



Waste Management Techniques by Construction Firms in Lagos State, Nigeria: Challenges and Prospects

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ABSTRACT

The generation of construction waste in Lagos State is almost inevitable, a state which is considered to have one of the fastest growing economy on the Africa planet. In an economy with such huge potential, construction activities would be carried out almost at such fast pace to meet with the demands that come with such growth. Hence resulting to the constant construction of both commercial and residential buildings, as well as basic infrastructure to cater for its growing population. Waste generation which generally comes with development of cities and towns, and construction waste is said to contribute to the large chunk of total waste generated around the, therefore creating the need to seek ways to control waste generated on construction sites by construction firms in Lagos State, Nigeria. In doing so, this paper aims to examine challenges currently experienced by the various construction firms working within the state and the prospect that generated construction waste could offer in the context of improving the construction sector of the state, while also improving the Lagos State waste management potential. In addition to the limitations faced in the research, a quantitative study was carried out among construction professionals practicing within Lagos State, the administering questionnaires. The data collected was analysed using SPSS. The results revealed that majority of construction professionals within Lagos State are familiar with waste management techniques, with waste disposal having the highest employment rate of 80%. The challenges of the employing waste management techniques however revolve around lack of adequate waste management facilities, with 73.3% acceding to the fact that an improved recycling facility would improve waste management on sites. The paper then concludes by recommending strategies to help improve management of construction waste within Lagos State

Keywords: Waste, Management, Construction, Techniques, Lagos State.

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1. INTRODUCTION

Construction wastes which could be defined as the various forms of waste generated from various types of construction works, which may include: renovation and demolition activities which may involve land excavation or formation, building renovations, various building and civil activities, site demolition and clearance, and roadwork. These construction activities though tend to have positive impact through improvement of public facilities and providing better liveable environments.



However come with a price of generating huge mass of waste which are considered unavoidable in the nature of the job according to (Hongping & Liyin, Trend of the research on construction and demolition waste management, 2011). Waste generation trends from around the world were studied by various literatures and it was observed that, the construction industry according to (Jaime, Madelyn, & Maria, 2009) constitutes as much as 35% of all the industry waste generated around the world, with countries like Hong Kong having 38% of their solid waste generated by the construction sector (Hong Kong Government - Environmental Protection Department, 2006), also in the US it was report construction waste makes up 29% of solid-waste stream, while in the Canada 35% of landfill areas are taken over by construction waste, and it was also identified that 50% of waste in a typical landfill space within the UK could be made up of construction waste (Oyeshola & Shabbir, 2008).

These trends thus shed light on how much waste construction activities contribute to the environment, causing environmental degradation and pollution. As identified by (Poon, Yu, & Ng, 2003) and (Esin & Cosgun, 2007), wastes from construction sites have generated adverse impacts which include using up huge amount of land resources for waste landfilling, posing threats of hazardous pollution to surrounding environment, and wastage of natural resources which could have been minimised or reused. Hence, techniques for managing or reducing the various waste must then be explored. Especially in a state such as Lagos, where various construction activities are being undertaken to respond to the growing need of its ever-expanding population and also a fast-growing economy, rapid action must then be taken to curtail construction wastes generated from construction sites within the state. In doing so, this paper seeks to answer the following research questions: what are the existing construction waste management techniques currently employed by construction firms within Lagos State; What are the current challenges faced with managing wastes generated during the construction process; Are there any prospects for managing construction waste within Lagos State; How can existing waste management techniques be made more efficient and effective.

2. LITERATURE REVIEW

As indicated by past literatures, waste from construction sites are now a growing problem that threaten sustainability in various countries around the world. The goal for waste management however is to reduce waste sent to landfill by a margin of 43%, cut down on energy usage by 40%, reduce consumption of materials by about 43%, and also cut savings incurred on waste handling charges by 50% (Waste Resource Action Program (WRAP), 2011). In order to achieve WRAP's goals of managing waste, various methods and techniques must be implemented. As stated by (Adeagbo, Achuen, & Oyemogun, 2016) waste management techniques are limited in the way they can approach material generation, further highlighting any action taken to prevent waste generation beyond this limit would become ineffective and thus leading to a waste of resources in managing waste generation.

2.1 Sources of material waste

In trying to understand how various waste generated can be controlled or reduced, we must first understand the various sources of the various waste generated during construction activities. (Adeagbo, Achuen, & Oyemogun, 2016) categorised sources of waste into two, namely: direct waste and indirect waste.

2.1.1 Direct Waste

This type of waste can be generated at various stages of the construction work, before the material is delivered to site or after the material has been implemented for use on the construction project. They include the physical loss of material, which in the process may lead to waste generation.



Table 2.1: Categories of Direct Waste

Category	Reason	Example
Delivery waste	During the transportation of materials to the site, unloading and placing in addition to the initial storage	Bricks, glassing
Cutting and conventional waste	Cutting materials into various sizes and uneconomical shapes	Formwork, tiles
Fixing waste	Dropped, spoiled or discarded materials during fixing	Bricks, roof tiles
Application and residue waste	Hardening of the excess materials in containers and cans	Paint, mortar, plaster
Waste caused by other trades	Damage occurs by succeeding trades	Painted surfaces
Criminal waste	Theft and vandalism	Tiles, cement bags
Management waste	Lack of supervision or incorrect decisions of the management	Throwing away excess material

Source: (Adeagbo, Achuen, & Oyemogun, 2016)

2.1.2 Indirect Waste

This category of waste does not include the physical lost of materials but rather the misappropriation of materials for works carried out on construction sites. An example of this type of material waste may occur when a concrete slab is made thicker or larger due to oversight on the side of the contractor or subcontractor.

Table 2.2: Categories of indirect waste

Category	Reason	Example
Substitution waste	Substitution of materials in work, which will incur losses to either contractor or client	Use of facing bricks for common Bricks
Production waste	Contractor does not receive any payments for the works he has carried out	
Negligence waste	Site errors because of the condemned work or use of additional material	Over-excavation of foundation resulting in the use of additional concrete
Operational waste	Unavailability of proper quantities in the contract documents /the materials that are left on sites	Formwork

Source: (Adeagbo, Achuen, & Oyemogun, 2016)

2.2 Construction waste management

Several literatures have over the years proposed various approaches to combating waste generated on construction sites, these approaches are majorly referred to as the 3 Rs: reduction, reuse, and recycling. In considering the waste management method to be employed, the impact of each method at the various stages of implementation must first be accessed through an hierarchy of influence, determining whether they help in preventing waste, minimise it, or require to find a better use for the waste in some cases. Waste prevention according to (Adeagbo, Achuen, & Oyemogun, 2016) should be considered first before any other method, as they help to cut cost on purchased materials and also resources expended in transporting the materials as well, hence seeming as a more effective approach before and during construction activities.



Hongping & Liyin, (2011) in their paper established a hierarchy for waste management, identifying the impact the various highlighted method has on the environment and on impacting the wastes generated, also added the option of “disposal” to the already established 3 Rs. The established hierarchy is aimed at reducing consumption of resources and preventing environmental pollution, towards meeting the needs of the various pillars of sustainability.

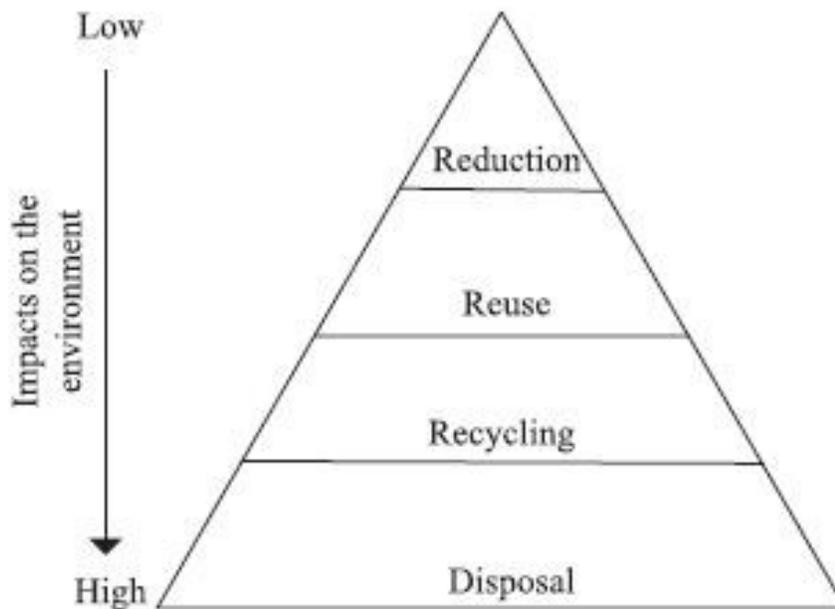


Figure 2.1: Construction waste method hierarchy
Source: (Hongping & Liyin, 2011)

2.2.1 Reduction

This is considered to be the most efficient and effective waste management method in cutting the quantity of waste generated on construction sites, so as help eliminate waste disposal and environmental degradation. Waste reduction can be carried out in a number of ways, through proper planning of works to be carried from the outset of the project, detailed design process, and proper specification and quantification of materials to be used on site so as to avoid the supply of more than required quantity.

2.2.2 Reuse

It is a known fact that construction waste is completely unavoidable, in such case material reuse is one of the methods that can be employed so as to reduce the possibility of waste dump in landfills. Reuse can happen in two major ways: The first being the reuse of the same material for the same purpose on site, with the reuse of wooden formworks for concrete casting works; the other way in which reuse can also occur on site is through repurposing materials used on site for new use, an example of such activities would include backfilling of foundation trenches with excavated soil or the use of rubbles from demolition as boulders on site. As stated by (Reardon, Fewster, & Harkenness, 2013) the reuse of materials would help to reduce cost, cut down volumes of waste generated on site, and also help reduce the quantity of resources demanded.



2.2.3 Recycling

Construction wastes that cannot be reused are then considered for disposal or recycling, recycling being the next option on the waste management method hierarchy. By recycling, construction waste can be made into new materials that could be useful in other areas, thus reducing the tonnes of construction waste that would have been transported to landfills. Recycling is however possible only when material separation is made easy by those disposing them on site, by creating separate waste disposing containers for the various categories of waste generated on site. (Hongping & Liyin, 2011) outlined some of the benefits of carrying out recycling, this included;

1. Recycling helps to reduce the demand for new resources
2. It helps to cut down on material transportation and cost of energy consumed during production
3. Helps to repurpose waste that could have been lost to landfill
4. Recycling helps to reduce waste dump in landfill areas, thereby helping to preserve land for future development
5. Recycling of materials help to improve the general state of the environment

3. METHODOLOGY

This paper is considered a quantitative research, which would make use of questionnaires as a major source of data collection. The review of various literatures helped to identify the various management techniques for construction waste, while also pointing out the importance of managing such waste in the environment. Based on the various techniques identified and the research questions posed by the paper, a questionnaire was structured to identify the various challenges, prospects, and the possibility of improving existing construction waste management techniques within Lagos State, Nigeria. The questionnaires were administered using random sampling method to selected groups of construction professionals practicing within the study area (Lagos State). Data collected would be analysed and presented using graphs, tables, and descriptive discussions.

4. RESULTS AND DISCUSSION

4.1 Demographic Data

Table 4.1 showing the demographic data of the respondents show that majority of the respondents within the study population have been practicing between 5 to 10 years with 73.3%, while the remaining 26.7% consisted of respondents who have been practicing between 0 to 5 years. Majority of the respondents only executed architectural construction with 53.3, while the remaining 46.7% carried out both architectural and civil construction. In trying to understand how construction waste can be managed, the various possible sources of these wastes would also need to be identified.

It was then identified that majority of waste generated on construction sites were residues from application during the construction process with 73.3%, with the rest of the wastes generated coming from poor planning and error from workers with both bearing 13.3%. Based on the above responses, this can be considered a true representation of what is attainable, as Lagos State is a fast-growing city both economically and in human population, hence the need to meet the housing needs of such fast-paced society and commercial buildings to cater for the economic growth being experience within the city as well.



Table 4.1: Demographic data of respondents

Variable	Frequency	Percentage (%)
<i>How long has your firm been in professional practice</i>		
0-5years	41	26.6
5-10years	113	73.4
<i>Type of construction carried out</i>		
Architectural	82	53.3
Architectural and Civil	72	46.7
<i>Common sources of waste</i>		
Residue from application	113	73.4
Poor planning	21	13.6
Errors from workers	20	13

4.2 Existing construction waste management techniques currently employed by construction firms within Lagos State

In a bid to identify the existing construction management techniques employed by construction professionals within Lagos State, table 4.2 below presents the various responses in line with gathering data towards answering this research question. Based on the responses, it was observed that majority of the respondent actually consider waste management techniques as part of the logistics for the construction process with 80% acceding to this, 6.7% admitted to not considering waste management as part of their logistics, and 13.3% identifying as not totally considering it as part of the logistics planning for the construction process. Respondents were asked if there was usually a designated place on the construction site for waste keeping generated waste before the management technique to be employed is decided, 60% identified to having a designated place on site, 33.3% respondents did not have a designated space for keeping waste generated, and 6.7% responded to maybe having a designated space for keeping waste generated in site.

Under this section of the questionnaire, towards a bid to identify existing construction waste management techniques employed, respondents were asked if wastes generated were usually sorted out for the various techniques to be employed, 40% agreed to sorting waste generated, 46.7% admitted to not sorting wastes generated, while 13.3% selected the maybe option showing that they sometimes sorted and other times they did not. Respondents were also asked the frequency for which generated wastes were taken out of site, it was observed that majority of the respondents frequently took out waste generated off the site with 80% identifying to this, 6.7% admitted to not doing this often, and 13.3% identified that they were not consistent with the frequency of taking waste out of the site.



Table 4.2: showing responses for existing waste management techniques employed

Variables	Frequency	Percentage (%)
<i>Is waste management considered as part of the logistics for the construction process?</i>		
Yes	123	79.9
No	10	6.5
Maybe	21	13.6
<i>Does the construction site have a designated space for waste disposal?</i>		
Yes	92	59.7
No	52	33.8
Maybe	10	6.5
<i>Wastes are usually sorted out for them to managed by different techniques</i>		
Yes	62	40.3
No	72	46.7
Maybe	20	13
<i>Are generated waste constantly taken out of the site?</i>		
Yes	123	79.9
No	10	6.5
Maybe	21	13.6

Figure 4.1 showing responses for the construction waste management techniques currently being employed on construction sites within Lagos State. It was observed that majority of the respondents managed generated waste by disposing them with 80%, while reuse, reduction, and recycling all had similar responses with 6.7% across the three techniques. It can be said that with majority of respondents identifying that management of construction wastes generated being factored into the logistics for the construction process, majority currently plan to dispose of their waste, with reuse, reduction, and recycling being barely considered as part of the logistics. This would however lead to increase in the number of dumpsites created within the state, which would eventually have a significant on the sustainability of the environment through pollution according to (Esin & Cosgun, 2007)

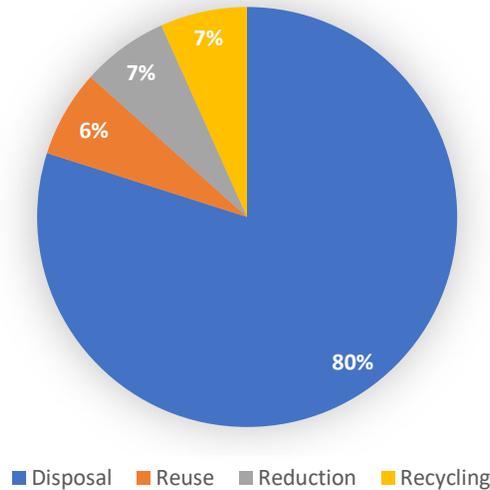


Figure 4.1: construction waste management techniques usually employed on your construction site

4.2 current challenges faced with managing wastes generated during the construction process

This section is based on the five-point Likert scale to measure the current challenges faced with managing wastes generated during the construction activities within Lagos State. It was observed from table 4.3 that 53.3% identified that waste generated on construction sites are usually more than the planned capacity, with 40% disagreeing with this notion, and 26.6% being undecided on the issue. 70% of the respondents identified that they did not have government personnel coming by the site to pick up waste generated, with 40% both agreeing and disagreeing that the construction firm usually had to handle off-site management of generated waste. 46.7% of the respondents however identified to reusing generated waste, while 40% disagreeing to reusing generated waste, and 13.3% being undecided on this matter. Majority of the respondent, however, disagree with the practice of recycling being common on their site, while 33.3% identified to recycling waste generated on their site, and 6.7% being undecided. 40% of the respondents identified that waste reduction was usually not achieved on their construction site, while 46.7% not being sure if they actually reduced waste on their sites, and 33.3% agreed to reducing waste on their site.

Table 4.3: Showing responses for current challenges faced with managing construction waste

S/N	Items	SD	D	U	A	SA
1	Waste generated on site is usually beyond the planned capacity	0%	40%	26.7%	20%	13.3%
2	There are designated government personnel that come to pick up waste generated on site for disposal	13.3%	46.7%	20%	6.7%	13.3%
3	off-site management of waste is done by the firm	13.3%	26.7%	20%	33.3%	6.7%
4	Generated wastes are often reuse in the construction process	6.7%	33.3%	13.3%	40%	6.7%
5	Recycling of waste is a common practice on site	0%	60%	6.7%	33.3%	0%
6	Waste reduction is easily achieved on site	13.3%	26.7%	46.7%	6.7%	6.7%



4.3 Prospects for managing construction waste within Lagos State

The five-point Likert scale was employed in measuring the prospect of construction waste management within Lagos State. It was observed from table 4.4 that 40% of the respondents believe that management of construction waste has improved in their years of practice, with 26.6% disagreeing with the notion that construction waste management has improved in their years of practice, and 13.3% being undecided on the issue. 60% believe that current construction methods help to reduce generated waste. 40% believe that recent government regulations have the ability to help improve waste management within the state, while 73.3% believe that an improved recycling culture within the state would play a major role in managing construction waste within the state. 73% of the respondents also identified that the design stage plays an important role in helping to reduce wastes generated on construction sites within Lagos State.

Table 4.5: Showing responses for prospects of managing construction waste within Lagos state

S/N		SD	D	U	A	SA
1	Waste management in Lagos State has improved in your years of construction	13.3%	33.3%	13.3%	26.7%	13.3%
2	Current construction methods help to reduce waste generated on site	6.7%	6.7%	26.7%	46.7%	13.3%
3	Recent government regulations can help to improve waste management	6.7%	13.3%	40%	26.7%	13.3%
4	Improved recycling culture within Lagos State can help to improve waste management	6.7%	6.7%	13.3%	53.3%	20%
5	The design stage plays a huge role in managing waste during construction	6.7%	13.3%	6.6%	26.7%	46.7%

5. CONCLUSION AND RECOMMENDATION

The results from the analysis, it was revealed that the knowledge of managing waste is one that is familiar to construction professionals, however the most common waste management practice for most construction professionals is waste disposal, which has been identified through literature to have an adverse effect on the environment. The option of disposal can however be said to be popular due to it being the most readily available technique to professionals, as many agree that an improved recycling culture would play a major role in improving waste management in the construction industry.

The following recommendations are then proffered based on the above conclusion:

1. The government should encourage the recycling of generated waste by improving any existing recycling plant within the states, while also providing more plants to be adequate for the excess wastes generated on construction sites.
2. Construction professionals should make more allowances for various waste management techniques in during the planning stages before moving to site.
3. Considering the role of the design phase in controlling the quantity of waste generated from application residues, designers should also factor in waste management from the early stages of conceptualisation
4. Designers factoring waste management early in the design phase would also help to improve waste management through reduction
5. Construction professionals should also seek innovative construction techniques that help to reduce waste generated on site.



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