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IMPACT OF WASTE MANAGEMENT PRACTICES ON OPERATIONAL COSTS OF SELECTED HOSPITALITY INDUSTRY IN ADAMAWA STATE, NIGERIA

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ABSTRACT

The hospitality industry generates a significant amount of wastes that significantly affects their operational costs and the environment. This challenge requires urgent sustainable practices that mitigate its negative impacts. This study assesses the impact of waste management practices on operational costs of selected hospitality industry in Yola and Mubi metropolitan cities of Adamawa State. By employing a mixed-method design with a study population of 153 hotels in Yola and Mubi metropolitan areas, the study collected data through structured questionnaire and interview guides from 104 hotels operational managers. The descriptive analysis result revealed that waste management practice in Yola metropolis was more effective with the overall mean value of 3.60 against 3.28 in Mubi metropolis and the regression analysis results show a negative and statistically significant relationship between waste management practice and operational cost in the hotel industry. The regression model demonstrates strong explanatory power (R^2 = 67.31%, Adjusted R^2 =66.33%) and good model fit Therefore, this study recommended that the government should create mandatory recycling, sustainability certification and training and educational programmes for waste reduction and management in the hospitality industry. Moreover, all stakeholders should be engaged in developing strategies for addressing waste management challenges in hotel industry.

Keywords: *Hospitality, waste management, hotel, operational cost, environmental impact*

Introduction

The growth of the hospitality industry has made waste management an important operational issue because the sector depends heavily on food, beverages, packaging, water, energy and other consumable resources. Hotels and other hospitality establishments provide accommodation, food and beverages, recreation and related services, contributing substantially to economic activity and employment. In 2024, Travel & Tourism contributed approximately US$10.9 trillion to the global economy and supported 357 million jobs worldwide (WTTC, 2025). However, these activities generate considerable waste through food preparation, housekeeping, guest services and maintenance. Waste management therefore concerns not only disposal but also the efficient use of resources. Food purchased but not consumed, reusable materials discarded and recyclable materials sent for disposal represent avoidable resource losses. Effective waste reduction, reuse, recycling and composting may consequently reduce material losses and operational expenditure.

The increasing volume of waste worldwide strengthens the economic case for improved waste management. The World Bank's What a Waste 3.0 reports that global municipal solid waste generation reached approximately 2.56 billion tons in 2022 and could rise to 3.86 billion tons by 2050 under a business-as-usual scenario (World Bank, 2026). Waste-collection coverage varies considerably across world regions, with North America recording the highest rate and Sub-Saharan Africa the lowest.

Table 1.1 *Municipal Solid Waste Collection Rates by World Region*

World region	Waste collection rate (%)
North America	100
Europe and Central Asia	90
East Asia and Pacific	86
Middle East and North Africa	83
Latin America and Caribbean	79
South Asia	67
Sub-Saharan Africa	31

Source: *World Bank (2026), What a Waste 3.0.*

The differences in collection coverage demonstrate substantial inequalities in waste-management capacity. For hospitality establishments, inadequate collection systems may increase costs associated with on-site storage, private collection, transportation and disposal. Food waste is also significant because it represents both the cost of discarded food and the resources used to produce, transport, prepare and serve it. UNEP (2024) estimates that 1.05 billion tons of food were wasted in 2022, including approximately 290 million tons from food service. Thus, waste reduction in hospitality should be viewed as both an environmental and resource-efficiency concern.

The implications are particularly important in Africa, where rapid urbanization and changing consumption patterns are increasing waste generation while collection and recovery systems remain weak. Evidence indicates that many hospitality establishments continue to rely more on disposal than on practices that retain material value. Mensah (2020) found that small hotels in Accra, Ghana, practiced disposal, prevention and reduction more frequently than reuse, recycling and recovery. Similarly, Agesa et al. (2022) found that waste-management practices significantly influenced hotel operating costs in Nakuru County, Kenya, identifying waste reduction, recycling and composting as potential cost-control measures. Poor waste management can increase procurement, handling and disposal costs, whereas reuse, recycling and composting may reduce disposal volumes and recover material value.

In Nigeria, waste-management challenges occur alongside expanding urban and commercial activities. The National Environmental (Sanitation and Wastes Control) Regulations, 2009 established requirements for waste handling, transportation and disposal (NESREA, 2009). However, implementation remains problematic in the hospitality sector. Filimonau & Tochukwu (2020) found that hotels in Lagos were predominantly disposal-oriented, with limited emphasis on waste prevention and reduction. In Adamawa State, existing studies have mainly examined municipal and household waste. Mshelia et al. (2022) examined projected municipal solid waste generation in Yola, while Sunu et al. (2018) investigated household solid waste generation and disposal in Mubi Metropolis. These studies demonstrate the

importance of waste management in the two urban areas but provide limited evidence on its implications for hotel operational costs.

This limitation reveals an empirical gap concerning the relationship between waste-management practices and operational costs among hospitality establishments in Adamawa State. Previous studies in Adamawa have focused largely on municipal and household waste (Mshelia et al., 2022; Sunu et al., 2018), while Nigerian hospitality research has emphasized waste-management behaviour and disposal practices (Filimonau & Tochukwu, 2020). Although Agesa et al. (2022) found a significant relationship between hotel waste-management practices and operating costs in Kenya, these findings cannot be assumed to apply to Adamawa State because cost implications may vary according to local collection systems, waste characteristics, establishment size and recycling opportunities. Accordingly, this study examines the impact of waste-management practices on the operational costs of selected hospitality establishments in Adamawa State, focusing on Yola and Mubi. The study seeks to provide evidence to help hospitality managers identify cost-relevant waste-management practices and support policymakers in developing effective and sustainable waste-management interventions.

Literature Review

Conceptual Clarification

Waste Management Practices in the Hospitality Industry

Waste is any substance or object discarded by the holder (European Commission Directorate on Environment, n.d.). Improper waste disposal causes serious problems, such as water and soil pollution, and creates habitats for disease vectors (Olorunlana & Ogunade, 2022). Effective waste management significantly affects the environment, public health, and operational costs in the hotel industry. Waste management practices not only minimize environmental damage but also lead to cost savings and enhance a hotel's eco-friendly reputation (Chandani et al., 2024).

Waste management techniques such as segregation, reuse, recycling, and composting can greatly reduce the amount of waste sent to landfills. This, in turn, helps mitigate

greenhouse gas emissions and contamination, which contribute to climate change. Hotels should, therefore, reduce landfill waste by implementing reduction, reuse, and recycling strategies (Kimeu, 2015).

The hotel industry generates substantial amounts of waste daily due to its continuous operations and significant consumption of resources (Ghadban et al., 2017). Biodegradable waste, which includes food scraps and garden trimmings that can be composted, is the most common type of waste. Pham et al. (2018) indicate that over 80% of hotel waste consists of biodegradable and recyclable materials. Non-biodegradable waste, such as plastic and metal, cannot decompose but can be reused.

Composting can convert waste into income for hotels, presenting a cost-effective solution for waste management, although many small hotels have been slow to adopt these practices (Omidiani & Hashemi, 2016; Mensah, 2020).

Operational Costs in the Hotel Industry

Operational costs refer to the expenditures involved in the routine functioning of hotels (Kimeu, 2015). These costs encompass various categories, including food, labour, energy, water, and waste management (Mensah, 2006). According to Chikezie (2023), operational performance in terms of cost reduction involves key factors such as decreased water bills, lower packaging material costs, reduced food waste, and minimized maintenance and labour expenses, as well as competitive room tariffs.

Implementing effective waste management strategies is crucial for enhancing profitability by minimizing waste-related expenses. In contrast, inefficient waste management imposes substantial costs on both the public and private sectors. Filimonau & Tochukwu (2020) and Chikezie (2023) emphasize that sound waste management practices significantly enhance hotel operational performance by reducing overall costs.

Enhancing management systems through environmentally focused processes can result in considerable cost savings (Yenidogan et al., 2021). To remain competitive in the global tourism sector, hotels must enhance their environmental performance to

meet the standards of their target markets (Han, Hsu, & Lee, 2009). However, hotels face various operational challenges, including rising water bills, increasing labour costs, electricity expenses, and fees for waste collection and disposal.

Waste Management Practices and Operational Costs in the Hotel Industry

Waste management practices significantly impact the operational costs of the hotel industry. Effective waste reduction, reuse, recycling, composting, and appropriate disposal are critical determinants of operational costs. Adopting efficient strategies can significantly reduce costs (John, 2024). Good waste management practices lower operational expenses, leading to higher profit margins, while poor management increases costs and reduces profits (Obamen et al., 2019). Hotels must adopt best practices to control costs effectively and streamline their operations.

A study by Agesa et al. (2022) recommended that hotels prioritize effective waste management to curb increasing costs. Waste reduction can minimize waste generation through better product design and green purchasing, ultimately reducing costs. Reusing materials decreases waste generation and conserves resources, leading to savings.

Lawson (2018) stated that waste reduction, recycling, and composting help hotels save money on waste management costs. Recycling allows hotels to lower expenses and generate revenue from recyclable materials. Waste composting significantly reduces expenses incurred in waste collection, sorting, transportation, and disposal (Nath, 2014).

Theoretical Framework

Several theories are relevant to analyzing the impact of waste management practices on the operational costs of selected hospitality industries. However, this study focuses on the Circular Economy model because it aligns more closely with the research objectives.

Circular Economy Theory

This study is anchored on the Circular Economy (CE) theory, which provides an alternative to the traditional linear model of "take, make, and dispose." The circular economy focuses on keeping resources in use for as long as possible through practices such as reuse, repair, recycling, and recovery, thereby reducing waste and pressure on natural resources (Heshmati, 2015).

The theory is relevant to the hospitality industry because hotels generate considerable amounts of food, packaging, and other solid waste. Applying circular economy principles can help hotels reduce the quantity of waste sent to disposal sites and improve the efficient use of materials. Practices such as reusing materials, recycling, reducing food waste, and purchasing durable products can also help lower waste-related costs (Chandani et al., 2024).

For this study, the Circular Economy theory provides a basis for examining how waste management practices can influence the operational costs of selected hospitality industries in Adamawa State. The theory suggests that reducing waste at source, reusing materials, and recovering recyclable resources can reduce the quantity of waste requiring collection and disposal while making better use of available resources. Thus, hotels that adopt circular waste management practices may be able to improve resource efficiency and reduce some operational costs.

Empirical Literature Review

A considerable number of studies have been conducted to assess the impact of waste management practices on the operational performance or costs of the hotel industry around the world. Although most of these studies have methodological similarities, they differ with respect to the geographical areas in which they were conducted. This necessitates the examination of the relationship between waste management practices and the operational costs of the hotel industry in Adamawa State, Nigeria, in order to fill the identified knowledge and scope gaps. Some of the studies reviewed include the following:

A pioneer study was conducted by Karimi (2014) on the relationship between green operations practices and the operational performance of hotels in the Coastal Region of Kenya. The study used a descriptive, cross-sectional census survey design. The results revealed a strong positive correlation between green operations practices and operational performance.

In addition, Kimeu (2015) investigated the effect of waste management practices on hotel operational performance in Mombasa County, Kenya, using a census survey research design. The study employed descriptive and inferential analyses, and the results revealed that effective waste management practices can improve hotel operational performance. However, the study was conducted in Kenya rather than in Adamawa State or Nigeria.

In the same vein, Liyanage et al. (2021) investigated environmental management and operational costs in the hotel sector in Sri Lanka. Correlation and multiple linear regression analyses were employed to examine the relationships between the independent and dependent variables. The results revealed a significant positive correlation between energy management and green procurement and operational costs, while waste reduction and recycling, along with water conservation and organizational systems, showed significant negative correlations.

Similarly, Agesa et. al. (2022) found that waste reduction negatively affected operating costs, while waste composting also had a negative effect on operating costs for classified hotels. Conversely, waste collection and disposal had a positive effect on operating costs. The study examined the influence of waste management practices on operating costs among selected classified hotels in Nakuru County, Kenya. The authors utilized structured questionnaires and semi-structured interview guides, reporting coefficients (β) and significance levels (p-values) corresponding to each practice. The study variables, both dependent and independent, correspond to those of the present study, but the study areas differ significantly.

Furthermore, using 120 structured questionnaires administered to 20 hotels, Chikezie et al. (2023) investigated waste management practices and the operational performance of hotels in Lagos State using linear regression analysis. The results

revealed that waste management practices were rated as very important, with a mean score of 3.83, while operational performance was rated as being achieved to a large extent, with a mean score of 3.16. The results also showed that waste reduction, reuse, and recycling practices had a significant influence on operational performance (β = 0.383); waste collection and depositing practices also had a significant influence (β = 0.413); and waste composting and treatment practices significantly influenced operational performance (β = 0.258). Further, Dani et al. (2023) investigated the probable association between green hospitality practices and operational expenses in two- and three-star hotels in Dehradun. The study employed a case study method to explore how green hospitality initiatives relate to operational expenses in the selected hotels. It involved both qualitative and quantitative approaches to gather comprehensive insights. The results indicated that there were both negative and positive associations between green hospitality practices and operational expenses, as perceived by hotel employees.

Gaps in the Literature Review

While there is a substantial body of literature addressing waste management practices, most of these studies do not specifically focus on the hotel industry and its operational costs. Furthermore, existing research on related topics has predominantly been conducted in other countries, creating both geographical and contextual knowledge gaps. This study, therefore, aims to address these gaps by examining the relationship between waste management practices and operational costs in selected hospitality industries in Adamawa State, Nigeria

Methodology

Research Design

The study employed a mixed-methods research design because this approach enhances data collection, validity, and reliability of findings and offers greater flexibility than the use of a single method.

Population and Sample of the Study

The study focused on registered hotels in Yola and Mubi metropolises. According to the Adamawa State Ministry of Culture and Tourism (2025), the total population comprises 153 hotels. A sample size of 111 hotels was determined using the Taro Yamane formula. Stratified random sampling was employed to select samples from each local government area using the formula: Sample allocation = (Population of each stratum / Total population) × Sample size

Distribution of target population and Sample size

Local Government Area	Population (2025 Projection)	Number of Hotels	Sample Size
Yola North	328,700	76	33
Yola South	323,500	26	32
Mubi North	244,800	36	
Mubi South	213,500	15	25
Total	1108,500	153	111

Source: *Field Survey 2026*

Sampling Technique

This study employed a multi-stage sampling technique to ensure comprehensive and representative results. The stages are presented as follows:

1. Selection of Local Government Areas

The first stage involved the purposive selection of Yola and Mubi metropolises, which comprise four local government areas: Yola North, Yola South, Mubi North, and Mubi South. These areas were selected based on their significant population density, economic activities, and substantial number of hotels.

2. Selection of Hotels

In the second stage, a proportional stratified sampling technique was used to select the sampled hotels from the identified local government areas. The hotels were

categorized according to their respective local government areas, and samples were randomly selected in proportion to the size of each category within the total hotel population.

3. Selection of Respondents

The final stage involved surveying respondents in the selected hotels, with particular focus on operations managers. This approach was adopted to obtain relevant perspectives on the impact of waste management practices on operational costs.

Sources and Data Collection Methods

Data were collected from both primary and secondary sources. Primary data were obtained from operations managers within the selected hotels. Secondary data were sourced from relevant state ministries, published journals, theses, and online resources.

Research Instruments

Primary data collection involved the distribution of 111 closed-ended questionnaires and the conduct of structured interviews. The questionnaire was organized into three sections: Section A: Socio-economic and demographic characteristics of the hotels and respondents. Section B: Waste management practices. Section C: Impact of waste management practices on operational costs. The questions were adapted from Kimeu (2015).

Methods of Data Analysis

The study employed descriptive analysis to determine the mean values of the data and inferential analysis using multiple regression modelling to estimate the impact of the independent variables on the dependent variable.

Model Specification

The focus of this study was to evaluate the impact of waste management practices on the operational costs of the hotel industry in Yola and Mubi metropolises. The operational cost index was considered the dependent variable, while the independent

variables were waste reduction, reuse and recycling; waste collection and disposal; and composting. The linear regression model determining the extent of the relationship is expressed as:

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \mu$

$OP = f(W3R + WC + WCD + \mu)$

Where:

Y = Dependent variable

α = Constant/intercept

β_1, β_2 and β_3 = Slope coefficients

X_1, X_2 and X_3 = Independent variables

μ = Error term

The study adopted a model initially developed by Kimeu (2015) and subsequently utilized by Chikezie (2023), Agesa et al. (2022), and Win (2024). The model was expressed as follows:

$OP_i = \beta_0 + \beta_1 W3R_i + \beta_2 WC_i + \beta_3 WCD_i + \mu_i$

Where:

OP = Operational cost

W3R = Waste reduction, reuse and recycling

WC = Waste composting

WCD = Waste collection and disposal

β_0 = Constant

β_1–β_3 = Slope coefficients

μ = Error term

A Priori Expectations of the Model

The a priori expectations suggest that:

$\beta_1 < 0, \beta_2 < 0, \beta_3 > 0$

This implies that the coefficients of waste reduction, reuse and recycling, and waste composting are expected to be negative, while the coefficient of waste collection and disposal is expected to be positive. These expectations are consistent with the objectives of the study.

Results and Discussion

This section presents the results and interpretation of the key findings in relation to relevant theories and empirical evidence from the literature.

Descriptive Statistics Analysis

The study aimed to compare waste management practices in hotels between Yola and Mubi metropolises. The results reveal that hotels in Yola demonstrate more effective waste management practices than those in Mubi. This difference may be attributed to Yola's status as the state capital, which may provide greater access to government resources, institutional support, and awareness of waste management practices.

Table 4.1: Mean Scores of Waste Management Practices in Yola and Mubi

Table 4.1: *Descriptive Statistics Waste Management Practices in Yola and Mubi Metropolis*

S/No	Waste Management Practice	Mean Score in Yola	Mean Score in Mubi
1.	Waste Reduction, Reuse and Recycling	3.87	3.47
2.	Waste Composting	2.84	2.63
3.	Waste collection and Disposal	4.10	3.75
	Overall mean score	**3.60**	**3.28**

Source: *Field Survey 2026*

Table 4.1 presents the mean values of waste management practices in Yola and Mubi. Yola achieved a higher mean score of 3.87 for waste reduction, reuse, and recycling compared with 3.47 in Mubi. Composting scores were 2.84 in Yola and 2.63 in Mubi, while waste collection and disposal recorded the highest mean score in Yola, at 4.10, compared with 3.75 in Mubi. Overall, Yola recorded a mean score of 3.60 compared with 3.28 in Mubi.

These findings align with previous studies by Kimeu (2015) and Agesa et al. (2022), which emphasize the importance of waste reduction, composting, collection, and disposal as key waste management practices in the hotel industry.

The theoretical interpretation is consistent with the Waste Hierarchy Model, which prioritizes waste reduction over collection and disposal. However, this study found that collection and disposal were more highly practiced than reduction and composting. Similarly, Stakeholder Theory emphasizes the importance of considering and engaging relevant stakeholders in organizational decision-making and

policy implementation (Freeman, 2010) in the development and implementation of waste management policies. The findings reveal that waste reduction and composting practices are currently underutilized, suggesting that greater stakeholder involvement could improve waste management practices in hotels.

Inferential Statistical Analysis

The study aimed to evaluate the impact of waste management practices on operational costs in the hotel industry in Yola and Mubi. The findings indicate significant effects, with waste reduction, reuse, and recycling showing a negative relationship with operational costs, while waste collection and disposal have a positive relationship with operational costs.

Table 4.2: *Regression Results of Waste Management Practices and Operational Costs*

Variable	Coefficient	t-statistic
W3R	-0.9310167	-13.61
WC	-0.141381	-2.55
WCD	0.2954345	4.40
Constant	7.292259	14.23
F-statistic = 68.62		
Prob > F = 0.0000		
R-squared = 0.6731		
Adjusted R-squared = 0.6633		

Source: *Authors computation using STATA*

The multiple regression analysis presented in Table 4.2 is statistically significant, as indicated by the F-statistic of 68.62 and a p-value of 0.0000. This indicates that the waste management variables jointly have a statistically significant relationship with operational costs. The R-squared value of 0.6731 shows that approximately 67.31% of the variation in operational costs is explained by the waste management variables included in the model. The adjusted R-squared value of 0.6633 further indicates a good model fit.

The key coefficient for W3R is -0.931, with a t-statistic of -13.61 ($p < 0.001$), indicating that a one-unit increase in waste reduction, reuse, and recycling is

associated with a decrease in operational costs. Another important coefficient is WC, which is -0.141381, with a t-statistic of -2.55 ($p = 0.012$), suggesting a negative relationship between waste composting and operational costs. Conversely, WCD has a coefficient of 0.2954345 and a t-statistic of 4.40 ($p < 0.001$), indicating a positive relationship between waste collection and disposal and operational costs. The constant term is 7.292259, with a t-statistic of 14.23, indicating statistical significance.

These findings align with previous studies, including Kimeu (2015) and Liyanage et al. (2021), which highlighted the relationship between environmental management practices and operational costs. Further research by Yenidogan et al. (2021) indicated that environmental management practices positively affect both profitability and operational costs. Agesa et al. (2022) confirmed the negative impact of waste reduction on operational costs, while Dani et al. (2021) reported mixed results regarding green hospitality practices in Dehradun, reflecting variations in perceptions and outcomes across studies.

Conclusions

The importance of waste management practices in the hotel industry has increasingly gained attention from hoteliers, environmentalists, and academics. Empirical evidence from previous research indicates that waste management is a crucial practice that can positively influence both operational costs and environmental outcomes. This mixed-methods study compared waste management practices in Yola and Mubi, assessed their impacts on operational costs, and proposed sustainable strategies that could enhance both economic viability and environmental sustainability. The study concludes that effective waste management practices present significant opportunities for hotels to reduce operational costs while enhancing environmental sustainability. Consequently, all stakeholders must collaborate to achieve effective waste management practices and realize the economic, social, and environmental benefits associated with these initiatives.

Recommendations

Based on the key findings of the study, the following recommendations are proposed:

i. Government and policymakers should formulate and implement comprehensive policies that promote waste reduction, reuse, recycling, and efficient collection and disposal in the hotel industry.
ii. Relevant authorities should develop strategies that actively engage all stakeholders in addressing waste management challenges within the hospitality sector.
iii. Hotels should implement diverse waste management practices that not only reduce operating costs but also generate income from recyclable and reusable waste materials.
iv. The hospitality industry should adopt advanced waste management practices and strategies that ensure efficient and effective ways of reducing operational costs and minimizing environmental degradation.
v. Hotels should invest in intensive training programmes to educate both employees and guests about the importance of implementing effective waste management practices.

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