Sustainable WEEE management in academic institutions: The case of Aristotle University of Thessaloniki

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EXTENDED ABSTRACT

Introduction

Waste from Electrical and Electronic Equipment (WEEE) is one of the fastest growing waste streams globally, with an estimated annual growth rate of 3-5% (Cucchiella et al., 2015). In 2022, global WEEE production reached 62 million tonnes (7.8 kg per capita), compared to 34 million tonnes in 2010 (Baldé et al., 2024). WEEE is a non-homogenous mixture of materials and components, containing hundreds of different substances, including both valuable and potentially highly toxic compounds (Williams, 2016). WEEE recycling is crucial, towards the proper management of the hazardous substances and the effective recovery of the valuable compounds. Only 22.3 wt% of the globally generated WEEE was properly collected and recycled in 2022, (Baldé et al., 2024).

Academic institutions use a wide range of electrical and electronic devices (computers, laboratory equipment, printers etc.) – EEE and are therefore a significant source of WEEE. Managing WEEE in universities is crucial for fostering sustainable waste practices. Various strategies have been identified, including segregating waste, refurbishing devices, recycling materials, and ensuring responsible disposal. Effective approaches involve implementing product take-back schemes, organizing awareness campaigns, and integrating e-waste policies into university governance structures. Research underscores the importance of extended producer responsibility (EPR) and collaborations with certified recyclers to ensure adherence to environmental standards. Utilizing digital tracking systems and inventory management also helps reduce e-waste. Recommended best practices include adopting a circular economy model, which encourages device reuse and sustainable procurement to minimize WEEE generation and mitigate environmental impacts.

This paper focuses on the sustainable management of WEEE within the Aristotle University of Thessaloniki (AUTH) and aims to propose an environmentally sustainable and economically viable way to manage the electrical and electronic devices of the university when they reach the end of their lifetime.

Keywords
WEEE, sustainable management, academic institutions, recycling

Methodology

Literature review

Waste from Electrical and Electronic Equipment (WEEE) management in universities is a critical aspect of sustainable waste practices. Research highlights various methods, including waste segregation, refurbishment, recycling, and responsible disposal. Effective strategies involve implementing take-back schemes, awareness programs, and integrating e-waste policies into institutional frameworks. Studies emphasize the role of extended producer responsibility (EPR) and partnerships with certified recyclers to ensure compliance with environmental regulations. Digital tracking systems and inventory management also contribute to reducing e-waste. Best practices suggest that universities should adopt a circular economy approach, promoting reuse and sustainable procurement to minimize WEEE generation and environmental impact.

Bibliometric analysis

A bibliometric analysis of the literature on WEEE management in universities was conducted using the "Scopus" database and the "VOSviewer" software. The search in the "Scopus" database was done by using the combination of the keywords "universit* AND e-waste", "campus AND e-waste" and "universit* AND electronic AND waste*" in the field "Article Title". The final data set comprised only

24 publications, spanning from 2009 to 2025. The bibliometric maps and words obtained from all the aforementioned publications were then extracted using the "VOSviewer" software.

Most of the publications originated from Malaysia, Bangladesh, Brazil and South Africa. Only one European country (Finland) has published a relatable article, despite the fact that Europe is considered to be a leader in the environmental sound management of WEEE. The publications mainly investigate the level of awareness and knowledge on how to properly handle WEEE among university community and examine the current WEEE management practices in certain universities. Some of them highlight the main challenges and shortcomings, such as the lack of awareness, the absence of sustainable policies and the lack of facilities within universities and provide some recommendations for the improvement of WEEE management practices within universities.

SWOT analysis

SWOT Analysis was performed to assess the current WEEE management plan (WEMP) of AUTH and focus on the main drawbacks needing improovement It is thus of primary importance to identify the main problems and thus explore possible solutions. The analysis was operated while taking into consideration the WEMP implemented in other universities and academic institutions in Greece and overseas.

The existing WEMP in AUTH supports both the possibility for reuse of the electronic equipment through different departments and the retracting of WEEE after its characterization as non-usable. While AUTH accomplishes retracting big quantities of WEEE every year, there are some shortcomings need to be addressed. The WEMP appears to be slightly complicated and not applicable to all sources of WEEE. The plan doesn't offer the opportunity to every member of the University to dispose of their personal WEEE and all other electronic equipment not included in its "property".

A proposal for the improvement of the existing plan, should include the appropriate development of an app in which all the community of AUTH could effectively upload, exchange and buy others' EEE cheaper. Moreover, the proper inclusion of all sources of WEEE in the plan, could lead to the recycling of higher quantities of WEEE and could effectively generate possible intensives.

Additional challenges should also be faced while improving the WEMP. Lack of awareness, which was also ascertained in the bibliometric analysis and lack of funding appear to be the main threats. Towards the improvement and the effective elimination of these drawbacks, acting towards the enhancement of the knowledge and the awareness of the AUTH community on the proper and sustainable WEEE management is considered crucial. These actions are expecting to bring all parties in a closer co-operation and could lead in establishing effective practices to be followed in other public organizations.

Conclusions

The most significant conclusions can be summarized to the following:

- The presence of EEE in Academic Institutions is inevitable and therefore their proper waste management is crucial. Sustainable WEEE management needs more research.
- Lack of awareness and limited resources are the primary barriers to the implementation of a sustainable WEEE management plan in universities.
- There is a lot of room for improvement in the plan that is implemented in Aristotle University of Thessaloniki. Reuse must be more encouraged throughout the departments, whilst personal WEEE should be included in the plan.
- Economic limitations and administrative drawbacks suppress the University's opportunity for the effective establishment of viable and sustainable MP with the involvement of all stakeholders and the introduction of research and innovation.
- The support and the commitment of all the members of the University regarding the WEEE management plan are crucial factors affecting positively the necessary awareness and participation.

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