

# **WASTE MANAGEMENT: CHALLENGES AND ISSUES**

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# E-WASTE AWARENESS AND PRACTICES: INSIGHTS FROM EDUCATIONAL INSTITUTIONS IN NAGALAND



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## Abstract

*This study examines electronic waste (e-waste) practices and awareness within educational institutions in Nagaland, with a particular focus on students. The global surge in the use of electrical and electronic equipment has led to a substantial increase in discarded devices, contributing to environmental and health concerns. The research explores the lifecycle of e-waste, the causes of the global e-waste problem, and the concept of the circular economy (CE). It highlights the role of consumers, especially students, in determining the fate of e-waste and emphasizes the importance of awareness for proper disposal. The objectives of the study include assessing the penetration of information and communication technology (ICT) for academic purposes and understanding the willingness of students and faculty to participate in e-waste recycling. The methodology involves conducting surveys across various academic institutions in Nagaland, analysing demographic profiles, electronic device usage, and environmental consciousness. Results indicate a high level of awareness of e-waste among respondents but reveal a limited understanding of e-waste materials and policies. The findings of the study highlight the importance of increasing public understanding of e-waste composition, environmental impact, and proper management practices to foster sustainable behaviors. The study concludes with recommendations for establishing e-waste management centres, enhancing environmental awareness, enforcing regulations, and engaging stakeholders to address the e-waste challenge effectively.*

**Keywords:** E-Waste, Awareness, Recycling Practices, Educational Institutions.

## Introduction

Any materials unused and rejected as worthless or unwanted are considered as waste material. Everyone bears the obligation of ensuring that hazardous waste is disposed of safely and in an environmentally friendly manner, while adhering to all waste disposal laws. E-waste is rising significantly at a growth rate of 20-25% annually. According to the World Health Organization (WHO), e-waste is one of the fastest growing solid waste streams in the world. In 2022, an estimated 62 million tonnes of e-waste were produced globally. Out of which, only 22.3% was documented as formally collected and recycled. International Labour Organization (ILO) and World Health Organization (WHO) estimates that millions of women and child labourers working in the informal recycling sector globally may be at risk of hazardous e-waste exposures.

Pollution prevention involves the use of less energy, less equipment, and fewer hazardous and non-hazardous products overall. Efficient waste management can reduce the need for transportation and disposal, as well as lower operating expenses. The waste contains multiple facets, including valuable and rare materials.

The rapid growth of electrical and electronic equipment (EEE) across the globe has made these gadgets indispensable. Large volumes of abandoned EEE have resulted from the growing demand for such products. The number of devices nearing their end of life (EoL) has increased due to ongoing technological advancements that shorten the lifespan of EEE goods. Electrical and electronic waste, or “e-waste” refers to EEE products at their end of life. E-waste is typically divided into six main categories: large equipment, small equipment, displays and monitors, IT or telecommunications devices, temperature exchange equipment, and lighting.

Over the last two decades, the production and consumption of EEE have grown exponentially worldwide. The increased market penetration of items in developing countries like India and the emergence of a replacement cycle in industrialized countries are the main causes of this spike (UNEP, 2007). A greater number of people can now afford electronic equipment due to rising incomes and falling prices.

Furthermore, rapid technological advancements have led to the introduction of many new electronic products, whose life spans have decreased due to obsolescence. The rise in electronic waste can also be attributed to the shift from analog to digital technology, as well as the widespread use of flat-screen TV's, monitors, and small multipurpose gadgets like the iPad, iPhone, and Kindle. Therefore, it is crucial to evaluate the overall sustainability of e-waste by considering the three pillars of sustainability – environmental, economic, and social. Adopting sustainable development practices is a call to action for higher education institutions aiming to positively impact their communities. The present study examines the perspectives of the students in Nagaland's academic institutions on electronics.

## Objectives

1. To analyze the use of Information and Communication Technology (ICT) in education across academic institutions in Nagaland.
2. To examine the perceptions and practices of faculty and students regarding the safe disposal and recycling of e-waste in Nagaland's educational institutions.

## Methodology

The current study was conducted with the support of several academic institutions in Nagaland, including graduate and postgraduates' colleges and universities. Questionnaires were designed specifically for students and faculty members of these educational institutions. The questionnaire focused on various aspects of e-waste generation, usage, and disposal attitudes. Through this approach, the researchers were able to interview students aged 17 to 25. The sample population also included faculty members for colleges and universities in Nagaland. Insights from various literature surveys were also used to explore perspectives on e-waste management and collection practices.

Variable used: The types of devices used by participants from various groups were documented to assess the extent of ICT adoption among instructors and students across different colleges and universities. A structured questionnaire was developed to gauge the perceptions of professors and students regarding the generation, segregation, and collection of e-waste. As these institutions currently lack an efficient system for electronic waste collection, the quantity of e-waste produced was assumed to be equivalent to the amount of e-waste disposed of by the respondents. Data analysis and visualization were performed using SPSS software.

## Results and Discussion

The demographic profile of the survey population included details such as gender, age, designation, and type of institution. Data was collected from 300 respondents during the survey; of these, 189 (63%) identified as males and 111 (37%) as female. The majority of respondents, 267 (89%), were between the ages of 17 and 25, while the rest 33 (11%) were aged 25 and above. Among the respondents, 261 (87) were students, and 39 (13%) were staff members.

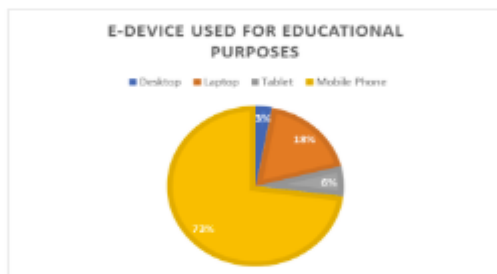


Figure 1

Respondents ranked four types of electronic devices (desktop, laptop, tablet, mobile phone) from “most often used” to “used least often” in the questionnaire. The findings revealed that 73 % of respondents indicated mobile phones as the most frequently used electronic device. Laptop and Tablets computers followed, with usage rates of 18 % and 6 % respectively. Desktops were the least frequently used, accounting for only 3 % of usage.

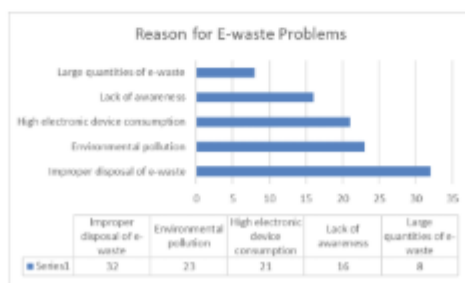


Figure 2

The questionnaire survey revealed significant insights into respondents' environmental awareness and their understanding of the global e-waste problem. A total of 300 respondents participated. Among them, 52% demonstrated environmental concern through practices like reducing, reusing, and recycling garbage. Additionally, 48% of the participants identified themselves as environmentally conscious. Regarding awareness of "e-waste," the majority of respondents, 258 (86%), were familiar with the term, indicating a high level of awareness. However, 42 respondents (14%) admitted to having no prior knowledge of the term, while 87 respondents (29%) stated they had learned about e-waste through reading.

The findings also highlighted that 72% of the participants acknowledged the existence of a global e-waste problem, citing various reasons, whereas only 28% disagreed. Around 42 respondents, who were unfamiliar with the term, chose the "N/A" option. Despite the high level of awareness, only 96 respondents (32%) were able to articulate why they believed there was a global e-waste problem. This led to the identification of five key causes: improper disposal of e-waste, environmental pollution, overconsumption of electronics, lack of awareness, and the sheer volume of e-waste generated.

Among these, improper disposal emerged as the leading cause, with 96 respondents (32%) identifying it as the primary issue. Environmental pollution was the second most cited reason, with 69 respondents (23%) pointing to it as a significant factor. High electronic device consumption (63 respondents, 21%), lack of awareness (48 respondents, 16%), and large quantities of e-waste (24 respondents, 8%) followed in frequency. These findings underscore the need for enhanced education and sustainable practices to mitigate the global e-waste crisis (Fig-2). A significant portion of respondents acknowledged the existence of an e-waste problem both nationally (68%) and globally (72%), reflecting widespread awareness of the issue. The findings also demonstrated a strong understanding of proper e-waste disposal practices among participants. A substantial number, 240 respondents (80%), strongly opposed the idea of landfilling e-waste, while 210 respondents (70%) disagreed with incinerating it.

However, opinions were divided regarding the storage of e-waste. The majority of respondents (150 respondents, 50%) expressed uncertainty about whether e-waste should be stored, indicating a potential gap in knowledge or clarity on this aspect of disposal. These results suggest a need for targeted education to address uncertainties and reinforce best practices for managing e-waste effectively. Respondents demonstrated the highest willingness to recycle small home electronic equipment on campus. In this category, 78% of respondents expressed their willingness, while 54% indicated a strong willingness to recycle these items. Conversely, respondents showed a lower level of enthusiasm for recycling mobile phones on campus, with only 42% indicating willingness. The least interest was shown in recycling large home appliances, with only 28% of respondents expressing willingness to recycle this type of e-waste on campus.

**Table 1: Knowledge of E-waste**

Questions	Options	Numbers (%)
1. Your level of familiarity with the national waste management policy.	Good	11 (4%)
	Okay	22 (7%)
	Poor	267 (89%)

2. Your level of acquaintance with the nation's policies on managing electronic device and e-waste.	Good	15 (5%)
	Okay	30 (10%)
	Poor	255 (85%)
3. Your level of understanding of the constituents used in electronic devices and e-waste.	Good	18 (6%)
	Okay	36 (12%)
	Poor	246 (82%)
4. The extent of your knowledge about the environmental impacts of e-waste and electronic devices.	Good	24 (8%)
	Okay	42 (14%)
	Poor	234 (78%)
5. Your level of knowledge about the health effects of electronic devices and e-waste on the environmental system.	Good	21 (7%)
	Okay	33 (11%)
	Poor	246 (82%)
6. Your knowledge of valuable resources presents in electronic devices and e-waste.	Good	15 (5%)
	Okay	45 (15%)
	Poor	240 (80%)
7. Your awareness of any toxic constituents presents in electronic devices and e-waste.	Good	12 (4%)
	Okay	30 (10%)
	Poor	258 (86%)

Source: Primary Data

When asked to assess their knowledge on various aspects of e-waste, the majority of the respondents reported limited understanding. Specifically, 78% acknowledged having little knowledge of the environmental impacts of e-waste, 82% were similarly unaware of its health effects (Table 1). Additionally, 86% of respondents rated their knowledge of the harmful components found in e-waste as "poor". The data in Table 1 further reflects a general lack of awareness regarding national and e-waste management policies. A significant 89% of respondents indicated having "poor" knowledge of the national waste management policy, with only 4% claiming to have "good" knowledge of e-waste management policies.

### Recommendations

To effectively manage the growing e-waste problem, the establishment of e-waste refurbishment, dismantling, and recycling centres is crucial. These centres would address the significant volume of e-waste accumulating in homes, schools, and government offices.

It is also essential to raise awareness among managers about environmental concerns and to strengthen the enforcement of environmental regulations. Allocating sufficient funds, infrastructure, and logistics will ensure the effective management of e-waste. Moreover, better enforcement of environmental regulations will enhance public confidence in the government's commitment to addressing the e-waste crisis and in the seriousness of stakeholders involved.

Expanding computer refurbishing and training centres will significantly aid in the management of electronic waste. However, addressing the issue requires more than just recycling end-of-life products; the industry must reassess the design, manufacturing, use, and collection processes of electrical and electronic devices to prevent them from entering the waste stream. Government agencies, service departments, and other stakeholders should organize training sessions, awareness campaigns, research initiatives, and a reorganization of structures to manage e-waste, including inventory and e-waste accounting.

Additionally, proper space should be designed for the storage of electronic waste, with adequate services such as bins, boxes, and shelves to facilitate the efficient handling of e-waste. These measures will reduce the environmental and public health risks posed by e-waste by minimizing the accumulation of electronic waste. Lastly, it is critical for state government and lawmaker to lead the creation and implementation of an e-waste management system and enforce laws specific to this sector. As e-waste continues to grow, it is both timely and necessary to develop a comprehensive e-waste policy framework. Regulations should be enacted to address activities that involve improper e-waste disposal, which can harm the environment and public health.

## Conclusion

In conclusion, this study emphasizes the importance of e-waste management in educational institutions and examines the current practices adopted across various institutions in Nagaland. The findings highlight the urgent need for comprehensive e-waste management strategies in response to the increasing global generation of e-waste. Although respondents demonstrate a fair level of awareness, there are notable knowledge gaps, especially regarding the components of e-waste and existing policies. The study calls for a multi-dimensional approach, including the establishment of e-waste management centres. Increased environmental awareness, and stronger regulatory enforcement. The recommendation stressed the crucial role of consumers, particularly students, in improving e-waste management practices. By implementing these suggestions, educational institutions in Nagaland can play a significant role in reducing the environmental and health risks associated with the improper disposal of electronic waste.

## References

1. George, N., & Cekuls, A. (2022). E-WASTE MANAGEMENT SYSTEM PROBLEMATIC IN INDIA. *Scientific Programme Committee*, 13, 112.
2. Bagwan, W. A. (2024). Electronic waste (E-waste) generation and management scenario of India, and ARIMA forecasting of E-waste processing capacity of Maharashtra state till 2030. *Waste Management Bulletin*, 1(4), 41-51.
3. Secretariat, R. S. (2011). E-waste in India. *India Research Unit (Larrdis), Rajya Sabha Secretariat, New Delhi*, 1-122.
4. Singh, M., Singh, M., & Singh, S. K. (2024). Tackling municipal solid waste crisis in India: Insights into cutting-edge technologies and risk assessment. *Science of The Total Environment*, 170453.

5. Gupta, V., & Kumar, A. (2014). E-waste status and management in India. *Journal of Information Engineering and Applications*, 4(9), 41-48.
6. Maheswari, H., Yudoko, G., Adhiutama, A., & Agustina, H. (2020). Sustainable reverse logistics scorecards for the performance measurement of informal e-waste businesses. *Heliyon*, 6(9).
7. Priyadarshini, P., & Abhilash, P. C. (2020). Circular economy practices within energy and waste management sectors of India: A meta-analysis. *Bioresource Technology*, 304, 123018.
8. Kumari, S. C., Dhand, V., & Padma, P. N. (2021). Green synthesis of metallic nanoparticles: A review. *Nanomaterials*, 259-281.
9. Munni, M. N., Karim, M. R., Haque, M., Khan, S., Khan, M. A. S., & Hossain, I. (2024). Awareness, Safety Practices and Associated Factors Among E-Waste Recycling Workers in Bangladesh. *Environmental Health Insights*, 18, 11786302241271555.
10. Borthakur, A., & Govind, M. (2017). Emerging trends in consumers' E-waste disposal behaviour and awareness: A worldwide overview with special focus on India. *Resources, Conservation and Recycling*, 117, 102-113.