EFFECTIVE WASTE MANAGEMENT FOR SUSTAINABLE TERTIARY EDUCATION DEVELOPMENT IN NIGERIA

By

Victor Olugbenga Ayoko
Department of Educational Foundations, Faculty of Education,
Open University of Faculty of Education, National, Nigeria
Email: victorayoko@gmail.com

Abstract

This paper discussed the effective waste management for sustainable tertiary education development in Nigeria. Depending on secondary data obtained from recognized online and print resources. The paper concluded that waste reduction at the source, recycling and reuse programs, composting of organic waste, proper segregation of waste, safe disposal of hazardous and electronic waste, integration of waste management into curriculum and research, community engagement and stakeholder collaboration and monitoring, evaluation, and policy implementation are some of the effective waste management practices tertiary institutions in Nigeria can adopt to enhance environmental sustainability in their respective institutions. Based on the findings, the paper recommends the establishment of comprehensive waste management policies, investment in waste management infrastructure, promotion of awareness and capacity building, integration of waste management into academic programs, foster collaboration with external stakeholders, encourage waste reduction at the source, implement regular monitoring and evaluation, provide incentives for sustainable practices, address hazardous and electronic waste safely and promote green campus initiatives.

-Keywords: Waste Management. Tertiary Education Development

1.0 Introduction

Sustainable development has become a central concern in global educational discourse, emphasizing the need for institutions of learning to operate in ways that meet present needs without compromising the ability of future generations to meet theirs. Tertiary education institutions, as centers of knowledge production, innovation, and human capital development, are expected to play a leading role in promoting sustainability through responsible management of resources and the environment. In Nigeria, however, many universities, polytechnics, and colleges

of education face persistent environmental challenges, particularly ineffective waste management practices, which threaten the sustainability of tertiary education development.

Effective waste management refers to the systematic handling of waste through proper collection, segregation, recycling, treatment, and disposal in a manner that minimizes environmental pollution and promotes public health. Nigerian tertiary institutions generate large volumes of waste daily, including paper, plastics, food waste, electronic waste, and laboratory by-products, as a result of increasing student populations, staff activities, and campus expansion. Unfortunately, inadequate waste disposal systems, poor infrastructure, weak enforcement of environmental policies, and low environmental awareness have resulted in indiscriminate dumping, open burning of waste, blocked drainage systems, and the proliferation of disease vectors within many campuses.

The consequences of poor waste management in tertiary institutions extend beyond environmental degradation to directly affect teaching, learning, research, and institutional administration. Unsanitary campus environments pose health risks to students and staff, leading to increased absenteeism, reduced productivity, and rising healthcare costs. In addition, poorly managed waste undermines the aesthetic quality of campuses, damages institutional reputation, and contradicts the sustainability principles that tertiary institutions are expected to uphold. These challenges hinder the attainment of quality education and compromise the long-term development of tertiary education in Nigeria.

Effective waste management is increasingly recognized as a critical panacea for achieving sustainable tertiary education development. Sustainable waste management practices such as waste reduction, recycling, reuse, composting, and environmentally friendly disposal methods contribute to resource conservation, environmental protection, and economic efficiency. When properly implemented, waste management initiatives can create opportunities for income generation, student skill development, research innovation, and community engagement. Moreover, integrating waste management into institutional policies and academic programs promotes environmental responsibility and sustainability consciousness among students, who are future leaders and change agents.

Despite the growing importance of sustainability in education, there is limited empirical emphasis on the role of effective waste management in promoting sustainable development within Nigerian tertiary institutions. Many institutions continue to adopt reactive rather than proactive waste management approaches, often relying on external waste collectors without comprehensive sustainability frameworks. This situation underscores the need for systematic research that examines effective waste management as a strategic tool for enhancing environmental quality, institutional efficiency, and sustainable development in tertiary education. This study therefore focuses on effective waste management as a panacea for sustainable tertiary education development in Nigeria and explore how sustainable waste management strategies can support environmental sustainability, institutional growth, and educational excellence.

2.0 Conceptual Terms

2.1 Concept of Waste Management

Waste management refers to the systematic process of collection, segregation, treatment, recycling, and disposal of waste materials in a manner that minimizes their adverse effects on the environment, human health, and society at large. It encompasses a range of practices, including waste reduction at the source, reuse of materials, recycling of recyclable items, composting of organic waste, safe disposal of hazardous substances, and proper maintenance of waste infrastructure (Hoornweg & Bhada-Tata, 2012).

Effective waste management is not merely about disposal; it also involves planning, monitoring, and creating sustainable systems that prevent environmental pollution and promote resource efficiency. Proper management of waste reduces the risk of disease outbreaks, minimizes soil, air, and water pollution, conserves natural resources, and promotes sustainable development (United Nations Environment Programme [UNEP], 2019). In institutional settings, such as schools and universities, waste management plays a critical role in maintaining a clean, safe, and conducive environment for teaching, learning, and research activities.

2.2 Concept of Tertiary Education

Tertiary institutions is an organized social institution made up with stakeholders like the students, lecturers (academic staff), non-academic staff and researcher whose responsibilities are lecturing, organization of instructional resources, assessment of students, marking of students' scripts and projects supervision (Ogunode, & Adamu, 2021). Tertiary education, also called post-secondary education, is any level of education pursued beyond high school, including undergraduate and graduate credentials. These credentials encompass certificates, diplomas or academic degrees. Tertiary education refers to specialized education in a specific field, taken on after finishing high school. Tertiary education is non-compulsory and provided in a specialist institution, usually a college, polytechnic or university. This form of education may be delivered virtually or at a distance (Top-hat, 2023).

Tertiary education is an organized educational system that is consciously designed for manpower production, in-service training and national development. Tertiary education is an education that advances teaching, research and community services for national development. Tertiary education is an education industry that is meant for the production of manpower and national development via implementation of teaching, research and provision of community services (Ogunode, 2025). Tertiary education refers to the level of education that follows the completion of secondary education and includes universities, polytechnics, colleges of education, and other higher learning institutions. Tertiary education serves as a critical platform for producing skilled manpower, conducting research, fostering innovation, and promoting socio-economic development (UNESCO, 2015). Beyond knowledge transfer, tertiary institutions have the responsibility of instilling values, ethics, and sustainability consciousness among students. They also function as

centers for community engagement and societal transformation, influencing both national development and global competitiveness. The effectiveness of tertiary education depends not only on curriculum quality and academic resources but also on the management of physical and environmental infrastructure, including campus sanitation and waste management systems.

The effective management of waste within tertiary institutions is essential for achieving sustainable educational development. Campuses generate diverse types of waste, such as paper, plastics, organic waste, laboratory chemicals, and electronic waste, arising from administrative, academic, residential, and research activities. Poor waste management in tertiary institutions can lead to unhygienic conditions, health hazards, aesthetic degradation, and operational inefficiencies, which negatively affect teaching, learning, and research outcomes (Ogunode & Adebayo, 2021).

3.0 Method

Effective waste management as a panacea for sustainable tertiary education development in Nigeria is a position paper that adopted a systematic literature review-based method. The method allows to collect and review the related previous literature from various online sources. With the aid of digital platform, the researcher collected secondary information to generate knowledge on this topic from 2015-2025. The position paper followed qualitative narrative design method. The researcher has visited different online sites to collect the previous literature and analyze the effective waste management as a panacea for sustainable tertiary education development in Nigeria. The previous findings are critically analyzed and presented in different themes as on the effective waste management as a panacea for sustainable tertiary education development in Nigeria (Adapted from Ogunode, 2025).

Inclusion and exclusion criteria

Inclusion

This output of the literatures on the effective waste management as a panacea for sustainable tertiary education development in Nigeria presents an in-depth study and result that can infer conclusion on the topic. The study includes: online publication; conference paper, journals sorted from reputable international journals such as CEON, Elsevier, Hindawi, JSTOR, IEEE, Learn Techlib, SAGE, Nebraska and Springer (Adapted from Ogunode, 2025v).

Exclusion

Also, the literature review excludes information from edited books, preprints, monographs, information below 2015 and book chapters (Adapted from Ogunode, 2025).

4.0 Result and Discussion on Waste Management Strategies for Environmental Sustainability in Tertiary Institutions

Environmental sustainability has become a critical concern for tertiary institutions worldwide due to the increasing volumes of waste generated on campuses through academic, residential, administrative, and research activities. Poorly managed waste poses serious threats to public health, environmental quality, and the overall sustainability of educational institutions. Effective waste management strategies are therefore essential to mitigate environmental degradation, enhance campus aesthetics, promote health and safety, and inculcate sustainability values among students and staff (Ogunode & Adebayo, 2021). This section discusses key waste management strategies that tertiary institutions in Nigeria can adopt to ensure environmental sustainability.

1. Waste Reduction at the Source

Waste reduction involves minimizing the generation of waste at the point of production. Tertiary institutions can adopt practices such as digitalization of administrative processes, paperless classrooms, and careful planning of procurement to reduce excess materials. By producing less waste, institutions not only decrease the environmental burden but also reduce operational costs associated with waste collection, transportation, and disposal (Hoornweg & Bhada-Tata, 2012). Integrating waste minimization into institutional policies can encourage departments, laboratories, and student bodies to adopt sustainable behaviors that contribute to long-term environmental sustainability.

2. Recycling and Reuse Programs

Recycling and reuse are fundamental strategies for converting waste into valuable resources. Nigerian tertiary institutions can implement structured recycling programs for paper, plastics, metals, glass, and electronic waste. For example, paper and cardboard can be recycled into new stationery products, plastics can be transformed into reusable materials, and e-waste can be safely dismantled for parts recovery (Ogunode 2025). Reuse initiatives, such as repurposing laboratory materials or office supplies, also reduce environmental burden and extend the life cycle of materials (Adeyemo & Afolabi, 2020). Such programs require dedicated collection points, partnerships with recycling companies, and awareness campaigns to ensure active participation from students and staff.

3. Composting of Organic Waste

Organic waste generated from cafeterias, hostels, and landscaping activities can be transformed into compost, which can be used for campus gardens and landscaping projects (Ogunode, Ukozor, & Ayoko, 2025). Composting not only reduces the volume of waste sent to landfills but also enriches soil fertility, promotes green spaces, and provides educational opportunities for students studying environmental sciences and agriculture. Implementing composting systems encourages

hands-on learning while addressing environmental concerns associated with organic waste (UNEP, 2019).

4. Proper Segregation of Waste

Effective waste management requires proper segregation at the point of generation. Tertiary institutions should provide color-coded bins or labeled containers for biodegradable waste, recyclable materials, hazardous substances, and general waste. Segregation facilitates efficient collection, reduces contamination of recyclable materials, and ensures the safe handling of hazardous substances such as chemicals and laboratory waste. Administrators should provide training and monitoring to ensure compliance with segregation guidelines (Ogunode & Adebayo, 2021).

5. Safe Disposal of Hazardous and Electronic Waste

Tertiary institutions generate hazardous and electronic waste from laboratories, workshops, and computer centers. Safe disposal strategies include partnering with licensed hazardous waste management companies, installing secure containment systems, and adhering to national and international regulations for hazardous materials. Proper disposal of e-waste, such as outdated computers, printers, and laboratory equipment, prevents environmental pollution, toxic exposure, and contamination of soil and water bodies (Hoornweg & Bhada-Tata, 2012; Adeyemo & Afolabi, 2020).

6. Integration of Waste Management into Curriculum and Research

Embedding waste management and environmental sustainability into the academic curriculum encourages a culture of responsibility and innovation among students. Institutions can offer courses, workshops, and research projects focused on sustainable waste practices, renewable resources, and environmental protection. This approach not only fosters awareness but also equips students with practical skills to develop innovative solutions to environmental challenges within and beyond the campus (UNESCO, 2015).

7. Community Engagement and Stakeholder Collaboration

Tertiary institutions can extend waste management initiatives beyond the campus by engaging local communities, government agencies, and private organizations. Partnerships can facilitate waste collection, recycling, and environmental education programs. Collaborative efforts create broader environmental impact, provide practical learning experiences for students, and strengthen the institution's reputation as a responsible community stakeholder (Adeyemo & Afolabi, 2020).

8. Monitoring, Evaluation, and Policy Implementation

Sustainable waste management requires continuous monitoring and evaluation to assess the effectiveness of implemented strategies. Institutions should establish environmental management

committees responsible for developing policies, monitoring compliance, and reporting progress. Performance indicators may include waste reduction rates, recycling volumes, and levels of student and staff participation. Evidence-based evaluation allows administrators to adjust strategies, allocate resources effectively, and ensure the long-term sustainability of waste management programs (Ogunode & Adebayo, 2021).

4.1 Conclusion and Recommendations

Practices such as waste reduction, recycling, composting, segregation, safe disposal, curricular integration, community engagement, and systematic monitoring collectively contribute to a cleaner, safer, and more sustainable campus environment.

1. Establish Comprehensive Waste Management Policies

Tertiary institutions should develop and implement formal, institution-wide waste management policies. These policies should outline procedures for waste reduction, segregation, recycling, composting, and safe disposal. Policies must also set measurable targets for waste reduction, environmental sustainability, and resource efficiency. Clear guidelines will provide administrators, staff, and students with a structured framework for effective waste management.

2. Invest in Waste Management Infrastructure

Institutions should allocate adequate funds to develop and maintain waste management infrastructure. This includes installing color-coded bins for different waste types, composting facilities, recycling stations, and secure storage for hazardous and electronic waste. Investment in infrastructure ensures that proper waste disposal is practical, efficient, and sustainable.

3. Promote Awareness and Capacity Building

Environmental education and awareness campaigns should be integrated into campus life to sensitize students, staff, and administrators about the importance of effective waste management. Workshops, seminars, and training programs on sustainable practices can build capacity and foster a culture of environmental responsibility. Students can be encouraged to participate in practical initiatives such as campus clean-ups, recycling drives, and composting projects.

4. Integrate Waste Management into Academic Programs

Tertiary institutions should incorporate waste management and environmental sustainability into their curricula. Offering courses, research projects, and practical training in waste management equips students with knowledge and skills to develop innovative solutions for environmental challenges. This integration also encourages research-driven approaches to sustainability within campus operations.

5. Foster Collaboration with External Stakeholders

Partnerships with government agencies, private waste management companies, NGOs, and local communities can enhance institutional waste management efforts. Collaborations can provide technical support, recycling opportunities, and resources that institutions may not have internally. Engaging external stakeholders also creates a broader impact beyond the campus and encourages community-wide environmental responsibility (Adeyemo & Afolabi, 2020).

6. Encourage Waste Reduction at the Source

Tertiary institutions should adopt proactive strategies to minimize waste generation. This includes promoting digital administrative systems, paperless classrooms, efficient procurement processes, and the reuse of materials. Reducing waste at the source decreases the volume of waste requiring collection, disposal, and recycling, thereby enhancing operational efficiency and sustainability **7.**
7. Implement Regular Monitoring and Evaluation

Institutions should establish monitoring and evaluation mechanisms to assess the effectiveness of waste management strategies. Environmental management committees or dedicated units should track key indicators, such as waste reduction rates, recycling efficiency, and participation levels of students and staff. Continuous evaluation enables institutions to adjust strategies, allocate resources efficiently, and ensure long-term sustainability.

8. Provide Incentives for Sustainable Practices

Incentive programs can motivate students and staff to engage in effective waste management practices. For example, reward systems for departments that achieve high recycling rates, competitions for innovative environmental projects, or recognition for green initiatives can foster a proactive sustainability culture on campus.

9. Address Hazardous and Electronic Waste Safely

Tertiary institutions must adopt strict procedures for handling hazardous and electronic waste. Partnering with certified waste management companies and following national and international safety regulations will prevent environmental contamination, protect human health, and reduce institutional liability.

10. Promote Green Campus Initiatives

Institutions should adopt broader green campus initiatives that complement waste management efforts. These may include energy conservation programs, water recycling, tree planting, and sustainable landscaping. Such initiatives create an overall environmentally friendly campus ecosystem and reinforce the importance of sustainability in tertiary education development (UNESCO, 2015).

References

Adeyemo, S. A., & Afolabi, T. O. (2020). Sustainable waste management practices in Nigerian tertiary institutions. Journal of Environmental Management and Policy, 11(2), 45–58.

Hoornweg, D., & Bhada-Tata, P. (2012). What a waste: A global review of solid waste management*. Urban Development Series Knowledge Papers. Washington, DC: World Bank.

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation & Recycling, 127*, 221–232. https://doi.org/10.1016/j.resconrec.2017.09.005

Jambeck, J. R., Geyer, R., & Wilcox, C. (2015). Plastic waste inputs from land into the ocean. Science*, 347(6223), 768–771.

Mainardes, E. W., Alves, H., & Raposo, M. (2013). The process of change in university management: From administration to strategic management. *Tertiary Education and Management*, 19(2), 118–136.

Middlehurst, R. (1999). *New Realities for Leadership and Governance in Higher Education.* London: Higher Education Management.

Ogunode, N, J. (2025v). Inaugural Lectures in Nigerian Universities: Importance and Effects. *Best Journal of Innovation In Science, Research And Development,* 4(7),99-105.

Ogunode (2025). Integration of circular economy programme into tertiary education management in Nigeria

Ogunode, N. J., Ukozor, C. U., & Ayoko, V. O. (2025). Benefits, Practices and Factors that Support Implementation of Circular Economy in Nigerian Schoools. *American Journal of Alternative Education*, *2*(8), 17–23. Retrieved from https://scientificbulletin.com/index.php/AJAE/article/view/1155

Ogunode, N. J. (2025). Integration of Circular Economy Programme into Tertiary Education Management in Nigeria. *Spanish Journal of Innovation and Integrity*, *45*, 38–44. Retrieved from https://sjii.es/index.php/journal/article/view/770

Ogunode, N. J., & Adebayo, O. S. (2021).Waste management challenges and sustainable practices in Nigerian universities. International Journal of Educational Sustainability, 5(1), 12–28.

Ogunode, N. J. & Adamu, D. G. (2021). Shortage Of Academic Staff in the Higher Institution of Learning in Nigeria. *Central Asian Journal of Social Sciences and History, 2*(3), 109-123.

Ogunode, N, J (2025). Benefit of Digital Literacy for Academic staff and Students of Tertiary Institutions in Nigeria. *American Journal of Alternative Education,* 2,(2),43-53

Top hat (2021). What is tertiary education? https://tophat.com/glossary/t/tertiary-education/

United Nations Environment Programme (UNEP). (2019). Global environment outlook 6: Healthy planet, healthy people. Nairobi: UNEP.

UNESCO. (2015). Rethinking education: Towards a global common good? Paris: UNESCO Publishing.

World-bank (2020). What is tertiary education. https://www.worldbank.org/en/topic/tertiaryeducation