Electronic Waste Management Practices and Its Extent of Implementation: A Case of an Academic Institution

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Abstract

The increase of Information and Communication Technology (ICT) electronic wastes and electronic products depends on the technology upgrading and obsolescence rates in the equipment. It can be assumed that the disposal of electronic equipment is driven by the production of new technological development. This descriptive study assessed the electronic waste management practices and extent of implementation of e-waste management. Data on the practices on e-waste disposal was collected using a researcher-made questionnaire, with Southern Leyte State University (SLSU) end-users of ICT serving as respondents. Findings showed that e-waste management was practiced only by a few and that processing techniques were only partially implemented. This revelation strengthens the need to implement the best practices and processing techniques in the handling and disposal of electronics waste.

Keywords: E-waste disposal; hazardous; obsolete equipment; toxic materials

Introduction

In today’s constantly changing technology, innovations can quickly make existing electronic gadgets obsolete. Electronic waste or e-waste is universally understood as electronic wastes disposed of by the end users, and are is becoming a social and health concern since these contain hazardous and toxic materials such as lead, mercury, cadmium, and chromium. Devices like personal computers (PCs), laptops, computer displays, keyboard, computer mouse and department devices such as scanner and printers, are all classified as e-waste, once disposed.

Globally, e-waste is one of the fastest growing waste streams (Hotta et al., 2008). According to Carisma (2009), Asia has been considered as the prime generator of world waste. Brown-West (2010) added that the volume of electronic waste is growing at an increasing rate. The rapid adoption of electronic gadgets and purchasing of multiple appliances and the rapid obsolescence of products are contributing factors of electronic waste.

Peralta (2008) stated that Filipinos tend to store their electronic wastes for a long period before eventually giving them away or disposing them into the ordinary garbage bin. This practice is common due to the lack of guidelines on proper disposal. Discarded e-wastes contain hazardous materials, and if disposed of improperly, they pose a potential threat to human health and the environment.

The e-waste management of Morioka et al. (2005) stated that all products have a life cycle...
that covers a sequence of interrelated stages from the acquisition of raw materials until their end-of-life when the product's functionality no longer satisfies the requirements of the original owner.

Bandhopadhyay (2010) stated that at the end of life, the product could be disposed of or its life cycle extended over time. Sivaramanan (2013) concluded that the electronic waste has been emerging as a risk to the society, considering the volumes of e-waste being generated, and the content of both toxic and valuable materials in them. These toxic chemicals found in the different components of electronics and computer parts can contaminate soil, air, and groundwater.

A pressing issue is how e-wastes are managed to mitigate its potentially negative effects. Hence, this study assessed the e-waste management practices at SLSU during the first semester 2012-2013 as basis for e-waste technology management adoption. Sources of e-waste, type and volume of e-waste, e-waste personnel, e-waste facilities, and e-waste policies and the extent of the implementation of e-waste management practices (reduce, re-use, recycle, recovery, disposal) were determined.

**Research Design and Methods**

This study used the descriptive survey method in gathering the data. The researcher-made questionnaire was distributed to four selected departments in order to collect facts and information needed, and to identify the practices of e-waste disposal. This questionnaire was prepared, validated by content experts, and calculated using Cronbach’s alpha of 0.839, which means it was acceptable before it was given to the respondents. The 30 respondents of the study included 18 selected Computer Studies and Information Technology (CSIT) Computer Laboratory Professors, seven full-time instructors, 11 part-time instructors, six supply office staff, four Management and Information Systems (MIS) personnel and two professors from the Electronics Department. The questionnaire was composed of three parts, namely the sources, types, and volume of e-waste; facilities, e-waste policies and extent of the implementation of e-waste management practices using the 4Rs.

The data collected were tabulated and analyzed as the basis for interpretation using frequency counts, simple percentages, and weighted means. The percentage was used to determine the status of e-waste as to sources, types, and monthly volume. The weighted mean determined the extent of implementation of e-waste management practices, and simple percentage expressed the raw information. Table 1 shows the scale used on the e-waste management practices.

**Results and Discussion**

**Sources of E-Waste**

Figure 1 shows the different sources of e-waste generated from SLSU main campus as perceived by the respondents. From the 30 respondents, 28 identified e-wastes as generated from ICT or electronic equipment, eight saw e-wastes as generated by electrical equipment, five believed that most university e-waste came from refrigeration and air-conditioning equipment, and four saw e-wastes as generated by mechanical equipment. This observation indicates that ICT had the highest volume of e-waste, as perceived by the respondents, while mechanical equipment generated the lowest percentage of e-wastes.

**Volume of E-waste Generated Monthly**

Presented in Figure 2 are the four selected departments and their generated volume of e-waste. It shows that more than 40 kilograms of e-wastes were generated monthly. This result is similar to the study of Gaidajis et al. (2010) that rapidly developing technology
nowadays have led to increased e-waste volumes. The rapid growth and faster change in computer modules and consumer electronics is responsible for the amount of e-wastes being generated.

This result means that the CSIT, MIS,
Electronics department and Supply office have to ensure that e-waste is handled and managed properly.

**Projected E-waste Volume Growth at SLSU Sogod**

Presented in Figure 3 is the expected volume of e-wastes from 2012 to 2020. This accuracy is estimated to be ± 15%.

**E-Waste Facilities**

According to Jain (2006), increase in consumption patterns leads to an increase in product obsolescence which will result in higher generation of electronics waste. Figure 4 presents e-waste facilities in SLSU main campus. These include supply office storage room, recycle, waste bins, trash can, compost pit, and incinerator. These were needed to come up with results on how the school managed and handled the final disposal of e-waste. The results shown in Figure 4 indicates that the respondent preferred that their e-wastes be kept in the storage room rather than recycled. Customers, who like to replace their ICT equipment when they see a new product with improved features, contribute to more e-waste generation.
According to the supply officer, SLSU has no specific policy on e-waste; however a number of guidelines in the disposal of unserviceable property from the handbook on property and supply management system were adopted as shown in Table 2.

Table 3 presents a summary of the e-waste practices of the four departments. The average weighted mean of 2.25, indicated as Practiced by Few (PF) sums up the e-waste practices of the four departments in SLSU main campus. With this, there is a need to strengthen the recycling practices in every department; somehow this will help divert e-waste from the landfills, thereby extending landfill life and at the same time providing a new source for materials recovery. Recycling is the practice of reusing items which otherwise may considered as waste. E-waste recycling is a process of disassembling and separating components and raw materials of waste electronics (Wang, 2014; Gupta, 2011). The procedures of re-using, donation, and repair are not strictly recycling; they are other common sustainable ways to dispose e-waste. Presented in Table 4 are the data collected from the summary of the extent of implementation on processing techniques of generated e-waste. As observed, the computed average weighted mean of 1.94 implied that extent implementation on processing techniques of generated e-waste was Partially Implemented (PI) in the four selected respondents group in SLSU main campus.

The results are similar to the study of Kalana (2010) that most people were aware of the hazardous materials present in electronic products, but only few knew the practices to

Table 2. Guidelines in disposal of unserviceable property

1. Once the supplies or property becomes unserviceable from any cause or no longer needed, the users are accountable for the property and therefore he/she shall return immediately to the property officer.
2. The property officer shall file an application for disposal to the COA auditor with appropriate supporting documents.
3. The COA auditor inspects the items and determine if the equipment are with or without value.
4. The concern head agency forwards the documents to the disposal committee.
5. The disposal committee shall recommend to the Head of agency the mode of disposal most advantageous to the government.
6. The valuable of the unserviceable property are sold at public auction to the highest bidder under the supervision of the proper committee or similar body.

<table>
<thead>
<tr>
<th>Practices</th>
<th>CSIT Department</th>
<th>MIS</th>
<th>Electronics Department</th>
<th>Supply Office</th>
<th>Average</th>
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<tr>
<td></td>
<td>$\bar{x}$</td>
<td>$\bar{V}D$</td>
<td>$\bar{x}$</td>
<td>$\bar{V}D$</td>
<td>$\bar{x}$</td>
</tr>
<tr>
<td>Reduce</td>
<td>1.59</td>
<td>PF</td>
<td>1.51</td>
<td>PF</td>
<td>1.88</td>
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<tr>
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<td>PF</td>
<td>1.10</td>
<td>NP</td>
<td>1.82</td>
</tr>
<tr>
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<td>NP</td>
<td>1.52</td>
<td>PF</td>
<td>1.90</td>
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<tr>
<td>Recovery</td>
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<td>NP</td>
<td>1.12</td>
<td>NP</td>
<td>1.94</td>
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<tr>
<td>Disposal</td>
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<td>MP</td>
<td>3.21</td>
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</tr>
<tr>
<td>Average</td>
<td>1.81</td>
<td>PF</td>
<td>1.69</td>
<td>MP</td>
<td>1.92</td>
</tr>
</tbody>
</table>

E-Waste Policies

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The results are similar to the study of Kalana (2010) that most people were aware of the hazardous materials present in electronic products, but only few knew the practices to
be adopted to recycle their waste. Maximizing the end of life cycle in electronics equipment involves repair to reuse and maintain the life of electronics equipment.

**Conclusion**

Based on the findings, more than 40kg of e-waste were generated monthly during the first semester school year 2012-2013. SLSU main campus had partially implemented the e-waste practices, however there is still a need to make necessary improvement to ensure that all e-waste is minimized by implementing the policies on e-waste. With the above mentioned arguments and with increasing e-waste in the school, these methods and practices used in the disposal of discarded equipment in the school may be improved.

**References Cited**


