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Public and Private Higher Education Institutions Challenges on Electronic Waste Management

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ABSTRACT

The study attempted to determine the challenges of the e-waste management among higher educational institutions in Zamboanga Peninsula. The study employed a qualitative method research design involving 16 participants in select Higher Education Institution in Zamboanga Peninsula. The findings revealed that, the Challenges encountered in e-waste management in terms of collection, monitoring, disposal, storage and in recycling were 'difficulty of setting up convenient and accessible collection points', 'Inconsistency of measures, methods and regulations governing collection and processing of e-waste', 'difficulty in ensuring consistent adherence to regulatory standards', 'limited storage space' and 'lack of awareness on e-waste program'. The study concluded that the HEIs have to address the challenges in e-waste management in terms of collection, monitoring, disposal, storage and recycling. The study recommends that, the HEIs may adopt measures/mechanisms to address appropriately the challenges met by the personnel to achieve sound e-waste management and may develop regulations and policies for managing e-waste because Electronic and ICT equipment were used extensively by most HEIs.

Keywords: Electronic Waste, E-waste Management, E-waste Challenges

INTRODUCTION

The government and other institutions must create a system that effectively addresses the growing cycle of Electronic Waste (E-Waste) product generation and its speed. The Philippine government has passed laws (Republic Act No. 6969) addressing the management of e-waste; nonetheless, in order to accomplish effective and efficient e-waste collection and disposal, a number of enabling legal measures must be drafted and improved. According to Baoas et al. (2016), it is crucial to properly dispose of e-waste at all costs. Accurate identification and characterization of electronic trash has led to a considerable degree of acceptable waste disposal techniques that comply with current policies and national legislation and are safe for humans and the environment.

Many higher education institutions find it difficult to put into practice efficient e-waste management procedures, even in the face of increased awareness of the risks e-waste poses to the environment and human health. Attempts to solve this urgent issue are frequently hampered by elements including a lack of knowledge among stakeholders, insufficient infrastructure, and a lack of money. Furthermore, the issue of e-waste in higher education settings is made worse by the quick turnover of electronic gadgets brought on by technical improvements.

Examining the present situation of e-waste management practices issues in higher education institutions is vital given the significance of sustainability and environmental stewardship. By undertaking a thorough examination into the difficulties associated with electronic waste management practices in higher education institutions, this study aims to close this gap and provide information for the creation of policies, encourage cooperation, and advance sustainable e-waste management solutions.

Higher Educational Institutions (HEIs) in the Zamboanga Peninsula undoubtedly produce e-waste, so they have implemented ways to monitor, collect, and dispose of it, either systematically or unsystematically. Other HEIs rely on city ordinances to enforce disposal orders. As a result, HEIs are

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still unlikely to manage e-waste. This study sought to identify the difficulties associated with e-waste management methods in Zamboanga Peninsula higher education institutions in light of the gap.

OBJECTIVES OF THE STUDY

The study aimed to determine the challenges of the e-waste management practices among higher educational institutions in Zamboanga Peninsula. Specifically, it aimed to: 1) Determine the challenges encountered in e-waste management practices among Public and Private HEIs in terms of Collection, Monitoring, Disposal, Storage and Recycling; 2) Develop a Proposal for Sustainable Environmental Plan.

METHODOLOGY

The study employed a qualitative method since the researcher wanted to collect relevant data on the challenges encountered on e-waste management among HEIs in Zamboanga Peninsula through an open-ended question. This strategy aimed to develop a better measurement with specific population samples (Cresswell, 2014). The data collected served as the basis for the development of a program for a sustainable solution in e-waste management practices among HEIs. The target population of the study were the teaching and non-teaching personnel of the select Public and Private HEI's in Zamboanga Peninsula.

Table 1

No. of participants per Institution

Institution Code	**No. of participants per Institution (*for interview*)**
HEI-B1	2
HEI-B2	2
HEI-B3	2
HEI-B4	2
HEI-A1	2
HEI-A2	2
HEI-A3	2
HEI-A4	2
Total	**16**

Table 1 shows 16 participants as key informants participated during the interview on the challenges faced by higher educational institutions in managing e-waste effectively. These key informants were personnel of the HEIs assigned and had specific roles and knowledge on e-waste management practices of the institution. In addition, there were 16 participants who were invited to participate to achieve data saturation to answer the research questions on the challenges faced by higher education institutions in managing electronic waste effectively. According to Guest et al., (2006) an average of 12–13 interviews reached saturation, one of the first studies to empirically assess saturation,

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which reported saturation at 12 interviews. Data saturation is the point in a research process where enough data has been collected to draw necessary conclusions. The institutions were coded as follows:

HEI-B1 is a private university in Western Mindanao. This HEI initially catered to primary and secondary education for boys. It became a college in 1952, and elevated into a university in August 2001. This HEI offers 25 baccalaureate programs and 14 graduate programs. Many of its programs are accredited by the Philippine Accrediting Association of Colleges, Schools, and Universities, such as Accountancy, Teacher Education, Business and Arts and Sciences, this is the only higher educational institution in Zamboanga Peninsula that is granted an Autonomous Higher Education status by the Commission on Higher Education.

HEI-B2 is a private Catholic basic and higher education institution owned and administered by the Religious of the Virgin Mary (RVM) in Zamboanga City. The college provides Catholic education to the children and the youth of Zamboanga City and of the southwestern part of Mindanao. It offers nursery, kindergarten, elementary, junior and senior high schools and eight academic programs in the tertiary level.

HEI-B3 is a private non-sectarian college founded on December 8, 1946. The institution is presently managed by a president. It presently has three Campuses, namely the Central Campus, the West Campus and the East Campus, all located in Zamboanga City. This HEI provides junior, and senior high schools. In addition, HEI – A3 offers six academic programs.

HEI-B4 is a private, Catholic, coeducational basic and higher education institution run by the Roman Catholic Diocese of Pagadian in Pagadian City, Zamboanga del Sur, Philippines. This HEI is considered as the largest among the Diocesan Schools of Pagadian. It offers primary, secondary and tertiary education. The Accountancy and Information Technology programs are distinguished as a Center for Excellence and Center for Excellence and Development, respectively.

HEI-A1 is a state university in Zamboanga City. It was established in July 1905. With a strong commitment to higher education, it has 15 colleges, one institute and two autonomous campuses offering undergraduate and post graduate programs. This HEI is the center of development in College of Education, College of Architecture, and College of Social Work and Community Development was awarded the best school for social work in the Philippines.

HEI-A2 is a state college in Zamboanga City, Philippines. It is located at the heart of Zamboanga City and offers 12 academic programs in the tertiary level and eight graduate programs. This HEI has been chosen by the Department of Agriculture-Bureau of Agricultural Research as a lead agency for the National Research and Development Network for Capture Fisheries. It has also served as Zonal center for fisheries and marine biodiversity of the Mindanao Advanced Education project of the Commission on Higher Education.

HEI-A3 is a non-profit public higher education institution located in Zamboanga City. This university provides engineering, physical, technical education, and senior high school program. The University is also a CHED and MARINA Accredited Maritime Schools by 2023-2024. In addition, it offers two master's programs and two doctorate programs. Other baccalaureate degree programs are also opened, like the Civil Engineering Program, Basic Education and Technology Program, Hotel and Restaurant Management Program, BS ComTech, BS DevCom, BS Infotech and the Professional Education Certificate. Many of its programs are accredited by the Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACCUP), such as Engineering and Technology, Teacher Education, Arts, Humanities and Social Science, Information Technology, and Graduate Programs of the University.

HEI-A4 is a public higher education institution in the island province of Basilan, Philippines. Its main campus is located in Isabela City with satellite campuses in Lamitan, Maluso and Tipo-Tipo and an agricultural campus in Santa Clara, Lamitan. The institution offers programs in Education, Political Science, English Language Studies, Islamic Studies, Public Administration, Social Work,

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Computer Science, Criminology, Nursing, Nutrition and Dietetics and also Agricultural Technology. Moreover, it is also Accredited in some of its programs in the Bachelor of Science in Criminology, Bachelor of Science in Nutrition and Dietetics, and Graduate Programs.

Parallel with this, in selection of the participants, purposive sampling was used through the inclusion of criteria such as: 1. willing to be a participant, 2. personnel of the HEIs assigned on e-waste management, and 3. has the ability to express ideas in writing. These criteria served as a reference that qualifies them to be the participants to share their observations on the challenges in E-waste management practices implemented in their respective institution.

The research instrument of this study consisted of two (2) parts. Part I was intended to gather data about the types of HEI's. Part II was the interview on selected participants to answer open-ended questions through unstructured interviews in the roles and responsibilities directs within the e-waste management practices.

To be able to gather the data needed, the researcher was first and foremost sought the permission from the Presidents of State Universities and Colleges (SUCs) and President/Director of Private Colleges and Universities to conduct the gathering of data from their personnel. Upon approval, the letter was presented to the coordinating office like the Office of Research, Supply Office and College Head or Dean of the participating schools with attachments of instrument and informed consent form. The researcher communicated with the college secretary and supply office personnel with matters relative to the data gathering such as distribution and retrieval schedules. All information was dealt with great confidentiality. Neither demographic profile nor background information was solicited from the respondents. A coding system was utilized simply for filling out the questionnaires. The research was conducted in accordance with the ethical guidelines. This includes obtaining a certificate of exemption as an ethics clearance from the office of Research Ethics Oversight Committee

To facilitate the analysis of data, Thematic Analysis was used to identify common themes such as topics, ideas, and patterns of meaning that come up repeatedly in the answer supplied by the question on the primary challenges faced by higher educational institutions in managing electronic waste effectively and also Frequency Count and Rank was used to count the frequency of similar responses for each challenges encountered in terms of collection, monitoring, disposal, storage, and recycling.

RESULTS AND DISCUSSION

This section presents, analyzes and interprets the data obtained from the participants using the open-ended questions in the unstructured interview.

1. The challenges encountered in e-waste among Public and Private HEIs in terms of collection, monitoring, disposal, storage, and recycling.

Table 2

Challenges Encountered on E-Waste Management in Terms of Collection Among HEIs

Challenges	f	%
1.Difficulty of setting up convenient and accessible collection points	10	52.63
2.Lack of awareness of proper e-waste management	8	42.11
3) Lack of Collaboration	1	5.26
Total	**19**	**100.00**

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As shown in Table 2, 10 or 52.63% of the participants considered difficulty of setting up convenient and accessible collection points as the top challenge. This suggests that the common challenge among respondents was collection point of e-waste materials. This can be interpreted that HEIs did not have common area where e-waste materials can be collected. Participant No. 1 disclosed that "to ensure efficient and effective e-waste collection across the campus, ensuring that collection bins are strategically placed and frequently emptied". Participant No. 3 expressed that one major challenge in ensuring e-waste is collected efficiently and effectively across the campus is the "lack of convenient drop-off locations leading to low participation and improper disposal".

In addition, participant No. 1 disclosed that "inadequate infrastructure and "lack of manpower", has also considered a challenge. This shows that infrastructure and manpower were hindrances in the collection of e-waste. Moreover, participant no. 1 expressed his opinion by indicating that "*efficient and effective e-waste management collection across the campus environment is hindered by several challenges, including inadequate infrastructure although the university is addressing these issues by developing comprehensive e-waste policies.*"

Another challenge encountered by HEIs in the e-waste collection was the lack of awareness of proper e-waste management. Participant no. 13 disclosed that, efficient and effective e-waste management collection across the campus environment was caused by *low awareness about e-waste."* Similarly, participant no. 4 claimed that, *"one major challenge in ensuring e-waste is collecting effectively and efficiently across the campus is the lack of awareness."* In addition, participant no. 7 revealed that the," challenge *here is that employees in this institution is not aware what this e-waste disposal*". Participant claimed that, "*The campus does not have trash bin for e-waste around the campus."* Another participant no. 9 indicated that, "*there was no proper storage"* for e-wastes. Another participant no. 13 claimed that, "*Ensuring that collection bins are strategically placed and frequently emptied requires careful planning and resources.*" This is evident as Maphosa (2021) reported that unavailability of collection point was an impairment to e-waste management.

Another challenge encountered by HEIs personnel was the **l**acked of collaboration. In other words, different units in the HEIs do not carry out the collection of e-waste as a team. This can be interpreted that, the institutions did not have the guidelines and procedures on how collection of e-waste can be done. Participant No. 2 expressed that the personnel in the campus is *not practicing good e-waste management.* This means that personnel in HEIs do not follow certain procedures and standards on how e-waste be handled and collected.

Table 3

Challenges Encountered on E-Waste Management in Terms of Monitoring Among HEIs

Challenges	f	%
1.Inconsistency of measures, methods and regulations governing collection and processing of e-waste.	8	50.00
2.Informal of e-waste disposal practices	3	18.75
3.Limited infrastructure	1	6.25
4.Lack of awareness	2	12.5
5.Difficulty in maintaining records	2	12.5
Total	**16**	**100.00**

Table 3 shows that 8 or 50% of the participants recognized the, "*Inconsistency of measures, methods and regulations governing collection and processing of e-waste."* In other words, the participants indicated that there was no standard of measurement, processes and regulations to be

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observed in dealing with e-waste. HEIs personnel adopted their own measures and procedures in collecting e-waste without following the standards of collecting e-wastes. In addition, the participant no. 3 revealed that there was no "*right tools to monitor the records and data*." Moreover, participant no. 7 expressed that, "*I believe the primary obstacle is the inefficient process when it comes to e-waste transaction. It creates loop holes for the user to bypass a process.*"

Another challenge faced by the HEIs personnel was the Informal of e-waste disposal practices in which 3 or 20 percent of them acknowledged. Participant no. 1 claimed that the primary obstacle in maintaining records and data on e-waste primarily stems from the *Informal e-waste disposal practices*. Participant no. 7 indicated that HEIs personnel observed "*Inefficient process in e-waste transactions*" and e-wastes "*are not handed/dispersed properly which can cause minor records/data in monitoring sheet*."

Meanwhile, participant no. 1 claimed that "*lack of awareness*" on e-waste was considered challenging. It is said that, "*One of the primary obstacles is maintaining record and data of e-waste is to know what type of e-waste and whose item it is owned.*"

Meanwhile, "*Absence of e-waste program" is considered challenging by the participants*. In other words, there is an HEIs that did not implement e-waste management in terms of monitoring. This can be construed that, HEIs personnel were not oriented on how to conduct monitoring of e-wastes in their respective institutions. Perhaps HEIs management was not seriously considering e-waste management in their respective institutions.

Lack of awareness was reportedly a challenge among respondents of the HEIs. This shows that HEIs personnel need higher level of awareness on monitoring of e-waste materials. This can be achieved by attending seminars on e-waste management or the HIEs themselves have to invite resource persons who can adequately provide information on e-waste management. According to participant no. 1 that *insufficient awareness* among personnel hinders the effective implementation of e-waste monitoring.

Difficulty in maintaining records was also a hindrance to effective e-waste management in terms of monitoring. Participant No. 1 disclosed that, "*The primary obstacle in maintaining our records and data on e-waste primarily stems from the lack of consistent measurement methods and regulations governing the collection and processing of e-waste*."

With regard to inconsistent reporting manual data entry errors, participant no. 6 disclosed that, *one of the primary obstacles in maintaining accurate record and data on e-waste is to know what type of e-waste and who's item it is owned.* Similarly, participant no. 4 indicated that, *the primary obstacles in maintaining accurate records on e-waste are inconsistent reporting manual data entry errors*. Dayaday and Galleto (2022) in their study in the e-waste management implementation of HEIs in South Central Mindanao, reported that lacked of audit resolution and procedure, and no definite legislation or laws among HEIs are the main challenges for e-waste management in the region.

Limited infrastructure is another challenging issue in e-waste monitoring. In other words, HEIs do not have sufficient resources to carry out the monitoring activities of e-wastes in their respective campuses. Participant no. 1 disclosed that "insufficient infrastructure" hinders the monitoring of e-waste materials in the campus. Bagwan (2024) shows proper e-waste management and monitoring are essential for achieving maximum resource utilization and reducing the adverse impacts of E-waste, in line with the Sustainable Development Goals.

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Table 4

Challenges Encountered on E-Waste Management in Terms of Disposal Among HEIs

Challenges	f	%
1.Limited number of certified vendors	2	10.53
2.High cost	2	10.53
3.Difficulty in ensuring consistent adherence to regulatory standards	6	31.57
4.Lack of awareness	2	10.53
5.No proper waste disposal	3	15.79
6.Lack of bidders for e-waste for auction	3	15.79
7.Irregular schedule of picking-up of e-waste	1	5.26
Total	**19**	**100.00**

Table 4 reveals that participant no. 1 reported on the difficulty in ensuring consistent adherence regulatory standard was *the main challenge in working with authorized e-waste disposal ensuring consistent adherence to regulatory standards*. The same participant claimed that, *lacked of standardization in certification processes* is also a hindrance to effective disposal practices. Furthermore, another challenge was, *there is no clear disposal procedure* as indicated by participant no. 10 and *Non- compliance with policies and regulations* by Participant no. 11. In a nutshell, HEIs find it hard to implement the disposal program on e-wastes following the standards set by the government. This can be construed that HEIs have not given much serious attention on the e-waste disposal considering of the preparations that they need to comply for effective and efficient implementation of such program.

With regard to high cost, participant no. 16 elaborated that there is, high cost *of certified recycling and limited authorized recyclers*. Similarly, participant no. 14 said that, *certified vendors may charge higher fee for their services which can be a barrier to our organization*. On the other hand, participant no. 1 claimed that, lacked of awareness *about e-waste management* was a challenge in disposal of e-waste. The lack of awareness was a hindrance to e-waste management (Maphosa, 2021).

In addition, two of the participants claimed that there were," no authorized personnel to take charge of e-waste disposal." *The institution does not have authorized e-waste disposal personnel but only rely on the college IT technicians' expertise. In addition, our janitor or students or grant student scholar who help the disposal of the e-waste' and "the bulk of things to manage by the supply office will hinder us to properly dispose e-waste."*

In the same manner, two participants disclosed that there were limited buyers of disposed e-wastes. Accordingly, the participant stressed that it is *sometimes hard to find bidders for e-waste for auctions*. Similarly, another participant disclosed that "*With the fast innovation of computers and other electronic equipment the e-waste disposal authorized personnel or buyer are becoming few reason behind it there are lack of recycle plant that are willing to buy our e-waste to produce new product here in the Philippines."*

Based on this challenge revealed, Khetriwal et al. (2009); mentioned the Extended Producer Responsibility (EPR) states that businesses have obligations that extend to the safe disposal of products at the end of their useful lives. The growing incidence of EPR suggests that companies must collaborate with governments and society to address the sustainability issues brought on by e-waste. Companies may take the lead in promoting appropriate e-waste management.

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Similarly, a study conducted by Mayers et al. (2008) on Extended Producer Responsibility for Waste Electronics reported that European Union (EU) policy makers implemented a Directive that will make producers responsible for waste electrical and electronic equipment at end-of-life known as the "WEEE" Directive. Under this new legislation, producers are required to organize and finance the take-back, treatment, and recycling of WEEE and achieve mass-based recycling and recovery targets.

Table 5

Challenges Encountered on E-Waste Management in Terms of Storage Among HEIs

Challenges	f	%
1.Limited storage space	12	80
2.Risk of hazardous materials	1	6.67
3.Data security risk	1	6.67
4.Lack of personnel	1	6.67
Total	**15**	**100**

Table 5 shows 12 or 80 percent of the participants acknowledged that limited storage space as the top challenge; followed by other challenges with one participant acknowledging the following: risk of hazardous materials, data security risk, lack of personnel, slow processes and procedures, unserviceable equipment, and damaged properly number.

On the issue of limited storage space, participant no. 1 disclosed that, *lack of storage facilities* was a challenge. However, he said that, the *university has identified best location where to store e-waste and has plan to create or build a material recovery facility. It is a bigger and more spacious facility to accommodate not only e-waste but also for other waste or scrap materials.* Similarly, participant no. 5 disclosed that *no storage area* made a similar statement which states, *finding adequate space that is secure organized and compliant with regulations can be challenging*. This means that, HEIs took the initiative to establish a storage area sufficient to accommodate a bulk of e-waste. In other words, HEIs were concerned of e-waste and took action of addressing the challenge posed by e-waste materials. In the study of Paghasian (2017), majority of the problems of waste management is due to the health hazards, inadequate facilities and waste containers.

The risk of hazardous materials was also considered a challenge by one participant. Participant no. 4 reported that *e-waste materials are hazardous if not handled properly*. This can be deduced that most personnel observed that HEIs did not have sufficient storage of e-wastes that they concluded that risk is eminent if not properly addressed.

Participant no. 4 claimed that data security risk was also a concern on the storage of e-waste. In other words, HEIs did not have available storage for files taken from the computer units. The danger of loss of important data is imminent since there are no available units where the data can be stored.

The lack of personnel who can handle e-waste products was considered a challenge. This suggests that, there was no sufficient number of personnel who can handle or manage in storing e-waste materials. To effectively handle it, HEIs have to train personnel who can take charge of e-waste disposal. Participant no. 11 confirmed that it *is hard to find people who will say it is to be disposed or not*. This indicates that HEIs have no personnel equipped with knowledge and skills to look at the disposal of e-waste materials. Based on this challenge, Paghasian (2017) mentioned that storage of e-waste materials was less practiced because of the problems of waste management due to insufficient funding, inadequate facilities and waste containers.

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Table 6

Challenges Encountered on E-Waste Management in Terms of Recycle Among HEIs

Challenges	f	%
1.Lack of awareness on e-waste program	7	43.75
2.Lack the motivation to participate	2	12.5
3.Setting up of infrastructure	2	12.5
4.Chaotic filing of e-waste equipment	1	6.25
5.Limited funding	1	6.25
6.No designated personnel	3	18.75
Total	**16**	**100.00**

Table 6 reveals 7 or 43.75% of the participants recognized that, there was lacked of awareness on e-waste program, no designated personnel with 3 or 18.75%, lacked of motivation to participate and setting up of infrastructure with 2 or 12.5 percent. Other challenges have one each or 6.25% such as chaotic filing of e-waste equipment and limited funding.

In terms of awareness on e-waste program, Participant No.1 disclosed that, *there is a minimal participation in recycling effort necessitating extensive outreach and education to enhance engagement*. In addition, Participant No.13 confirmed that e*nsuring that students, faculty and staff are aware of the e-waste program and motivated to participate can be challenging*. This can be deduced that HEIs personnel lacked the awareness on how to recycle e-waste. HEIs need to advocate for awareness on recycling of e-waste to ensure that every HEI personnel has to capacity to carry the recycling of e-wastes in their institutions. In a study of Maphosa (2021), she asserted that; the lack of awareness was a significant impairment to e-waste management.

Meantime, two participants expressed their challenges in recycling e-waste in their respective institutions. The lack of designated personnel was their concern. Participant No. 7 said that, "*I think the current challenge is that there is no designated personnel in-charge in the recycling of e-waste.*" This was evident that HEIs management did not designate personnel who will manage in the recycling of e-waste. This is therefore imperative that HEIs have to appoint a trained personnel on recycling of e-waste so that efficient and effective implementation can be ensured.

Participant No. 4 expressed that, "*the key challenges implementing effective e-waste recycling program in a higher education setting include the difficulty in coordinating across multiple department and stakeholders.*" This difficulty happened when there are no designated personnel who will spearhead the initiative of recycling e-waste to implement. The absence of a personnel who will implement such practice can render e-wastes unattended. The need to designate personnel to take charge of recycling of e-wastes can make HEIs achieve the goal of the e-waste management program.

Another concern raised by the participant in recycling of e-waste is the lacked of motivation to participate in the recycling program among stakeholders. The participant pointed out that motivation to participate among personnel can be challenging. Similarly, Participant No.1 disclosed that only a *minimal number of personnel participate in recycling effort which needs an extensive outreach and education to enhance engagement*. In other words, personnel in HEIs were not motivated to engage in the recycling of e-waste. This can be attributed to lacked of knowledge and awareness on how to recycle e-waste materials. A study made by Nolasco et al. (2019), that poor e-waste management information dissemination tactics, will reduce public awareness and program participation. Therefore, HEIs management has to address this issue by holding seminars to raise awareness among personnel of HEIs.

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It is through this medium that HEI personnel can become motivated and engaged in the recycling of e-waste.

2. Develop a Proposal for Sustainable Environmental Plan

Program: E-Waste Management Practices Program: A Proposal for Sustainable Environmental Plan

Rationale:

E-waste is a worldwide problem since it poses human health risk and environmental hazard. It has become the fastest growing waste stream in the industrialized world. The United Nations Economic Programmed (2004) reported that e-waste was accelerating at 4% a year and the rate of its volume is increasing at 5 – 10% yearly (Wong, 2007). Though third world countries do not generate e-waste equally with the industrialized; however, they are facing the danger of its effects since 80% of electronics from the industrialized countries are transported to developing countries like the Philippines (Kitila & Woldemikael, 2019). This shows that the risk of e-waste gradually increases that it poses problems to environmental sustainability and human health throughout the world.

In order to manage e-waste in the nation, the Philippine government has adopted pertinent and responsive rules and guidelines, echoing similar voices. A draft of the "Guidelines on the Environmentally Sound Management (ESM) of Waste Electrical and Electronic Equipment (WEEE)" was released by the Environment Management Bureau (DENR-EMB) of the Department of Environment and Natural Resources. The Guidelines also seek to address the financial requirements associated with the implementation of extended producer's responsibility (EPR) by institutionalizing it. With this method, the post-consumer phase of a product's life cycle is included in the manufacturers' and importers' responsibilities.

The management practices of e-waste materials are crucial in educational institutions since teaching and non-teaching personnel as well as the students are actively engaged in their specific tasks directed towards achieving educational goals. The proper management practices on e-waste can directly or indirectly impact their effectiveness and efficiency in the performance of their respective engagements. However, the poor e-waste management practices can endanger their health and engagement in the tasks that they are expected to perform.

In the context of this study, e-waste management practices in terms of collection, monitoring, disposal, storage and recycling were rated less practiced. In other words, the HEIs' personnel had not demonstrated well in their e-waste management practices that an intervention has to be introduced to achieve efficiency and effectiveness in dealing with e-waste management.

Hence, the proponent of this paper has conceived an intervention program, that is, on "E-Waste Management Practices Program: A Proposal for Sustainable Environmental Plan" among HEIs personnel, local community and other stakeholders in Zamboanga City.

GOALS

This program aims to enhance e-waste management practices of the teaching and non-teaching personnel of higher educational institutions, along the areas of collection, monitoring, disposal, storage and recycling.

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OBJECTIVES:

As the school head, in collaboration with local community, LGUs and other stakeholders, in adapting, employing, and implementing this intervention plan, they are expected to accomplish the following:

1. Acquire knowledge on the government policies and regulations covering e-waste management;

2. Improve e-waste practices specifically in the process of collection, monitoring, disposal, storage and recycling.

3. Apply the knowledge and skills on e-waste management practices for effective implementation of e-waste management program in HEIs.

Program Activities

✓ **Events for the Collection of E-Waste:**

In order to properly tackle the problem of e-waste in the school community, the HEIs will plan quarterly collecting activities at easily accessible sites with coordination to accredited recycling partners. These activities will guarantee that hazardous materials are not disposed of inappropriately by giving the personnel easy ways to get rid of their outdated devices.

✓ **Awareness Campaign:**

To inform the HEIs personnel about the value of collection, monitoring, disposal, storage, and recycling e-waste and the environmental problems linked to inappropriate disposal, a multifaceted awareness campaign must be started. To reach a wide audience, this campaign will make use of a variety of platforms, such as captivating social media postings, eye-catching fliers distributed around the school community, featured in local media outlets.

Partnership with Recycling Facilities:

Identifying and working with accredited e-waste recycling facilities that follow environmental rules will help the management assure appropriate recycling processes. Through these collaborations, the infrastructure required for the secure disposal and recycling of gathered electronic trash will be provided. The school management shall set up an open procedure to follow e-waste from the pickup location to the end recycling step. By using this tracking system, it will be certain that the abandoned electronics are being disposed of properly and aren't harming the environment. In order to inform the HEIs community on the amount of e-waste processed and to guarantee adherence to best practices, the assign personnel shall establish regular communication with the recycling partners. Fostering these partnerships will enable to establish a dependable and trustworthy recycling network that advances the objectives of the program.

✓ **HEIs Engagement:**

The E-Waste Management Practices Program's which involves collection, monitoring, disposal, storage, and recycling effectiveness depends on the involvement of school personnel and management. HEIs shall establish an advisory body that will make up of local stakeholders, such as the captain of the Barangay, companies, and environmental groups, to help with this. This committee will play a key role in guiding the development and implementation of the program, ensuring that the project reflects the

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needs and objectives of the school community as well as the larger community. HEIs can develop a program that appeals to a wide range of community people by encouraging diverse viewpoints. The committee will also establish volunteer opportunities to motivate community members to actively participate in outreach and collection activities.

- ✓ **Monitoring and Evaluation:**

The HEIs will develop key performance indicators (KPIs) that provide measurable data in order to evaluate the efficacy of the E-Waste Management Practices Program. These measures will include changes in the general public's awareness of e-waste issues, rates of community involvement, and the total amount of e-waste collected. Through post-event questionnaires, participants will be asked for their opinions, and the data collected will be examined to acquire crucial information about the program's impact. To ensure that the program continues to meet community needs and effectively contributes to environmental sustainability by constantly examining this data and making educated adjustments to future projects. Reinforcing the positive impact of collective efforts in e-waste collection, monitoring, disposal, storage, and recycling

Targeted Audiences

- ✓ **Schools and Educational Institutions:**

Teachers, administrators, and students can all gain from recycling activities and e-waste education campaigns.

- ✓ **Businesses and Corporations:**

Local companies that produce electronic trash and want direction on appropriate recycling and disposal methods.

- ✓ **Nonprofit Organizations**:

Community groups that can work together on e-waste projects and are centered on sustainability, education, or environmental issues.

- ✓ **Government Agencies**:

Departments and representatives of the local government working on sustainability, environmental protection, and waste management projects.

- ✓ **Environmental Advocates**:

Environmental Advocates that are actively involved in sustainability and environmental conservation initiatives and who can support the recycling of e-waste.

- ✓ **Tech Enthusiasts and Consumers**:

People who frequently replace their electronics might not know how to properly dispose of their e-waste.

- ✓ **Local Residents:**

The community's residents who produce e-waste, which includes outdated devices like computers, phones, and appliances.

- ✓ **Recycling Centers and Waste Management Companies**:

Recycling and waste management organizations that can collaborate on the collecting and processing of e-waste.

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- ✓ **Community Leaders and Influencers**:

Influencers and local leaders who can promote involvement in programs and assist spread the word about recycling e-waste.

- ✓ **Researchers and Academics**:

Professionals and students with expertise in sustainability, waste management, and environmental science who can add knowledge and research to the project.

Budget

- ✓ **Collection Event Logistics: 20, 000**

Funds for planning and carrying out e-waste recycling collecting events are allotted by this budget line. It covers a number of logistical elements, such as renting a space for secure and convenient drop-off sites, paying for transportation for the required tools, and providing trash cans to guarantee a smooth experience for attendees. This sum also includes the cost of hiring volunteers or paid staff to help with the event, as well as any licenses or permits required to carry out the collection events in a lawful and effective manner.

- ✓ **Educational Materials and Campaigns: 50, 000**

This funding is used to create and distribute educational materials meant to raise public awareness of the importance of recycling e-waste. With the funds, educational publications, pamphlets, and brochures that outline the detrimental environmental impacts of e-waste and provide detailed instructions on where and how to recycle electronic equipment will be produced. This fund will also pay for digital campaign expenses including community lectures, online seminars, and social media advertising. Reaching a large audience is intended to educate people about appropriate disposal practices and inspire them to take an active part in the recycling program.

- ✓ **Partnership Development with Recycling Facilities: 20, 000**

Building reliable partnerships with recognized recycling facilities is essential to the e-waste recycling program's success. This cash allocation will help with outreach activities, such as conference travel expenses and discussions with potential recycling partners. It includes the cost of negotiating contracts that ensure appropriate recycling practices, safe treatment of hazardous items, and secure processing of collected e-waste. By developing strong relationships with these institutions, we can ensure that the collected resources are handled properly and promote resource recovery and environmental sustainability.

- ✓ **Local Community Engagement Activities: 30, 000**

Involving the local community is essential to the program's success. This funding will fund a range of initiatives to raise awareness and encourage involvement in the e-waste recycling program. This entails setting up town hall meetings, workshops, and volunteer training sessions to educate the local population about recycling procedures and e-waste issues. Funds will also be utilized to provide participation incentives, like freebies or competitions, to entice locals to bring their electronic waste to collection events. Developing a close relationship with the community raises the program's profile and influence while also promoting an environmentally conscious society.

- ✓ **Monitoring and Evaluation Tools: 30, 000**

The resources and technologies required to track and assess the efficacy of recycling e-waste program are the main focus of this allocation. In order to evaluate community involvement rates and learn more about how the public views the program, the funds will be utilized for data collecting instruments including surveys and feedback forms. It will also be compatible with analysis tools that

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can be used to monitor e-waste collecting trends and pinpoint locations in need of development. For the program to be effectively modified to fit community requirements and to show its influence on encouraging sustainable e-waste habits, regular monitoring and evaluation are essential.

✓ **Total Estimated Cost: 150, 000**

The e-waste management practices initiative is expected to cost 1**50, 000** in total. This budget demonstrates a thorough strategy for tackling the community's e-waste disposal issues and encouraging environmentally friendly behaviors. In order to increase knowledge about proper e-waste disposal and have a long-lasting positive environmental impact, the program invests in partnerships, education, logistics, local community participation, and assessment. This budget ensures adequate money for all necessary components, leading to a successful initiative that might successfully reduce e-waste and promote recycling in the community.

Resources Required

✓ **Funding and Budget Allocation**:

▪ **Grant Funding**:

▪ Seek funding for the creation and execution of programs from government institutions, private foundations, and environmental groups.

✓ **Budget for Operations**:

▪ Allocate cash for operational costs, such as outreach education, processing, transportation, and collecting.

✓ **Collection Infrastructure**:

✓ **Drop-off Centers**:

• Establish designated e-waste collection points in schools, local community centers, to facilitate easy collection, monitoring, and disposal.

✓ **Mobile Collection Units**:

▪ The Local Government Unit may implement mobile collection events to reach areas with limited access to permanent drop-off sites.

✓ **Partnerships with E-Waste Recyclers**:

✓ **Certified Recycling Facilities**:

▪ Collaborate with certified e-waste recycling companies that adhere to environmentally responsible recycling practices.

✓ **Local Governments and Organizations**:

▪ Partner with local governments, non-profits, and businesses to expand outreach and collection efforts.

✓ **Educational and Outreach Materials**:

✓ **Awareness Campaigns**:

▪ HEIs Community may develop brochures, flyers, and digital content to inform the community about e-waste recycling, its benefits, and proper disposal methods.

✓ **Workshops and Seminars**:

▪ HEIs may organize educational events to engage the community, providing knowledge and information on the importance of e-waste recycling and how to participate.

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- ✓ **Logistics and Transportation**:
- ✓ **Transportation Services**:
- The LGUs may arrange for reliable transportation of collected e-waste to recycling facilities, including vehicles equipped to handle hazardous materials safely.
- ✓ **Inventory Management**:
- Government agencies such as EMB or Environmental Management Bureau may implement systems for tracking collected e-waste, ensuring proper inventory management and reporting.
- ✓ **Staffing and Volunteers**:
- ✓ **Program Coordinator**:
- Hire a dedicated coordinator for E-Waste to oversee the initiative, manage logistics, and ensure compliance with regulations.
- ✓ **Volunteer Recruitment**:
- Engage community volunteers or a Non-Profit Organization to assist with collection events, educational outreach, and administrative tasks.
- ✓ **Compliance and Regulatory Resources**:
- ✓ **Legal Guidance**:
- Consult legal experts to ensure compliance with local and state regulations regarding e-waste handling and recycling.
- ✓ **Documentation and Reporting**:
- Topping Government Agencies such as DICT to develop systems for documenting collection data, recycling processes, and outcomes for accountability and reporting purposes.
- ✓ **Technology and Equipment**:
- ✓ **Collection Bins**:
- Invest in secure and clearly labeled collection bins for e-waste to be placed at drop-off centers and collection events.
- ✓ **Recycling Equipment**:
- If applicable, procure necessary equipment for sorting, dismantling, or processing e-waste materials at designated facilities.
- ✓ **Evaluation and Monitoring Tools**:
- ✓ **Impact Assessment Tools**:
- Acquire assistance of DICT to develop metrics and tools to evaluate the program's effectiveness, including collection volumes, community participation rates, and environmental impact.
- ✓ **Feedback Mechanisms**:
- Implement surveys and feedback forms to gather input from participants and stakeholders for continuous improvement.
- ✓ **Sustainability and Future Planning**:
- ✓ **Long-Term Strategy Development**:
- Create a roadmap for sustaining the e-waste recycling initiative, including ongoing funding, partnerships, and community engagement efforts.

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✓ **Periodic Review**:

- There will be a Establish a regular timetable for program performance evaluations to pinpoint problem areas and guarantee consistency with community requirements.

Expected Outcomes

- **Increased E-Waste Recycling Rates:**
- The program's goal is to raise the community's e-waste recycling rates up by a measurable amount, with a 30% increase in the first year of operation. Partnerships with nearby recycling facilities and routine tracking of the e-waste collected during scheduled recycling events will be used to evaluate this result. The program expect more community participation and a larger amount of e-waste recycled by offering easy collection choices and using educational initiatives to promote the program. The personnel's community dedication to sustainable practices and appropriate electronic waste management is strengthened by success in this area, which also shows how beneficial the initiative is.
- **Enhanced Community Awareness:**
- One of the primary goals of the initiative is to raise community awareness of e-waste issues and recycling alternatives. After participating in the campaign, the program expects that at least 75% of the community members surveyed will be more aware of the importance of recycling and the harm that e-waste causes to the environment. Locals will gain knowledge about the risks associated with managing their e-waste and how to safely dispose of their electronic devices through targeted educational materials, workshops, and outreach programs. The program's influence will likely rise as a result of residents' growing sense of duty, which will encourage them to actively participate in recycling activities and share knowledge throughout their networks.
- **Reduction in E-Waste Sent to Landfills:**
- One of the primary environmental benefits of the E-Waste Recycling Program is the anticipated reduction in the quantity of e-waste disposed of in landfills. By implementing effective collecting procedures and raising public awareness of the environmental hazards associated with e-waste, the program seeks to keep a significant amount of electronic waste out of landfills. This reduction will not only make the environment cleaner but also lower the associated environmental hazards, such as soil and water pollution from dangerous substances. Through regular monitoring of garbage disposal parameters, the program will be able to quantify this outcome and show how it improves the local ecology.
- **Strengthened Community Partnerships:**
- Promoting and supporting sustainable e-waste recycling processes requires forging solid alliances with nearby companies, educational institutions, and civic associations. By working together with these stakeholders, we will increase the program's efficacy and reach. This result will entail creating collaborative projects, like jointly organized collecting occasions, instructional seminars, and advertising campaigns emphasizing the value of recycling e-waste. Will increase efforts, develop pooled resources, and promote a community-wide commitment to responsible e-waste management by assembling a network of partners who share dedication to environmental sustainability. These collaborations will also contribute to the program's durability and robustness.
- **Long-term Sustainability:**
- One of the main outcomes of the E-Waste Recycling Program will be the development of a sustainable e-waste management practices approach that can be adjusted and expanded to other communities. This model will be created using the knowledge gained and accomplishments made during the program's execution.

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CONCLUSION:

Based on the findings, the following conclusions were drawn:

1. There is a need to minimize the ICT, Telecommunications Equipment and Office Electronics waste by improving the proper handling and maintenance of electronic materials.

2. The teaching and non-teaching personnel have to enhance their e-waste management practices in terms of collection, monitoring, disposal, storage, and recycling.

3. The HEIs have to address the challenges in e-waste management practices in terms of collection, monitoring, disposal, storage and recycling.

RECOMMENDATIONS:

Based on the findings the following recommendations were made:

1. The HEIs may issue policies on proper handling and maintenance of electronic units to take rid of wastage. This may be disseminated to the different offices to make everyone aware on how to take care of electronic units.

2. The HEIs may adopt measures/mechanisms to address appropriately the challenges met by the personnel to achieve sound e-waste management practices.

HEIs may provide e-waste management seminars to their teaching and non-teaching staff in order to raise awareness and improve existing procedures. Bringing in experts from local or national government organizations and other interested parties who can help ensure the seminars go smoothly.

3. The local government units may take the initiative to conduct an orientation designed to strengthen e-waste management program of the HEIs. The local government can orient personnel of the HEIs on policies and regulations governing e-waste management for effective implementation.

4. HEIs may develop regulations and policies for managing e-waste because Electronic and ICT equipment were used extensively by most HEIs.

5. HEIs may promote advocacy campaign activities regarding E-waste management practices and awareness.

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