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**Effect of Waste Management Practices on Environmental Sustainability in Urban Areas in
South Africa**

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Abstract

Purpose: To aim of the study was to analyze effect of waste management practices on environmental sustainability in urban areas in South Africa.

Methodology: This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

Findings: Waste management practices in urban areas of South Africa play a major role in promoting environmental sustainability by reducing pollution, conserving resources, and improving public health. Effective recycling, waste collection, and disposal systems help minimize landfill overflow and lower greenhouse gas emissions in rapidly growing cities. However, challenges such as inadequate infrastructure, illegal dumping, and limited public awareness continue to hinder sustainable waste management efforts.

Unique Contribution to Theory, Practice and Policy: Theory of planned behavior, the circular economy theory & the ecological modernization theory may be used to anchor future studies on the effect of waste management practices on environmental sustainability in urban areas in South Africa. This study contributes to practice by giving urban managers, households, businesses, and waste service providers practical guidance on how to improve environmental sustainability through better waste handling. This study contributes to policy by providing evidence that waste management should be treated as a key environmental sustainability issue, not just a sanitation function.

Keywords: *Waste Management Practices, Environmental Sustainability, Urban Areas*

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INTRODUCTION

Environmental sustainability refers to the responsible use of natural resources so that economic growth, human wellbeing, and ecosystem protection can continue without destroying the ability of future generations to meet their needs. In developed economies, this concept is often measured through trends in carbon dioxide (CO₂) emissions, renewable energy adoption, waste reduction, energy efficiency, and biodiversity protection. For example, the United States of America (USA) has shown gradual improvement in emissions intensity, although it remains a high per-capita emitter compared with many countries. World Bank data define carbon dioxide (CO₂) emissions per capita as emissions from fossil-fuel burning and cement production, including solid, liquid, and gas fuels and gas flaring. A peer-reviewed study by Jie and Rabnawaz (2024) confirms that renewable energy use is strongly linked to carbon dioxide (CO₂) reduction efforts in both developed and developing economies.

Japan provides a strong developed-economy example because its greenhouse gas emissions fell by 4% in fiscal year 2023/2024 to 1.071 billion metric tons of carbon dioxide equivalent, the lowest level since records began in 1990/1991. The same data show that Japan's emissions were 23.3% below 2013 levels, while renewables contributed 22.9% of electricity generation in 2023/2024. The United Kingdom (UK) is another example of a developed economy where sustainability policy has focused on reducing emissions through cleaner electricity, energy efficiency, and climate regulation. These examples show that developed economies are generally moving toward environmental sustainability, but progress depends on reducing fossil-fuel dependence while maintaining industrial productivity. This supports the argument that environmental sustainability is not only about protecting nature but also about restructuring energy, production, and consumption systems toward low-carbon development (Jie & Rabnawaz, 2024).

In developing economies, environmental sustainability means balancing fast economic growth with pollution control, clean energy expansion, and protection of natural resources. Many developing countries face a difficult challenge because industrialization, urbanization, and rising energy demand often increase carbon dioxide (CO₂) emissions. India is a good example because its economy is expanding rapidly, while its power sector remains heavily dependent on coal. The International Energy Agency (IEA) reports that electricity and heat generation accounted for 54% of India's total energy-related carbon dioxide (CO₂) emissions in 2023. However, India is also expanding renewable energy, with International Renewable Energy Agency (IRENA) data showing that renewable power capacity reached 204,485 megawatts, or about 38% of installed electricity capacity, in 2023.

Brazil provides a second developing-economy example because it has one of the cleaner electricity systems among large economies, mainly due to hydropower and other renewables. In 2023, Brazil generated about 88.9% of its electricity from renewable sources, compared with India's 19.5% and the United States of America's 22.7%, showing a strong renewable-energy advantage. However, Brazil's environmental sustainability is weakened by deforestation and illegal mining pressures in the Amazon region. This shows that a country may perform well in clean electricity but still face sustainability risks through land degradation, biodiversity loss, and forest destruction. Jie and Rabnawaz (2024) emphasize that policymakers in developing countries need context-specific

renewable energy strategies because economic growth, energy use, and emissions behave differently across regions.

In Sub-Saharan economies, environmental sustainability is closely linked to access to clean energy, climate resilience, sustainable agriculture, forest conservation, and poverty reduction. Many Sub-Saharan African countries contribute relatively little to global carbon dioxide (CO₂) emissions per person, but they are highly exposed to climate shocks such as droughts, floods, and food insecurity. South Africa is a key example because it is more industrialized than many countries in the region and relies heavily on coal for electricity. Reuters reported that South Africa produced about 709 grams of carbon dioxide per kilowatt-hour of energy generated in 2022, making it one of the most carbon-intensive major economies. This trend shows that environmental sustainability in Sub-Saharan Africa is not uniform, because countries with coal-heavy energy systems face different challenges from countries with lower industrial emissions.

Kenya provides a contrasting Sub-Saharan example because its sustainability pathway is more strongly associated with renewable electricity, especially geothermal, hydro, wind, and solar energy. Although Kenya's total emissions are much lower than those of large industrial economies, its environmental sustainability challenges include deforestation, land degradation, water stress, urban waste, and climate-sensitive agriculture. At the regional level, Acheampong, Dzator, and Savage (2021) studied 45 Sub-Saharan African countries from 1960 to 2017 and found that economic growth causes carbon emissions, while renewable energy and institutional quality remain important in explaining sustainability outcomes. Their findings imply that Sub-Saharan Africa needs both clean-energy investment and stronger institutions to achieve sustainable development. Therefore, environmental sustainability in Sub-Saharan economies should focus not only on reducing emissions but also on protecting livelihoods, strengthening governance, and building climate-resilient infrastructure (Acheampong, Dzator, & Savage, 2021).

Problem Statement

Waste management practices refer to the planned methods used to reduce, collect, sort, treat, recover, and safely dispose of waste in a way that protects people and the environment. Conceptually, waste management is closely linked to environmental sustainability because poor handling of waste leads to land pollution, water contamination, greenhouse gas emissions, disease risks, and loss of useful resources. The first likely practice is waste reduction, which means minimizing waste at the source through careful production, responsible consumption, and reduced packaging. The second practice is waste segregation, where biodegradable, recyclable, hazardous, and residual waste are separated to make treatment easier and safer. These practices support environmental sustainability by reducing the amount of waste sent to landfills and improving resource conservation, which is consistent with the waste hierarchy and circular economy approach discussed by Awino and Apitz (2024).

The third likely waste management practice is recycling and reuse, where materials such as paper, plastics, metals, glass, and electronic waste are recovered and used again instead of being dumped. Recycling and reuse promote environmental sustainability by reducing the demand for raw materials, saving energy, lowering pollution, and supporting circular production systems. The fourth practice is composting and organic waste treatment, where food waste, garden waste, and other biodegradable materials are converted into manure or soil conditioner instead of being left

to rot in open dumps. This practice reduces methane emissions from decomposing organic waste and improves soil health, especially in urban farming and agricultural systems. Therefore, waste reduction, segregation, recycling and reuse, and composting all contribute to environmental sustainability by reducing pollution, conserving resources, improving public health, and lowering the environmental burden of waste disposal (Abubakar, 2022).

Theoretical Review

Theory of Planned Behavior

Originated by Icek Ajzen, argues that human behavior is influenced by attitude, social pressure, and perceived ability to act. In this study, it explains why urban residents may or may not practise waste sorting, recycling, reuse, and proper disposal. It is relevant because environmental sustainability in urban areas depends partly on household and institutional behavior toward waste management. Recent studies show that attitude, subjective norms, and perceived behavioral control significantly influence sustainable waste management behavior (Muniandy, 2021).

The Circular Economy Theory

Commonly associated with David Pearce and R. Kerry Turner, argues that resources should remain in use for as long as possible through reduction, reuse, recycling, recovery, and regeneration rather than following the linear “take-make-dispose” model. It is relevant because waste management practices such as recycling, composting, and reuse directly reduce landfill pressure, pollution, and natural resource depletion.

The Ecological Modernization Theory

Associated with scholars such as Joseph Huber, Arthur Mol, and Gert Spaargaren, argues that economic development and environmental protection can work together through cleaner technology, policy reform, innovation, and institutional change. This theory is relevant because urban areas can improve environmental sustainability by modernizing waste systems through smart collection, recycling technology, public-private partnerships, and stronger regulation. Recent research links circular economy and ecological modernization thinking to sustainable production, waste management, recycling, eco-efficiency, and pollution prevention (Negrete-Cardoso, 2022; Julkovski, 2021).

Empirical Review

Quartey, Nyamah, and Charnor (2025) examined how household waste management practices influence environmental sustainability performance. The study also investigated whether institutional pressure strengthens the relationship between waste practices and sustainability outcomes. The methodology used was an explanatory quantitative research design. The researchers collected data from 339 households, out of which 242 valid responses were used for analysis. The data were analyzed using Statistical Package for the Social Sciences (SPSS) and Smart Partial Least Squares (Smart-PLS). The findings showed that proper waste management practices had a positive effect on environmental sustainability performance. The study found that households that practised waste sorting, proper disposal, and responsible waste handling contributed more to cleaner urban environments. It also found that institutional pressure encouraged households to comply with better waste management practices. This means that laws, community expectations,

and municipal regulations can influence household behavior. The study recommended stronger enforcement of waste policies at the household and community levels. It also recommended continuous public education on waste sorting, recycling, and safe disposal. The findings are relevant because urban environmental sustainability depends greatly on household-level waste behavior. The study supports the view that waste management should not only be treated as a sanitation issue but also as an environmental sustainability strategy. Therefore, Quartey, Nyamah, and Charnor (2025) provide strong evidence that effective waste management practices can improve environmental sustainability in urban areas.

Shaibur (2025) assessed the implementation and effectiveness of the 5Rs strategies. The 5Rs included refuse, reduce, reuse, repurpose, and recycle. The study focused on both household and institutional levels of waste management. The methodology involved a survey of 160 randomly selected respondents. The respondents were drawn from suburban areas, the municipality, and communities around the Jashore Municipal Waste Treatment Plant. The findings showed that the implementation of the 5Rs was still weak in the study area. Many households had limited knowledge of waste refusal, reduction, and recycling. The study also found that improper disposal remained common in urban communities. However, some households practised reuse and recycling at a basic level. The findings suggest that urban environmental sustainability is difficult to achieve where residents do not fully apply the 5Rs. The study recommended stronger awareness campaigns on the importance of reducing and recycling waste. It also recommended improved municipal support for waste separation and recovery. The study is relevant because the 5Rs reduce waste volume, conserve resources, and lower pollution. Therefore, Shaibur et al. (2025) show that urban sustainability can improve when waste management moves from simple disposal to resource recovery.

Apio, Opio, Acanga, and Akello (2024) assessed household willingness to pay for better waste collection services. The study also examined existing waste management practices and the factors influencing payment willingness. The methodology involved a multistage sampling technique. The researchers randomly selected 585 household heads. They also conducted key informant interviews with city officials and private waste collectors. The findings showed that only 48.12% of households were willing to pay for improved waste collection services. The study found that willingness to pay was influenced by household income, education level, awareness, and trust in service providers. It also found that poor waste collection contributed to environmental pollution, pests, disease risks, and poor urban sanitation. These findings show that environmental sustainability in urban areas depends partly on reliable waste collection systems. The study recommended affordable waste collection fees for households. It also recommended stronger public awareness on the benefits of proper waste collection. The researchers further recommended collaboration between city authorities, households, and private waste collectors. The study is relevant because collection is a key stage in the waste management chain. Therefore, Apio (2024) show that improved collection services can reduce open dumping and improve environmental sustainability in urban cities.

Derdera and Ogato (2023) assessed the status of the city's waste management system and propose an integrated sustainable system. The study focused on waste generation, collection, transportation, disposal, and stakeholder participation. The methodology used a mixed approach involving quantitative and qualitative data. The researchers gathered information from households,

municipal officials, and relevant stakeholders. The findings showed that waste management services in Shashemane were inadequate. The study found low public awareness about proper waste management. It also found weak coordination among stakeholders involved in waste handling. Illegal dumping and poor dumpsite management were identified as major environmental problems. These practices contributed to poor sanitation, public health risks, and environmental degradation. The findings showed that weak urban waste systems reduce the ability of cities to achieve environmental sustainability. The study recommended adoption of an integrated sustainable municipal solid waste management system. It also recommended stronger public awareness, institutional coordination, and improved collection capacity. The study is relevant because it links waste governance directly to environmental quality and public health. Therefore, Derdera and Ogato (2023) demonstrate that urban sustainability requires coordinated, inclusive, and well-planned waste management systems.

Almulhim (2022) evaluated household awareness of electronic waste, its environmental problems, and willingness to participate in proper e-waste management. Electronic waste includes discarded phones, computers, appliances, and other electrical products. The methodology used a household-based survey approach. The study collected data from households to understand their awareness, attitudes, and participation levels. The findings showed that many households had limited knowledge about the environmental risks of improper electronic waste disposal. The study found that unsafe e-waste disposal can release harmful substances into soil, water, and air. It also found that public information campaigns could increase willingness to participate in e-waste management. One reported finding was that many households were willing to participate after being exposed to awareness information. This shows that education can influence sustainable waste behavior. The study recommended formal e-waste collection systems. It also recommended household education campaigns and safe disposal programs. The study is relevant because electronic waste is becoming a serious urban sustainability challenge. It shows that environmental sustainability requires attention not only to ordinary solid waste but also to hazardous and technology-related waste. Therefore, Almulhim (2022) confirms that awareness and participation are important in improving sustainable e-waste management in urban settings.

Yusuf and Fajri (2022) examined how environmental education and campus waste programs influence students' waste management behavior. The study compared students from science and social departments. The methodology involved collecting questionnaire data from 279 students. The researchers analyzed differences in behavior, engagement, and environmental knowledge. The findings showed that the educational environment contributed to better knowledge about waste management. The study found that students exposed to environmental education were more likely to understand proper waste handling. It also found that engagement in campus programs improved awareness of recycling and waste reduction. The findings suggest that education plays an important role in changing waste behavior. This is important because urban environmental sustainability depends on informed and responsible citizens. The study recommended stronger environmental education programs in higher learning institutions. It also recommended practical campus-based waste management initiatives. The study is relevant because universities are part of urban systems and can model sustainable waste behavior. It also shows that knowledge can influence responsible disposal, recycling, and conservation behavior. Therefore, Yusuf and Fajri

(2022) demonstrate that education-based waste management programs can support environmental sustainability in urban communities.

Doaemo (2021) evaluated the city's waste management system in relation to sustainable development. The study examined collection, disposal, recycling, stakeholder roles, and policy weaknesses. The methodology involved assessment of the municipal solid waste system using field information and sustainability-based evaluation. The findings showed that Lae City faced serious weaknesses in waste collection and disposal. The study found that poor waste handling contributed to environmental pollution and public health risks. It also found that limited recycling and weak resource recovery reduced sustainability outcomes. The study observed that the waste hierarchy was not being fully implemented. This means that reduction, reuse, recycling, and recovery were not prioritized enough. The findings showed that overreliance on disposal weakens environmental sustainability. The study recommended improved planning and stronger municipal waste governance. It also recommended better recycling systems and sustainable treatment methods. The researchers further recommended public participation in waste management. The study is relevant because it shows how weak urban waste systems affect sustainable development. Therefore, Doaemo (2021) provide evidence that cities need integrated waste systems to protect the environment and improve urban sustainability

METHODOLOGY

This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low-cost advantage as compared to field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

FINDINGS

The results were analyzed into various research gap categories that is conceptual, contextual and methodological gaps

Conceptual Gap

The existing studies mainly examine individual aspects of waste management such as household waste practices, willingness to pay, 5Rs strategies, electronic waste awareness, waste collection, and municipal waste governance. However, few of the reviewed studies combine the key waste management practices into one integrated framework linking waste reduction, waste segregation, recycling and reuse, composting, and safe disposal to environmental sustainability. This creates a conceptual gap because environmental sustainability is a broad outcome that includes pollution reduction, resource conservation, public health improvement, cleaner urban spaces, and reduced pressure on landfills. Therefore, the current study can fill this gap by examining how selected waste management practices jointly affect environmental sustainability in urban areas, Doaemo (2021)

Contextual Gap

The reviewed studies were conducted in different social and institutional settings, including households, universities, municipalities, and electronic waste management systems. For instance,

Yusuf and Fajri (2022) focused on university students, Almulhim (2022) focused on household electronic waste awareness, and Apio (2024) focused on willingness to pay for improved solid waste collection. However, these contexts may not fully explain how general urban households, businesses, private waste collectors, and local government agencies interact in day-to-day waste management. This leaves a contextual gap in understanding how waste management practices operate within broader urban environments where mixed waste streams, informal dumping, weak enforcement, limited recycling infrastructure, and public participation challenges occur at the same time. The current study can address this gap by focusing on ordinary urban areas as practical living and working spaces rather than only specific institutions, single waste types, or payment behavior.

Geographical Gap

The reviewed empirical studies were carried out in Ghana, Bangladesh, Uganda, Ethiopia, Saudi Arabia, Indonesia, and Papua New Guinea. Although these studies provide useful evidence, their findings may not be directly applicable to all urban areas because waste generation patterns, public awareness, municipal capacity, recycling infrastructure, enforcement systems, income levels, and environmental policies differ from one location to another. For example, the waste management situation in Cape Coast, Ghana may differ from that of Lira City in Uganda, Shashemane in Ethiopia, or Lae City in Papua New Guinea. This creates a geographical gap because there is still need for location-specific evidence on how waste management practices affect environmental sustainability in the selected urban area of the proposed study. Therefore, the current study is justified because it will generate localized findings that can guide urban waste management planning, policy enforcement, public awareness, and sustainability interventions in the study area.

CONCLUSION AND RECOMMENDATIONS

Conclusions

In conclusion, waste management practices play a major role in promoting environmental sustainability in urban areas. Effective practices such as waste reduction, waste segregation, recycling and reuse, composting, proper waste collection, and safe disposal help reduce pollution, conserve natural resources, improve public health, and protect land, air, and water quality. The discussion shows that when waste is poorly managed, urban areas experience serious environmental problems such as blocked drainage systems, open dumping, greenhouse gas emissions, disease outbreaks, soil contamination, and water pollution. However, when households, businesses, private waste collectors, and local authorities work together, waste can be transformed from an environmental burden into a useful resource.

Therefore, environmental sustainability in urban areas cannot be achieved without strengthening waste management systems. Urban authorities should invest in proper waste infrastructure, enforce waste management regulations, promote public awareness, support recycling initiatives, and encourage community participation. The study concludes that waste management should not only be viewed as a sanitation responsibility but also as a key strategy for sustainable urban development. By improving waste reduction, segregation, recycling, composting, and safe disposal, urban areas can become cleaner, healthier, more resource-efficient, and more resilient to environmental challenges.

Recommendations

Theory

This study contributes to theory by strengthening the understanding of how waste management practices influence environmental sustainability in urban areas. It extends the Circular Economy Theory by showing that waste should not only be disposed of, but should be reduced, reused, recycled, and recovered as a useful resource. It also supports the Theory of Planned Behavior by showing that people's attitudes, awareness, social pressure, and ability to act influence their waste management behavior. In addition, the study contributes to Ecological Modernization Theory by showing that urban sustainability can be improved through better technology, stronger institutions, cleaner systems, and improved waste governance. The study therefore links human behavior, resource recovery, and institutional modernization into one framework for understanding sustainable urban waste management.

Practice

This study contributes to practice by giving urban managers, households, businesses, and waste service providers practical guidance on how to improve environmental sustainability through better waste handling. It shows that sustainability can be improved when waste reduction, segregation, recycling, composting, collection, and safe disposal are implemented together rather than separately. The findings can help urban authorities design community awareness programs, improve waste collection schedules, place waste bins in strategic locations, and support recycling and composting initiatives. Waste collection companies can also use the findings to improve route planning, customer education, and separation of recyclable and organic waste. In practice, the study encourages a shift from simple waste collection to an integrated waste management system that protects the environment and supports cleaner urban living.

Policy

This study contributes to policy by providing evidence that waste management should be treated as a key environmental sustainability issue, not just a sanitation function. Policymakers can use the study to develop or strengthen urban waste policies that require waste segregation at source, promote recycling, support composting, regulate private waste collectors, and control illegal dumping. The study also supports the need for clear enforcement mechanisms, public-private partnerships, community participation, and budget allocation for waste infrastructure. It can guide county and municipal governments in setting measurable sustainability targets such as increased recycling rates, reduced landfill waste, improved collection coverage, and reduced environmental pollution. Therefore, the study provides a useful policy foundation for building cleaner, healthier, and more sustainable urban areas.

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