

Waste Electrical and Electronic Equipment in Libya

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نفايات الأجهزة الكهربائية والإلكترونية بليبيا

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المخلص:

مع ازدياد أهمية المعدات الكهربائية والإلكترونية (EEE) في حياتنا المعاصرة، حيث تُستخدم لإنجاز المهام بسرعة ودقة، استخدام EEE ينتج عنه النفايات الكهربائية والإلكترونية (WEEE). تتكون هذه المعدات EEE من مزيج من مواد ذات الثمينة والغير ثمينة. ونظرًا لتزايد كمياتها، تُعتبر النفايات مصدرًا للمواد الخام. يشهد قطاع تجميع وإعادة تدوير هذه النفايات في ليبيا نموًا سريعًا نظرًا لارتفاع استهلاك المعدات الإلكترونية والكهربائية، إلا أن المعلومات الدقيقة حول حجمها في البلاد غير متوفرة. تُسجل ليبيا أعلى معدل لإنتاج هذه النفايات في أفريقيا، حيث يُقدَّر بنحو 13 كيلو غرامًا للفرد سنويًا. كما لا توجد في ليبيا قوانين تُنظم هذا القطاع، مما يُقلل من المعلومات المتاحة عنه. تُجمع النفايات في الأراضي المفتوحة دون مراعاة الظروف البيئية الأمر الذي يؤثر على البيئة وصحة الإنسان لاحتواء WEEE على مواد سامة. إضافة إلى ذلك، تعتبر WEEE مصدرًا هامًا للمواد الخام، إلا أنها لا تُدار بشكل سليم. هذه الورقة تستعرض النفايات في ليبيا، كيفية إدارتها وتأثيرات E-Waste على البيئة والصحة.

الكلمات الدالة: النفايات الكهربائية، النفايات الإلكترونية، إعادة تدوير، مواد سامة، معدات كهربائية وإلكترونية.

Abstract

As electric and electronic equipments (EEE) become a vital and essential in our modern life. They are used to perform tasks in short time and in accurate manner. The use of EEE generates Waste of Electric and Electronic Equipments (WEEE). The EEE is constructed of combinations of many types of valuable and non-valuable materials. In addition, the WEEE is growth so they become a source of raw materials. Collection and Recycling industry of WEEE in Libya grows rapidly. There is no accurate information about the WEEE in Libya. The generation of WEEE in Libya has the highest rate in Africa which is estimated about 13 Kg/person per year. Also, in Libya there is no published legislations that organize the industry of WEEE so there is no real information about this sector. The sites of collecting WEEE are opened lands and the WEEE is harmful for the environment and human health

because of toxic materials that are EEE contained. In addition, the WEEE is can be a vital source of raw materials which is not managed well. In this paper, WEEE is the reviewed in libya three aspects: the E-Waste in Libya, E-waste management, Health and Environmental impacts

Keywords: electric waste, electronic waste, EEE,EEEW,E-Waste.

1. Introduction

Nowadays, in our modern life, there are wide variety of electronic equipments that are used in every single house and in every single hand in our world. These electronic and electric equipments can be small electronic equipments such as personal computers, labtops, tablets, and mobile phones and ...etc and they can be large electric equipments such as washing machines, fridges, and ...etc (Kar et al., 2025) (Shittu et al., 2025). These electronic and electric equipments can be used for a periode of time and after that they will be became unusefull equipments for many reasons such as they become old fashion or destroyed or even broken (Kar et al., 2025). So they become a source of waste which called electronic waste (e-waste) or Waste electric and electronic equipment (WEEE)(Kar et al., 2025). The EW can be defined as all the Electronic and Electric items and its parts that their owners discard them and they do not want to reuse them again(Moossa et al., 2023). Some of EEE is irreperable therefore they will become an WEEE (Lebbie et al., 2021) .The EW is globally growth in a fast rate with 53.6 Mt in 2019 compared to 44.4 Mt in 2014 (Moossa et al., 2023). E-Waste is characterized into different categories that include tiny IT and telecommunication systems, small electrical devices, screens and monotors, big electric appliances, lights, heating and frezing equipments (Elmnifi et al., 2019)(Moossa et al., 2023). The most common source of the e-waste is mobile phones, tablets, computers and Home appliances. These equipments have components such as battries and electronic chips, electrical motors....etc. in the high income regions, the average of EEE items is 109 items/capita with excluding lamps while the average in the lowest income country is 4 items/capita(Elmnifi et al., 2018) (Baldé et al., 2024). In 2016, Singh and Zeng state that the e-waste is growth globally to become approximately 41 million metric tons annually. In 2018, the WEEE is raised to become 50 million metric tons(Rizk et al., 2024). Globally, the materia of weee in 2019 was estimated to worth about \$57.0 billion (Nur et al., 2023). The e-waste is rapildly growing up in rate from 3% to 5% annually(Rizk et al., 2024). In addition, in 2017, the UN reported that the rate of e-waste is raised by 21% in the previous five years (Rizk et al., 2024: (Lamma, 2021)). Furthermore, the E-waste is xepected to become 74 million metric tons by 2030(Rizk et al., 2024). The generated WEEE of the world was about 53.6 Mt in 2019 and increased by 21% compared to 2015 (Nur et al., 2023). In 2019, the recovered raw materials was valued \$10 billion that recovered from 10% of WEEE which processed in environmental conditions which was redusing the emission of CO2 by 15 million metric tonnes (Nur et al., 2023). On the other hand, unfortunately, 83% of WEEE IN 2019 was not likely processed in illegal conditions such as openly burned or dumbred (Nur et al., 2023). This paper will review the past studies or papers in the recent five years that covers the electronic waste in libya. Key zone of concern in regarding of WEEE in Libya are identifying the WEEE, managing the WEEE and the risks of WEEE on human health and environment.

E-Waste in libya:

In libya many people do not know what is the e-waste. The writers of “Students’ Awareness and Behavior towards E-Waste Management: A Study in Tobruk” state that the 55.9% of people who are included in the study aware of the E-Waste and its management (Rizk et al., 2024). Also, in 2013, there is a study show that a 59% of participant do not recognize the meaning of E-waste (Rizk et al., 2024). Based on data in 2017, Libyan inhabitants are one of the highest three nations

of Africa that generating E-waste which its annual average is 11kg/capitan (Elmnifi et al., 2019) (Maes & Preston, 2022). In 2022, Libya generated 94 million kg and its average 13.4 kg/person (Baldé et al., 2024)

E-waste management in Libya:

In North African Country, there is a lack of awareness of the important of collecting and recycling e-waste (Baldé et al., 2024). Moreover, the E-Waste are not well managed in north African Countries, so there is no accurate information about quantity and types of E-Watse (Elmnifi et al., 2019). the WEEE is considered as a vital source of raw material (Nur et al., 2023). On the other hand, failer of managing e-waste can be dengerous on the environment and human (Shittu et al., 2025). As libya is one of NAC, there is not any official information about the e-waste (Baldé et al., 2024). There is no ligislation or policy in libya and it does not have a collection target and recycling target (Baldé et al., 2024; Lamma and Swamy (2015). According to data of year 2017, the libyan population is 6.375 million, so the genetated approximately 70 metric tons (Elmnifi et al., 2019). Such a significant amount can led to significatnt economic if it is well managed, Otherwise, it will be a source of environmental crises (Elmnifi et al., 2019). The electronic and electric equipments constructed from many materials. They have a wide range of elements such as wood, valuable and nonvaluable metals, plastic, rubber, glass, polywood, ciramic and printed Circuit Boards (Elmnifi et al., 2019). The EW can be an economic opportunity for poor people and less educated (Perkins et al., 2014).Recycling the EW will save the natural resources but must be done by appropriate methods that do not affect our environment (Alhadi et al., 2024). As an E-Waste contains many valuable and non-valuable materials which they can be a source of good income. For instance on ton of mobile phones can produce 3.5kg of Silver, 0.34kg of gold, 0.14kg of Palladium, and 130kg of copper which all together an estimated at value of about 15000 Euro in the market (Elmnifi et al., 2019). In addition, the recycled computer's value in the market is 8.16 Euro (Elmnifi et al., 2019). The lowest economy worth of the libyan E-waste in 2017 is EUR 163 million. According to the United State Environemental Safeguard Agency (USESA) has estimated that the rate of rising of E-waste is in between 5% to 10% (Elmnifi et al., 2019). The following table show the quantity of e-waste in million tons and their's economic values.

Table 1: the scenario of generation of EW.

Year EW in Tons	2017	2019	2021	2023	2025	2027	2029
Low Scenario	70	77	84.7	93.2	102.5	112.7	133.2
High Scenario	70	84	100.8	121	145.2	193.5	271

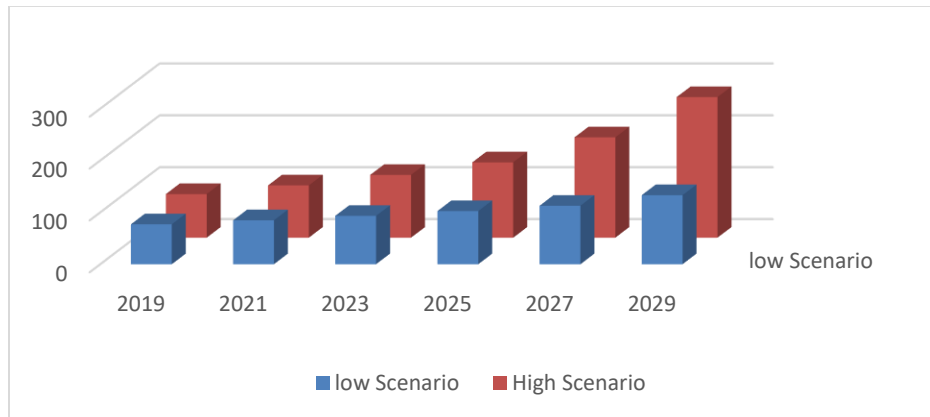


Figure 1: the Scenarios of E-Waste's production

The global economic value of the generated EW in 2016 was approximately Five Billion Euro for 44Mt of global EW which ment that the value of metric ton of EW was estimated 1199.86 Euro (Elmnifi et al., 2019). This number will be used for calculating the economic value of the Libyan EW as shown in the following table.

Table 2: the economic value of EW.

Value year	low Scenario	High Scenario
2019	92389.22	100788.2
2021	101628.1	120945.9
2023	111827	145183.1
2025	122985.7	174219.7
2027	135224.2	232172.9
2029	159821.4	325162.1

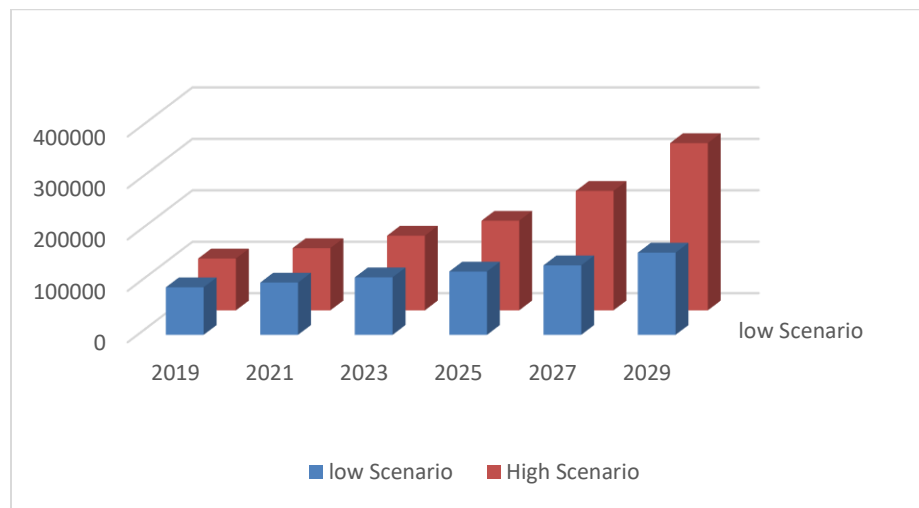


Figure 1: the scenarios of Economic value of EW.

Health and Environmental impacts of EW:

The recycling industry in developing nations has a series issue because of laking the ligislations which make managing the EW is a real challenge (Elmnifi et al., 2019). According to World Health Organization, the E-Wastes are dengorous because they contain a very poison elements such as Mercury, barium and Zinc (Alhadi et al., 2024). And it is conciderd as a vital issue in the world (Alhadi et al., 2024). There are many series hazards that can be highlighted in this sector (Baldé et al., 2024) (Perkins et al., 2014). each product of EEE constructed from a unique materials so they have unequal effects on the environment and on the human health (Baldé et al., 2024). Moreover, Most of people are collecting the EW is children who workin in unsuit conditions who deal with heavy and dengorous materials (Elmnifi et al., 2019). The recycled electric and electronic equipment are collected and processed in unregulated lands (Elmnifi et al., 2019). The ways that used to extracting the valuable metals are very simple such as burning and acid digestion, open burning and dismanling with bare hands some materials (Moeckel et al., 2020). Also, the e-waste agencies do not use modern industerial processe (Perkins et al., 2014). the soil of the dumpsite can be effected by the heavy metals which distroyed the plantes in that

area(Elmnifi et al., 2019). In addition, the EEE items contain a huge amount of toxic materials (Perkins et al., 2014) (Shittu et al., 2025).

Conclusion:

This review article reviews all the papers and articles that written about the WEEE in libya in the past 10 years. the generated WEEE of libya is very high which is about 13.4 kg / capita annually. And it conclude that there is no accurate information about the e-waste. All the previous study use an estimated information. In addition, there is no legislation that organize this e-waste sector. Furthermore, the sites are not well prepared to receive and collect the WEEE and people working in collecting e-waste use oped land so the soil will be destroyed by toxic chmical and oils. In addition, most of the people collecting the WEEE is young and sometimes they use simple ways to recover some materials such as open burn which expose people near to the site to a pison smoke and pollute the soil in the site with the solid waste. There is a shortage of information about Waste of electric and electronic equipments. The WEEE can be a vital economic sector in Libya.

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