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Effects of Waste Management Practices on the Performance of Building Construction Firms in Lagos State, Nigeria

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Abstract

The construction industry faces waste management issues which lead to cost overrun, adverse environmental and human health effect, heightened operational costs, reduced profitability, and diminished competitiveness. This study aims to investigate the effect of waste management practices on the performance of building construction firms in Lagos State, Nigeria. A descriptive survey research design was employed, targeting 345 construction professionals from 69 registered firms under the Federation of Construction Industry (FOCI) in Lagos State. Using Yamane's formula, a sample size of 185 was determined, the selection of the participants was based on purposive sampling and random sampling technique. The data collected were analysed using regression analysis. Findings revealed that waste management practices (waste reduction, waste re-use, and waste recycling) have significant positive effects on performance of building construction firms. The study concludes

that effective waste management practices contribute positively to the performance of building construction firms in Lagos State. Hence, this study recommends that building construction firms should prioritize waste reduction through sustainable construction practices, resource optimization, and staff training. Also, firms are encouraged to integrate re-use strategies at the project planning stage and collaborate with stakeholders to source reusable materials.

Keywords: Waste, management, practices, building construction firms, performance

Introduction

A common feature of developed nations is the high rate of waste generation (Dabo, Shehu, Muhammed and Umar, 2016; Butu and Mshelia, 2017; Mshelia, Emmanuel and Mbaya, 2020), and it is believed that there is a direct correlation between a country's level of development and the amount of waste produced (Nabegu, 2017). Waste is defined as any by-product of human and industrial activities that holds no residual value (Nepal, Irsyad and Nepal, 2019) and is generally seen as unavoidable in industries, especially in construction. Globally, the construction industry is regarded as a major contributor to the high rate of waste generation (Filho, Tripathi, Guerra, Gine-Garriga, Lovren and Willats, 2018). Construction is inherently detrimental to the environment (Muna, Mustafa, Aiman, Batool, Yazan and Bashar, 2022), largely due to its activities that contribute to pollution and generate significant amounts of waste. Tasks like excavation, construction, site clearance, demolition, road works, and building renovations are major sources of waste (Mshelia et al., 2020; Zhu, Zhu and Dewancker, 2020; Phdungslip, 2022). The concerns surrounding high levels of construction waste are numerous: they include the excessive use of land for waste disposal (Dondapati, Kondagunta, Guthi, Ade and Deekala, 2018), environmental damage from hazardous pollution (Pandiyarajan, Neelakantan, Sridharan and Romrao, 2022), depletion of natural resources (Mshelia et al., 2020), and increased construction costs. These issues highlight the need for alternative materials or methods that are less harmful to the environment, aiming to

better manage or control the negative impacts of waste on the environment and the consumption of raw materials (Nepal et al., 2019). The growing need to reduce waste and its negative environmental impacts is increasingly pressuring the construction industry to minimize its waste production (Dabo et al., 2016).

Aligning with sustainable development goals and by extension Lagos State, Nigeria, aimed for zero waste in demolition, excavation waste to landfill among others (Bai and Sutanto, 2022). To meet these targets and reap economic benefit of waste management, there is need to adopt various waste management practices (Das, Lee, Kumar, Kim, Lee and Bhattacharya, 2019). These practices are essential for enhancing construction firms' performance amidst regulatory obligations and sustainable goals (Nepal et al., 2019). However, the construction industry still present substantial issues relating to waste management practices in Lagos State, Nigeria. Based on this, while associating waste management with the construction industry, it is pivotal to carry out a study in this regard to know the effect of waste management practices on the performance of building construction firms in Lagos State, Nigeria.

Statement of the Problem

In developing countries, construction projects face challenges such as budget overrun, escalation of disposal costs due to increased waste volume (Mshelia et al., 2020; Zhu et al., 2020). It is estimated that between 10-30% of construction materials are wasted (Dabo et al., 2020; Muna et al., 2022), and construction-related waste accounts for 10-40% of total waste produced in developed economies (Filho et al., 2018). Consequently, construction firms face heightened operational costs, reduced profitability, and diminished competitiveness in the marketplace (Butu & Mshelia, 2017). Moreover, the absence of comprehensive waste re-use strategies further exacerbates the problem. Consequently, valuable resources that could be reclaimed and reintegrated into the production cycle are squandered, further exacerbating environmental degradation and resource depletion (Das et al., 2019; Phdungslip, 2022).

Furthermore, construction industry in Lagos State face a variety of waste management difficulties that jeopardize their performance and viability. These issues include poor waste segregation techniques, insufficient training and capacity

development activities, a lack of government support and incentives for sustainable practices, and cultural and behavioral impediments to change (Filho et al., 2018; Pandiyarajan et al., 2022). Hence, this study assessed waste management practices by providing information on the extent at which waste management practices affect the performance of building construction firms in Lagos State, Nigeria.

Aims and Objectives

The general objective of this study is to assess waste management practices with a view to improving the performance of building construction firms in Lagos State, Nigeria.

The specific objectives of the study are to:

i. assess the effect of waste reduction on the performance of building construction firms in Lagos State;
ii. analyze the effect of waste re-use on the performance of building construction firms in the study area; and
iii. evaluate the effect of waste recycling on the performance of building construction firms in Lagos State.

Literature Review

Concept of Construction Waste Management

Fernando (2019) described waste as the loss of various resources, including materials, time, labor, equipment, and capital, resulting from activities that incur direct or indirect costs without contributing value to the final product from the client's perspective. Construction waste, according to Amugsi, Muindi and Mberu (2022), is any byproduct removed from construction, renovation, or demolition sites of buildings and civil engineering structures. This waste can arise from errors, improper sequencing, unnecessary actions and movement, mistimed inputs and outputs, or delivering products or services that fail to meet customer requirements (Matheson, 2022).

Waste management is an essential component of contemporary society, involving the collection, transportation, processing, recycling, and disposal of waste materials (Bai and Sutanto, 2022). It involves a complex network of systems and facilities designed to handle various types of waste generated by human activities

(Zink and Geyer, 2019). Effective waste management requires collaboration among governments, businesses, communities, and individuals to implement comprehensive waste reduction, recycling, and re-use strategies (Gue, Lopez, Chiu, Ubando and Tan, 2022). Construction waste management is a multifaceted process that goes beyond simply disposing of waste; it's a comprehensive strategy focused on the efficient use of construction resources, aiming to minimize waste generation and maximize the beneficial use of any waste produced (Egun, 2017).

Performance of Construction Firms

Raisbeck, Duffield and Xu (2010) defined the performance of construction firms as the successful completion of a project according to the agreed requirements. Project performance is often seen as focus on execution, with an emphasis on managing risk and uncertainty (Yukalang, Clarke and Ross, 2018), while ensuring that projects are completed on time and within budget. Roy and Tarafdar (2022) also noted that the criteria for project success can differ depending on the field. As a result, factors like time, cost, health and safety, profitability, quality, technical performance, functionality, productivity, satisfaction, and environmental sustainability were classified into "objective" and "subjective" measures, with particular emphasis on design/build projects in the construction industry (Roy and Tarafdar, 2022). Defining project success is often seen as setting clear criteria for measuring project deliverables. Traditionally, the success of a project was evaluated based on time, scope, and budget constraints (Soni and Kandasamy, 2018). However, over time, this definition has expanded to include additional criteria such as achieving the organization's financial and strategic goals, with stakeholder satisfaction now playing a key role (Borowy, 2019).

Empirical Review

Kaza, Yao, Bhada-Tata and Van Woerden (2018) concluded that waste minimization is the most effective strategy for reducing waste generation and addressing many of the associated problems in their global study of solid waste management projections for 2050. The research used a systematic literature review. Marello and Helwege (2018) examined solid waste management and the social inclusion of waste pickers, identifying opportunities and challenges. They found

that the UK has achieved a recycling rate of approximately 45% for construction and demolition waste, while the Netherlands, Belgium, and Denmark have reached recycling rates of 90%, 87%, and 81%, respectively. The study, which used a questionnaire survey and descriptive statistics for data analysis, concluded that the success of recycling initiatives depends on the availability of a market for construction and demolition waste. This market, in turn, relies on users' confidence in the material's quality, availability, price, and timely delivery.

Bom, Belbase and Bibriven (2017) examined public attitudes and practices regarding solid waste recycling in Laramie, Wyoming, USA. The study found that the primary focus for reducing waste is to prevent it by designing out or minimizing waste at the source. It proposed three critical project phases for introducing waste minimization efforts: contractual, design, and site execution stages. The research emphasized the need for construction companies to create or adopt efficient waste reduction strategies to address material wastage in construction projects.

In a similar study, Egun (2017) assessed recycling and waste management practices in Delta State, Nigeria, and found that more than 60% of the production costs for most capital projects are tied to resources that generate waste. With increasing concerns about the volume of waste produced in the construction industry, recycling has been recognized as one of the most viable solutions for addressing construction waste. In many instances, up to 90% of the generated waste can be recycled. The study utilized a systematic literature review approach.

Akinkurolere and Franklin (2005) conducted a study on waste management at construction sites in South Western Nigeria, focusing on the risks posed by material waste in the construction industry. The study explored strategies for minimizing construction waste, maintaining accurate site records for accountability, and recommended effective waste management practices. Data were collected through questionnaires from construction professionals, and descriptive statistics were used for analysis. The study found that material waste raises construction costs and reduces contractor profits, attributing the wastage to poor management and a lack of awareness about effective waste management. It recommended that construction waste be recycled and re-used.

Methodology

This study adopted a survey research design which involves the use of structured questionnaire for data collection. A descriptive survey research design was

employed, targeting 345 construction professionals from 69 registered firms under the Federation of Construction Industry (FOCI) in Lagos State. Using Yamane's formula, a sample size of 185 was determined, the selection of the participants was based on purposive sampling and random sampling technique. The questionnaire was made up of two parts which contain questions relating to demography of the respondents and effects of waste management practices on the performance of building construction firms, The indicators for each of the construct employed a 5-point Likert scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree. The data collected were analysed using descriptive statistics and linear regression analysis on Statistical Package for Social Sciences (SPSS) software. The equation for the regression analysis is presented below:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \quad (1)$$

Where,

Y = Performance of building construction firms

X_1, X_2, X_3 = Waste management practices

X_1 = Waste reduction

X_2 = Waste re-use

X_3 = Waste recycling

β_0 = Regression constant

$\beta_1, \beta_2, \beta_3$ = Coefficients of independent variables

ε = Error term

Results and Discussion

Response Rate

A total of 185 copies of questionnaire were randomly administered among the respondents. 150 were retrieved, dully filled and considered valid for the purpose of this research.

Regression Model Summary of the Effect of waste reduction on the Performance of Building Construction Firms in Lagos State, Nigeria

Table 1 shows the model summary of the effect of waste reduction on performance of building construction firms. The coefficient of determination, R Square (0.521) indicates that 52.1% of the variation in performance is explained by waste

reduction practices. This shows that waste reduction practices have a substantial effect on performance. The 52.1% of variation explained implies that 47.9% is explained by other external factors which are not included in the regression model.

Table 1: Model Summary of Waste reduction and Performance of Building Construction Firms in Lagos State, Nigeria

Model	R	R Square	Adjusted R square	Std. Error of the Estimate
1	0.722	0.521	0.518	0.52766

a. Predictors: (Constant), Reduction

Source: Researcher's field survey (2024)

Regression Coefficients of the Effect of Waste reduction on the Performance of Building Construction Firms in Lagos State, Nigeria

Table 2 shows the regression coefficients of the effect of waste reduction on performance of building construction firms. The estimated coefficient of waste reduction ($\beta = 0.722$, $p < 0.05$) indicates that waste reduction practices have a significant positive effect on performance of building construction firms. This is in agreement with the study by Ajayi, Oyedele, Bilal, Akinade, Alaka and Owolabi (2017), who found that reducing waste not only minimizes disposal costs but also ensures optimal resource allocation, thereby improving the profitability and performance of construction firms.

Table 2: Regression Coefficients of Waste reduction and Performance of Building Construction Firms in Lagos State, Nigeria

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	**Std. Error**	**Beta**		
(Constant)	0.947	0.226		4.184	0.000
Waste Reduction	0.739	0.058	0.722	12.696	0.000

a. Dependent Variable: Building Construction Firms' Performance

Source: Researcher's field survey (2024)

Regression Model Summary of the Effect of Waste re-use on the Performance of Building Construction Firms in Lagos State, Nigeria

Table 3 shows a model summary of the effect of waste re-use on performance of building construction firms. The coefficient of determination, R Square (0.529)

indicates that 52.9% of the variation in performance is explained by waste re-use practices. This shows that waste re-use practices have a substantial effect on performance of building construction firms. The 52.9% of variation explained implies that 47.1% is explained by other external factors not included in the model.

Table 3: Model Summary of Waste re-use and Performance of Building Construction Firms in Lagos State, Nigeria

Model	R	R Square	Adjusted R square	Std. Error of the Estimate
1	0.728	0.529	0.526	0.52314

a. Predictors: (Constant), Re-use

Source: Researcher's field survey (2024)

Regression Coefficients of the Effect of Waste re-use on the Performance of Building Construction Firms in Lagos State, Nigeria

Table 4 shows the regression coefficients of the effect of waste re-use on performance of building construction firms. The estimated coefficient of waste re-use practices ($\beta = 0.728$, $p < 0.05$) indicates that waste re-use practices have a significant positive effect on performance of building construction firms. This is consistent with the findings of Hossain et al. (2017), who found that reusing materials such as wood, metals, and concrete can significantly reduce project costs while ensuring compliance with environmental regulations. They emphasized that by integrating waste re-use practices, firms not only achieve cost savings but also improve their corporate image, thereby enhancing client satisfaction and market competitiveness.

Table 4: Regression Coefficients of Waste re-use and Performance of Building Construction Firms in Lagos State, Nigeria

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	Std. Error	Beta		
(Constant)	1.252	0.200		6.273	0.000
Waste Re-use	0.676	0.052	0.728	12.906	0.000

a. Dependent Variable: Building Construction Firms' Performance

Source: Researcher's field survey (2024)

Regression Model Summary of the Effect of Waste recycling on the Performance of Building Construction Firms in Lagos State, Nigeria

Table 5 shows model summary of the effect of waste recycling practices on performance of building construction firms. The coefficient of determination, R Square (0.532) indicates that 53.2% of the variation in performance is explained by waste recycling practices. This shows that waste recycling practices have a substantial effect on performance. The 53.2% of variation explained implies that 46.8% is explained by other external factors.

Table 5: Model Summary of Waste recycling and Performance of building construction firms in Lagos State, Nigeria

Model	R	R Square	Adjusted R square	Std. Error of the Estimate
1	0.729	0.532	0.528	0.52196

a. Predictors: (Constant), Recycling

Source: Researcher's field survey (2024)

Regression Coefficients of the Effect of Waste recycling on the Performance of Building Construction Firms in Lagos State, Nigeria

Table 6 shows the regression coefficients of the effect of waste recycling on performance of building construction firms. The estimated coefficient of waste recycling practices ($\beta = 0.729$, $p < 0.05$) indicates that waste recycling has a significant positive effect on performance This concurs with the findings of Yuan and Shen (2011), who noted that waste recycling practices significantly enhance construction performance by reducing material costs, improving efficiency, and increasing client satisfaction.

Table 6: Regression Coefficients of Waste recycling and Performance of Building Construction Firms in Lagos State, Nigeria

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	**Std. Error**	**Beta**		
(Constant)	1.098	0.210		5.221	0.000
Waste Recycling	0.705	0.054	0.729	12.961	0.000

a. Dependent Variable: Building Construction Firms' Performance

Source: Researcher's field survey (2024)

Conclusion and Recommendations

This study assessed the effect of waste management practices on the performance of building construction firms in Lagos State, Nigeria. Based on the findings, the study concludes that waste management practices (waste reduction, waste re-use, and waste recycling) have a significant positive effects on building construction firms' performance in the study area. Hence, this study recommends that building construction firms should prioritize waste reduction through sustainable construction practices, resource optimization, and staff training. Also, firms are encouraged to integrate re-use strategies at the project planning stage and collaborate with stakeholders to source reusable materials.

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