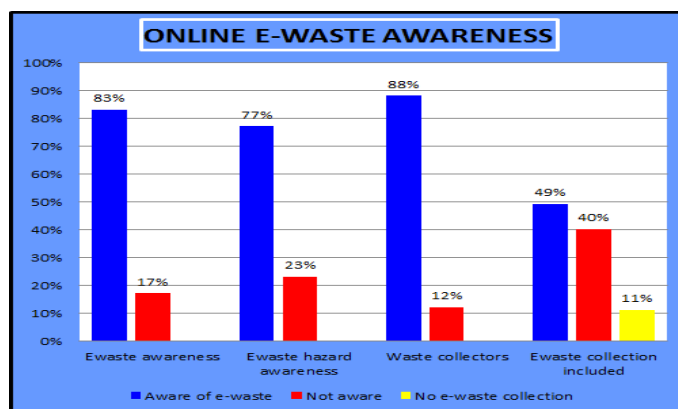


Figure 3. E-waste Awareness by Online Respondents

The household respondents from the offline and online surveys had shown significant difference in terms of their income. As can be seen in Figure 4, majority of the online respondents had a monthly household income of PhP10,000 to PhP50,000, while the largest percentage of the

offline respondents had a monthly household income of Php3,000 or lesser. The figures show that the online respondents had generally higher monthly income than the offline respondents and can therefore easily afford to purchase electronic equipment and gadgets.

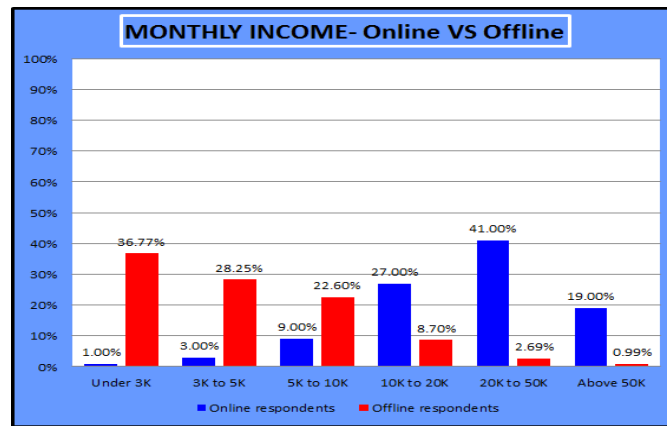


Figure 4. Online vs. Offline Household Income

Waste disposal can be considered as one of the most common problems in the Philippines. Some Industries have standard disposal area but some just disposed waste on the open air and land. No matter how strict is the monitoring of the waste generation in the private industries, there are still many actively running industries in the Philippines that do not cooperate in the Solid Waste Management Program of the Government.

In the households, the same problem is happening. Even the simple segregation of papers from plastics is not done properly. Dumping waste in open backyard is still very normal here in our locality. Some people are still burning waste due to lack of knowledge about its effect when burned. These are just some of the concerns that need to be addressed.

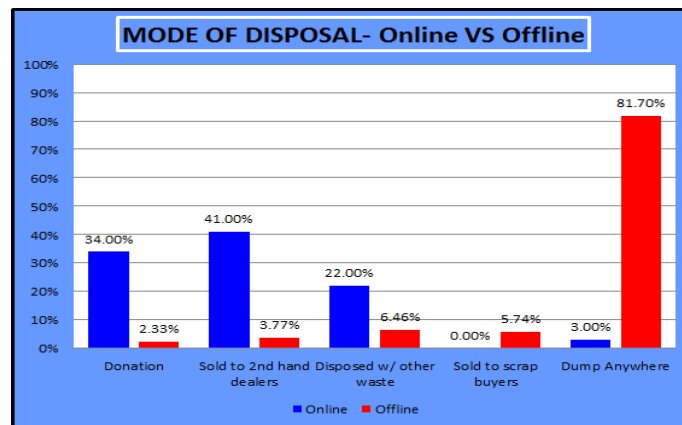


Figure 5. Mode of Disposal – Online vs. Offline

Figure 5 shows that 81.70 percent of the offline respondents just dumped their e-waste anywhere despite the fact that 67 percent of them are already aware about e-waste and 58 percent are aware of the harmful effects to health and to the environment. On the other hand, the highest percentage is 41 percent, of the online respondents sold their electronic wastes to

second hand dealers. The online respondents are more familiar with the internet use and are more informed on how developed countries handle electronic wastes. These are the group of respondents who are careful in disposing their electronic wastes. On the contrary, the offline respondents are less exposed to technology, perhaps constrained by their lower household monthly income, are less conscious of the better option of electronic wastes disposal.

As almost all households dumped their waste anywhere, one could just imagine some few years from now how the locality of Tuburan would look like. Perhaps, some other environmental effects or some health problems could be witnessed like typhoid fever outbreak in March of 2013 that victimized nearly 1000 patients and killed four (4) people.

Table 1 presents the most commonly used electronic equipment in the households which was ranked according to the number of respondents declaring the availability of the electronic gadgets/equipment. At the same time, the table also shows the hazardous components that are found in them. These health hazards from the top 10 electronic waste in the town of Tuburan would really contaminate the water if these will just be dumped in the lands and water or will then be exposed to the atmosphere and then contaminate the water that are used for drinking, the food and the air used by the animals living around. Similarly, the health hazards to human may come from the contaminated water, the intake of food and the air breathed every day.

**Table 1. Hazards Found in Various Electronic Devices from the Households**

<b>Top Ten (10) Sources of E-waste</b>	<b>Chemical Contents</b>
Mobile Phones	Cadmium, Lead, Nickel, Mercury, Manganese, Lithium, Arsenic, Antimony, Beryllium, Copper
Fluorescent Lamp	Mercury
Incandescent Bulb	Lead, Tungsten
Compact Fluorescent Lamp	Mercury
CRT television	Copper, Lead, Tin, Aluminum
Radio	Lead
Flat Iron	Aluminum
Electric Stoves	Aluminum
DVD Players	Silicon, Lead
Electric Fans	Copper,

The United States Environment Protection Agency states that “when one uses and disposes these wastes properly, they may enhance our quality of life but when one use or disposes them improperly, they can have harmful effects on humans, plants and animals.”

A simple library search would tell us that lead, which is present in most electronic equipment being used as component in soldering parts together, can cause disruption of the biosynthesis of hemoglobin and anemia, a rise in blood pressure, kidney damage, miscarriage and subtle abortion, disruption of nervous system, brain damage, declined fertility of men through sperm damage, diminished learning abilities in children, and behavioral disruption of children,

such as aggression, impulsive behavior and hyperactivity. Cadmium, commonly present in rechargeable batteries, can cause diarrhea, stomach pains and severe vomiting, bone fracture, reproductive even fertility, damage to the central nervous system and immune system, psychological disorders, and possible DNA damage or cancer development. Nickel can possibly have higher chances of development of lung cancer, nose cancer, larynx cancer and prostate cancer. Nickel also causes sickness and dizziness after exposure to its gas, lung embolism, respiratory failure, birth defects, asthma and chronic bronchitis, allergic reactions such as skin rashes, mainly from jewelry, and possibly, heart disorders. Mercury causes the disruption of the nervous system and damage to brain functions, also damages DNA and chromosomes. It can also cause allergic reactions, resulting in skin rashes, tiredness and headaches; it has also negative reproductive effects, such as sperm damage, birth defects and miscarriages. Manganese results to fatness, glucose intolerance, blood clotting, skin problems, lowered cholesterol levels, skeleton disorders, birth defects, and changes of hair color. Lithium, if inhaled, can cause cough, shortness of breathing, sore throat, skin redness and burn. If ingested, it can cause abdominal pain and cramps, nausea and vomiting. Arsenic cause irritation of the stomach and intestines, decreased production of red and white blood cells, skin changes and lung irritation. Very high exposure of inorganic arsenic can cause infertility and miscarriages in women, heart disruption and brain damage in both men and women. Inorganic arsenic can damage DNA. Antimony, if inhaled, can cause irritation in the eyes, skin, and lungs. Long exposure to this may cause lung disease, heart problems, and diarrhea, vomiting and stomach ulcers. If inhaled, beryllium can damage the lungs and can cause pneumonia. It can also cause Berylliosis and Chronic Beryllium Disease, contributes to cancer development and DNA damage. Long exposure to copper can cause eyes, mouth, and nose irritation. It can cause headaches, stomach aches, vomiting, dizziness and diarrhea. Intentional high intake can cause liver and kidney damage and even death. Tin can cause sickness and irritation, eye and skin irritations, headaches, severe sweating, stomach aches, breathlessness, urination problems, depressions, liver and brain damage, chromosomal damage, and malfunctioning of immune systems. Aluminum can damage the central nervous system. It can cause dementia, loss of memory, and severe trembling. Silicon is a potential health hazard that can cause chronic respiratory effects, can irritate the skin and eyes in contact. If inhaled, it can irritate lung and mucus membrane. Tungsten, if in contact, can cause skin and eye irritation. If inhaled, it can cause lung and mucus membrane irritation.

## **CONCLUSIONS**

The results of this study show that the people are really aware of the e-waste in terms of its proper disposal as they are also informed of its negative impact to the environment. However, due to the irregular collection, and in some places there were no collection of these wastes, the people tend to dump or throw them anywhere as can be observed in the different Barangays of Tuburan, Cebu particularly Alegria, Apalan, Jagbuaya, Mangga, Molobolo, Putat, and Tominjao.

## **RECOMMENDATIONS**

Due to the number of respondents who are dumping their waste and e-waste anywhere, the awareness program through IEC regarding electronic waste and waste in general is a must at the soonest possible time which can be done in tandem by the academe with the LGUs.

Collectors assigned in each barangay must be closely monitored by the local government to make sure collection of wastes can be assured of as their duties and responsibilities. Moreover, a storage facility for electronic waste in the community must be available so the people can just deliver the wastes and dump directly to this area without waiting for the collectors.

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