Effects of Material Waste Causes on Cost Overrun in Abuja, Nigeria: A Project Planning Stage Perspective

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Abstract:
Material wastage and cost overruns are global problems affecting construction projects. These problems occur at different stages of a project, from planning, design, estimating, and construction to project completion. The purpose of this paper is to examine the effects of material waste causes and their control measures on project-cost overruns at the planning stage of a project. The quantitative approach was adopted in this study. Interviews were purposively conducted with thirty (30) construction professionals' in Abuja from which a structured (tick-box) questionnaire was ticked/marked by the researcher in the course of the interviews. The results of the tick-box questionnaire were the 'only data' utilised in this research and were analysed using the descriptive (cross-tabulation) and inferential method. The paper found that material waste causes and their control measures have significant effects (very-high, high, medium, low, and very-low) in causing or minimising cost overruns at the planning stage of a project. It is recommended that management of material waste and cost overrun should be revised based on the findings of this research as a reference document and included as part of the pre-contract planning process for a project.

Key words:
Control measures, Cost overruns, Material waste, Project-planning stage

1 Introduction

Cost overruns and material waste are global problems which make it difficult for many construction projects to be completed within their budget (Saidu & Shakantu, 2015; Ameh& Itodo, 2013; Abdul-Rahman *et al.,* 2013; Nagapan *et al.,* 2012). Studies from different parts of the world have shown that material waste from the construction industry represents a relatively large percentage of the production costs. Thus, poor management of materials and waste leads to an increase in the total cost of building projects (Ameh & Itodo, 2013). The problems of material waste and cost overrun are occasioned by several causes at different stages of projects. These include: the planning stage, estimating stage, design and design management stage, as well as the construction stage. Identification of these causes at different stages and the application of relevant control measures to minimise their occurrence is a step towards alleviating the consequences (Mou, 2008; Oladiran, 2009; Nagapan *et al.,* 2012; Saidu & Shakantu, 2015).

Material waste is a problem requiring urgent attention in the construction industry. For instance, Ameh & Itodo (2013) highlighted that in every 100 houses built in Nigeria, there is sufficient waste material to build another 10 houses. Also, 10% of materials delivered to sites in the UK end up as a waste that may not be accounted for (Osmani, 2011). Similarly, cost overrun is a lingering problem which plague the construction industry for decades; and the argument on how to reduce or totally remove it from projects has been ongoing among the built environment professionals, project owners and the users for the past seventy years (Apolot *et*

al., 2010; Allahaim & Liu, 2012), but there is no substantial improvement nor significant solution in mitigating its detrimental effects (Allahaim & Liu, 2012). Consequently, Ameh & Itodo (2013) believed that building material wastage on construction sites accounts for cost overruns. And this is as a result of the fact that, most managers of construction projects pay little attention to the effects of material waste generated on cost overruns.

Many studies have been conducted in this field, for instance, Tam *et al.* (2007); Ameh & Itodo (2013); Saidu & Shakantu (2015); Saidu & Shakantu (2016a); Saidu & Shakantu (2016b). However, there is still a need for research that provides an empirical assessment of the material-waste causes and the material waste control measures that have effects on cost overruns at the planning stage of a project. In this line, Saidu & Shakantu (2016a) used a desktop methodology / literature review to examine the relationship between the material waste causes and those of cost overruns at the pre-contract and the post-contract stages of projects. The study recommended further study that would focus on the collection of empirical (field) data on these issues in the construction industry. This recommendation led to the development of the problem posed in this study that the empirical study on the effects of material waste causes and their control measures on cost overruns at the planning stage of a construction project is suboptimal. On this basis, this paper reports the findings of an empirical investigation on the effects of material waste causes and their control measures on cost overruns at the planning stage of a construction project.

2 Material Waste and Cost Overruns

Construction waste is generally classified into two main classes, namely: the physical waste and the non-physical waste (Nagapan *et al.,* 2012). The material waste comes from the physical construction waste. This is the waste from construction, renovation activities, including civil and building construction, demolition activities, and roadwork. It is, however, referred by some directly as solid waste (Saidu & Shakantu, 2015). This type of waste consists of material waste for recovery (re-use and recycling) or complete loss of materials for landfill disposal (Saidu, 2016).

Conversely, the cost overrun comes from the non-physical construction waste which normally occurs during the construction process. By contrast with material waste, the non-physical waste relates to time overruns and cost overruns for a construction project. Ma (2011) defines waste as not only associated with wastage of materials, but also to other activities such as repair, waiting time, and delays.

Saidu & Shakantu (2015) emphasised that since the term 'construction waste' entails both the physical and the non-physical waste, there is a relationship between material waste originating from physical waste and cost overruns from the non-physical waste, since they both emanate from the same waste family.

Saidu & Shakantu (2016a) highlighted through a desktop research that all the causes of material waste also lead to cost overrun at the pre-contract and the post-contract stages of a project. However, 96.9 percent and 81.8 percent of the causes of cost overrun also cause material waste at the pre-contract and post-contract stages respectively. There is an 86.7 percent overlap between the causes of material waste and those of cost overruns at all stages of a project. Other causes which are not related are mostly, the micro-economic and macro-economic factors.

Furthermore, the material waste causes that are similar to the causes of cost overruns at the planning stage of a project over the years, by different authors, and in different geographical locations are presented in Table 1.

Table 1. Relationship between the causes of material waste and those of cost overruns at the planning stage of a project

Sn	Causes of material waste that are similar to the causes of cost overruns	Material Waste		Cost overruns	
		Author and date	Geographical location	Author and date	Geographical location
1	Improper planning	Babatunde (2012); Nagapan *et al*. (2012)	Nigeria; Batu, Malaysia	Zewdu & Aregaw (2015); Allahaim & Liu (2012);	Ethiopian projects; Saudi Arabia
2	Over estimation to accommodate variations	Nguyen *et al.* (nd); Odusanmi, Oladiran & Ibrahim (2012)	Geelong, Australia; Nigeria	Ahiaga-Dagbui & Smith (2014); Zewdu & Aregaw (2015)	UK; Ethiopian projects
3	Lack of legislative enforcement	Nagapan *et al.* (2012)	Malaysia	Allahaim & Liu (2012)	Saudi Arabia
4	Inadequate site investigation	Osmani *et al.* (2008); Nagapan *et al.* (2012)	UK; Malaysia	Subramani *et al.* (2014); Chiktara (2011)	India; India; Turkey
5	Inadequate scheduling	Nagapan *et al*. (2012)	Batu, Malaysia	Subramani *et al.* (2014)	India
6	Poor communication flow among members	Okorafor (2014); Nagapan *et al*. (2012)	South Africa; Malaysia	Abdul Rahman *et al.* (2013)	Malaysia
7	Improper co-ordination of the entire project and professionals	Al-Hajj & Hamani (2011); Nagapan *et al*. (2012)	UAE; Malaysia	Abdul Rahman *et al.* (2013); Zewdu & Aregaw (2015)	Malaysia; Ethiopian projects
8	Unsatisfactory budget for waste management	Al-Hajj & Hamani (2011)	UAE	Jackson (2002)	Reading
9	Insurance problem	Osmani (2011)	UK	Allahaim & Liu (2012);	Saudi Arabia
10	Communication error between client and designer	Okorafor (2014); Nagapan *et al*. (2012)	, South Africa; Malaysia	Abdul Rahman *et al.* (2013)	Malaysia
11	Frequent demand for design change	Osmani *et al.* (2008); Nagapan *et al*. (2012)	UK; Malaysia	Abdul Rahman *et al.* (2013); Zewdu & Aregaw (2015)	Malaysia; Ethiopian projects
12	Lack of awareness	Okorafor (2014)	South Africa	Ameh Soyingbe & Odusanmi (2010)	Nigeria

Source: Researcher

3 Research Methodology

The study covered building construction projects within Abuja, the Federal Capital Territory of Nigeria. Abuja was selected because it is one of the metropolitan cities of Nigeria that has the highest population of professionals within the built environment and has many on-going construction projects.

Interviews were conducted with thirty (30) construction professionals (15 Project Managers {PMs}, 9 Quantity Surveyors {QSs}, 5 Site Engineers {SEs}, and 1 Senior Technical Officer {STO} of a waste management department) using purposive sampling technique on the issues relating to material waste and cost overruns at the planning stage of a construction project. The

sample was purposive because only building-construction professionals (PMs, QSs, SEs and STO) handling projects that are worth more than 1.6 billion Naira were consulted/interviewed. Projects valued more than 1.6 billion Naira are likely to be handled by more experienced professionals, who might be more familiar with the issues leading to material waste and cost overruns than the projects of lesser value.

The research employed the use of 'quantitative method' that is rooted in the positivist research paradigm. The research is quantitative because in the course of the interviews, a tick-box structured questionnaire containing a lists of literature based information (waste causes and control measures related to cost overrun) was ticked/marked by the interviewer / researcher, as the respondents mentioned or commented on any of the issues in the tick-box questionnaire. This was done to validate the literature based information by determining their frequencies of occurrence. The results of the tick-box questionnaire were the 'only research data' utilised in this study. Thus, the study must be quantitative rather than qualitative or mixed method research.

The research employed the descriptive and the inferential analyses. The descriptive tool that was used to analyse the data (tick-box structured questionnaire) was the cross tabulation method. The results are presented in Tables 2 and 3. The responses from the tick-box questionnaires are rated based on the cut-off points highlighted by Morenikeji (2006) in a five-points Likert scale that, the material-waste causes and control measures that have percentage of "90 to 100" are rated "very high effect"; 70 to 89% are rated "high effect"; 50 to 69% are rated "moderate effect"; 30 to 49% are rated "little effect"; and 1 to 29% are rated "very little effect" on cost overruns.

Inferentially, the analysis of variance (one-way ANOVA) was used to compare the means of the results / views of the different respondents / professionals, to determine if there is a statistically significant difference on the effects of material waste causes on cost overruns at the planning stage of a building construction project. The interview guide is found on the appendix page of this paper.

4 Findings and Discussion

This section presents and discusses the results of the tick-box questionnaires and ANOVA analyses on the effects of material waste causes and their control measures on cost overrun at the planning stage of construction projects

4.1 Material waste causes that have effects on cost overruns at the planning stage of projects

It was apparent from Table 2 that the material-waste causes that have 'very high effects' (90-100%) on project-cost overruns at the planning stage of a project were: (i) Inadequate site investigation; (ii) poor communication flow among members; (iii) inadequate waste management unit; (iv) improper planning of project risks; and (v) the lack of regular site meetings at the planning stage. These results corroborate the findings of Le-Hoai *et al.* (2008), Memon *et al.* (2010), Memon *et al.* (2011), Love *et al.* (2011), Flyvbjerg *et al.* (2004), Singh (2009), and Allahaim and Liu (2013). They identified these issues as the major causes of cost overruns in construction projects.

Coincidentally, the same results validate the findings of Babatunde (2012), Nagapan *et al.* (2012), Osmani *et al.* (2008), Okorafor (2014), and many others on the causes of material waste in the construction industry.

Percentages of 80, 73.3, 73.3 73.3, and 70 related to "improper co-ordination of the entire project and professionals", "improper planning", "communication error between clients and designers", "inexperienced personnel / professionals in planning and waste management" and "compliance with local authority in the case of local laws", respectively, were deemed by the respondents to have had 'high effects' in causing cost overruns; because they fall between 70 and 89 percent.

Conversely, the material waste causes that have very little effect on cost overruns were: (1) improper plan for the establishment of a quality-control unit; (2) improper planning and understanding of the method statement. These results are in line with the findings of Malumfashi & Shuaib (2012) who highlighted 'improper planning' as one of the major causes of project-cost overruns in the construction industry.

Table 2**.** Results of material-waste causes that have effects on cost overrun at the planning stage

	Causes of material waste that have effects on cost overrun at the planning stage of a project	**PM**	**QS**	**SE**	**STO**	**Total**	**Ranking**	**Decision**
1	Improper planning	12	7	3	0	22 (73.3%)	7	High
2	Over estimation to accommodate variations	2	0	0	0	2 (6.7%)	30	Very little
3	Lack of legislative enforcement	9	4	2	0	15 (50%)	13	Moderate
4	Inadequate site investigation	15	9	5	1	30 (100%)	1	Very high
5	Inadequate scheduling	8	4	1	1	14 (46.7%)	14	Little
6	Poor communication flow among members	15	8	5	1	29 (96.7%)	2	Very high
7	Improper coordination of the entire project and professionals	11	8	4	1	24 (80%)	6	High
8	Unsatisfactory budget for waste management	11	5	3	1	20 (66.7%)	11	Moderate
9	Insurance problem	10	5	4	1	20 (66.7%)	11	Moderate
10	Poor plan for material standardization	3	1	0	0	4 (13.3%)	23	Very little
11	Inadequate waste management unit	13	9	5	1	28 (93.3%)	3	Very high
12	Improper plan for material waste re-use & disposal	7	2	2	0	11(36.7%)	15	Little
13	Improper program of work	3	0	0	0	3 (10%)	27	Very little
14	Improper plan for site organization and layout	5	2	1	0	8 (26.7%)	16	Very little
15	Lack of regular site meetings	14	9	4	0	27 (90%)	4	Very high
16	Liaise/compliance with local authority in case of local laws	9	6	5	1	21 (70%)	10	High
17	Improper planning and understanding of method statement	3	0	1	0	4 (13.3%)	23	Very little
18	Improper planning of project risks	14	9	3	1	27 (90%)	4	Very high
19	Lack of inclusion of waste management in bidding process	0	0	1	0	1 (3.3%)	35	Very little

20	Improper plan for the establishment of a quality control unit	5	0	0	0	5 (16.7%)	20	Very little
21	Inexperienced personnel in planning and waste management	10	6	5	1	22 (73.3%)	7	High
22	Lack of re-improving process (learning from previous mistakes)	2	0	1	0	3 (10%)	27	Very little
23	Poor harmonization of brief	2	1	2	0	5 (16.7%)	20	Very little
24	Poor knowledge of site conditions	1	2	0	0	3 (10%)	27	Very little
25	Cost related problems	1	3	0	0	4 (13.3%)	23	Very little
26	Improper plan for adequate staff training and development	4	1	2	0	7 (23.3%)	18	Very little
27	Poor material estimation	3	1	0	0	4 (13.3%)	23	Very little
28	Lack of feasibility and viability studies	4	1	1	1	7 (23.3%)	18	Very little
29	Inadequate identification of construction techniques	0	1	0	0	1 (3.3%)	35	Very little
30	Plan for adequate site organization	4	3	1	0	8 (26.7%)	16	Very little
31	Improper plan for record of material inventory	0	1	0	0	1 (3.3%)	35	Very little
32	Improper plan for adequate site exploration	0	1	0	0	1 (3.3%)	35	Very little
33	Excess material delivery	0	1	0	0	1 (3.3%)	35	Very little
	Client							
34	Communication error between client and designer	11	7	4	0	22 (73.3%)	7	High
35	Frequent demand for design change	4	1	0	0	5 (16.7%)	20	Very little

Source: Researcher

4.2 Material Waste Control Measures that have Effects on Cost Overruns at the Planning Stage of a Project

It is apparent from Table 3 that the material waste control measures that have very high effects in controlling cost overruns at the planning stage of a project were: (i) plan for early sub-soil investigations; and (ii) proper co-ordination and communication among members at the planning stage. The causes with high effects on cost overruns were: (a) establishment of a good waste-management unit (b) regular site meetings (c) setting a target for material-waste reduction; and (d) engaging experienced personnel in planning. The respondents believed that adequate and early site/sub-soil investigation is needed for a project, in order to discover the conditions and nature of the site, such as: the site topography, the water table, the soil-bearing capacity, and the soil type, in order to reduce the risks of material wastage or additional cost on the project. They also believed that "regular meetings" at the planning stage of a project would help in supporting a free flow of communication among the members/professionals.

Conversely, the material-waste control measures that had very little effect on cost overruns were: (1) proper insurance of work; (2) plan for the inclusion of waste management in bidding and tendering process; and (3) re-improving process (learning from previous mistakes). These are important measures for improving project performance at the planning stage of a project. Learning from previous experience helps in solving the current problems. Hence, if these measures are adopted as organisational policy, they would simplify other stages of a project. These results support the conclusions of Abdul-Azis *et al.* (2013); and Brunes & Lind (2014) on the organisational control measures for cost overruns in construction projects. These results also confirm the findings of Saidu & Shakantu (2016a) who believed that material waste control measures have effect in controlling cost overruns.

Table 3. The results of the material waste-control measures that have effects on cost overruns at planning stage

	Control measures for material waste that have effects on cost overrun at the planning stage of projects	PM	QS	SE	STO	Total	Ranking	Decision
1	Plan for early sub-soil investigations	15	9	5	1	30 (100%)	1	Very high
2	Proper investment into waste reduction	6	3	3	0	12 (40%)	10	Little
3	Proper planning of construction projects layout	6	5	0	0	11 (36.7%)	11	Little
4	Plan for inclusion of waste management in bidding and tendering process	2	2	1	0	5 (16.7%)	16	Very little
5	Enhance regulation execution of related government departments	3	3	1	1	8 (26.7%)	12	Very little
6	Improved planning and scheduling	10	7	5	0	22 (73.3%)	5	High
7	Proper coordination and communication	15	8	5	1	29 (96.7%)	2	Very high
8	Proper insurance	2	4	0	0	6 (20%)	15	Very little
9	Set a target for material waste reduction	13	3	4	1	21 (70%)	7	High
10	Improve major project stakeholders' awareness on resource saving & environmental protection	2	1	0	0	3 (10%)	22	Very little
11	*Plan that will reduce frequent design change	5	2	0	0	7 (23.3%)	14	Very little
12	*Plan for material standardization	3	2	0	0	5 (16.7%)	16	Very little
13	*Carrying design team along	2	1	0	0	3 (10%)	22	Very little
14	*Regular site meetings	14	7	5	0	26 (86.7%)	3	High
15	*Establishment of good waste management unit	12	8	5	1	26 (86.7%)	3	High
16	*Re-improving process (Learning from previous mistakes)	2	1	2	0	5 (16.7%)	16	Very little
17	*Legislative enforcement	11	5	1	0	17 (56.7%)	8	Moderate
18	*Adequate material waste estimation	4	1	0	0	5 (16.7%)	16	Very little
19	*Planning of project risks	9	3	3	0	15 (50%)	9	Moderate
20	*Proper harmonization of brief	3	0	2	0	5 (16.7%)	16	Very little
21	*Experienced personnel in planning	11	6	4	1	22 (73.3%)	5	High
22	*Identification of construction technique	1	0	0	0	1 (3.3%)	27	Very little
23	*Feasibility and Viability studies	4	1	2	1	8 (26.7%)	12	Very little
24	*Buildability Analysis	3	0	0	0	3 (10%)	22	Very little
25	*Consideration of available technology, resources and materials	3	2	0	0	5 (16.7%)	16	Very little
26	*Geophysical surveys	0	1	0	0	1(3.3%)	27	Very little
27	*interaction between different designers (Architects and Engineer)	1	0	0	0	1 (3.3%)	27	Very little

Source: Researcher

The material-waste control measures that started with the sign (*) in Table 3 were the newly identified issues during the interview session with the respondents, which were not originally in the interviewer's/researcher's tick-box questionnaire.

4.3 Comparative Views of Respondents on the 'Effects of Material Waste Causes and Control Measures on Cost Overruns' with respect to the Planning Stage of a Project

Table 4 shows the results of ANOVA analyses performed to compare the views of the respondents (Project managers, Quantity surveyors, Site engineers and Senior technical officer) on the 'effects of material-waste causes and control measures on cost overruns' at the of planning stage of a project.

It was apparent from the analyses that the values of f-calculated (1.016 and 0.826) for the two analyses (material waste causes and material waste control measures) were both less than the f-tabulated value (1.701), respectively. The probability values (0.376 and 0.449) were both greater than the 5 percent (0.05) significance level at 95 percent confidence level within the mean-squared group of 4.11 to 4.18 and 6.16 to 7.45, respectively. The findings here are not statistically significant (difference). These imply that the respondents have therefore the same views on the effects of material waste causes and control measures on cost overruns at the planning stage of construction projects in the industry.

Table 4. Test of differences in the professional views on the "effects of material-waste causes and control measures on cost overruns"

S/n	Variables				Type of Analysis	Observation				Inferences
	$X1$	$X2$	$X3$	$X4$		Mean square within	F-cal	F-tab	Probability value	Remark
1	PM	QS	SE	STO	One-way ANOVA	4.18 4.11	1.016	1.701	0.376	Not statistically significant (Difference)
	Material waste causes that have effects on cost overrun									
2	PM	QS	SE	STO	One-way ANOVA	6.16 7.45	0.826	1.701	0.449	Not statistically significant (Difference)
	Material waste control measures that have effects on cost overrun									

Source: Researcher

5 Conclusion and Recommendations

Material waste and cost overruns are identified as global problems affecting the success of many construction projects. These problems occur at different stages of a project, from planning, design, estimating, and construction to project completion. The purpose of this paper was to examine the effects of material waste causes and their control measures on cost overruns at the planning stage of a project.

It was revealed from the literature that most material waste causes are similar to the causes of cost overruns at different stages of projects and at different locations around the world.

It was found from the analyses that material-waste causes and their control measures were identified to have significant (very-high, high, medium, low, and very-low) effects in causing/controlling cost overruns at the planning stage of a project. Also, there was no statistically significant difference in the views of the respondents on these issues. And so, the respondents have the same views on the results of the effects of material-waste causes and control measures on cost overruns at planning stage of a project.

Based on these findings, it can be concluded that effective management of the identified material waste causes at the planning stage of a project would translate into a reduction in the level of cost overruns for projects. The study recommends that management of material-waste causes should be encouraged, as it has the potential to minimise the rate of cost overruns for projects. It is also recommended that management of material waste and cost overruns should be revised based on the findings of this research as a reference document and included as part of the pre-contract planning process for a project. Further research in this area can be conducted to look at other stages of projects, most especially, the issues in the post contract stage.

6 References

Abdul-Azis, A. A., Memon, A. H. Abdul-Rahmann, I. & Abd Karim, A. T. (2013), Controlling Cost Overrun Factors in Construction Projects in Malaysia, *Research Journal of Applied Sciences, Engineering and Technology,* 5 (8), PP. 2621-2629.

Abdul-Rahman, I., Memon, A.H. & Abd. Karim, A.T. (2013), Significant Factors Causing Cost Overruns in Large Construction Projects in Malaysia, *Journal of Applied Sciences,* 13 (2), PP. 286-293.

Abdul-Rahman, I., Memon, A.H., Abdul-Azis, A.A. & Abdullah, N.H. (2013), Modeling Causes of Cost Overrun in Large Construction Projects with Partial Least Square-SEM Approach: Contractor's Perspective, *Research Journal of Applied Sciences, Engineering and Technology,* 5(6) PP. 1963-1972.

Ahiaga-Dagbui, D.D. & Smith, S.D. (2014), Dealing with Construction Cost Overruns using Data Mining, *Construction Management and Economics,* 32 (7-8), pp. 682-694.

Allahaim, F.S. & Liu, L. (2012), Cost Overrun Causes, the Framework in Infrastructure Projects: Toward a Typology, *Paper Presented at the 37th Annual Conference of Australasian Universities Building Educators Association (AUBEA)*, Sydney, Australia, 4-6 July, University of Technology, Sydney, Edited Liu L.; Publisher: University of New South Wales (UNSW), Sydney, pp. 1-15.

Al-Hajj, A. & Hamani, K. (2011), Material Waste in the UAE Construction Industry: Main Causes and Minimisation Practices. *Architectural Engineering and Design Management* (Heriot-Watt University Gate way), 7 (4), pp. 221-235.

Ameh, J.O. & Itodo, E.D. (2013), Professionals' Views of Material Wastage on Construction Sites, *Organization, Technology and Management in Construction. An International Journal,* 5(1), pp. 747-757.

Ameh, O.J., Soyingbe, A.A. & Odusami, K.T. (2010), Significant Factors Causing Cost Overruns in Telecommunication Projects in Nigeria, *Journal of Construction in Developing Countries,* 15 (2), pp. 49–67.

Apolot, R., Alinaitwe, H. & Tindiwensi, D. (2011), An investigation into the causes of delay and cost overrun in Uganda's public sector construction projects. In: Mwakali, J. & Alinaitwe, H. (Eds), *Proceedings of the Second International Conference on Advances in Engineering and Technology.* 31 January – 1 February, Entebbe Uganda. Uganda: Macmillan Uganda (Publishers) Ltd, pp. 305-311.

Babatunde, S.O. (2012), Quantitative Assessment of Construction Material Wastage in Nigerian Construction Sites. *Journal of Emerging Trends in Economics and Managent Sciences* 3 (3), pp. 238-241.

Brunes, F., and H. Lind. (2014), Policies to Avoid Cost Overruns: Critical Evaluation and Recommendations. Working Paper, Section for Building and Real Estate Economics Department of Real Estate and Construction ManagementCentre for Banking and Finance (Cefin), School of Architecture and the Built Environment, Royal Institute of Technology, Sweden, 2014, pp. 1-16.

Jackson, S. (2002), *Project Cost Overruns and Risk Management.* Paper, Whiteknights: School of Construction Management and Engineering,The University of Reading.

Ma, U. 2011. *No waste: Managing sustainability in construction.* Surrey: Gower Publishing Limited.

Mou, K. (2008), The Role of Government and Construction Waste. MSC Dissertation, The Centre of Urban Planning & Environmental Management, University of Hong Kong, Hong Kong, pp. 1-179.

Nagapan, S., Abdul-Rahman, I., Asim, A. & Hameed, A. (2012), Identifying Causes of Construction Waste-Case of Central Region of Peninsula Malaysia, *International Journal of Integrated Engineering,* 4 (2), pp. 22-28.

Nagapan, S., Abdul-Rahman, I. & Asmi, A. (2012), Factors contributing to physical and non-physical waste generation in construction industry, *International Journal of Advances in Applied Sciences (IJAAS),* 1(1), pp. 1-10.

Nguyen, B., Gupta, H. & Faniran, S. (n.d), Waste Minimization Strategiesin the Construction Industry-A Geelong Case Study. Geelong, pp. 1-10.

Odusami, K. T., Oladiran, O. J. & Ibrahim, S. A. (2012), Evaluation of Materials Wastage and Control in Some Selected Building Sites in Nigeria. *Emirates Journal for Engineering Research* 17 (2), pp. 53-65.

Okorafor, C. (2014), An Empirical Investigation of Waste and Management Strategies Adopted in the Construction Industry: A Case Study of the Tshwane Municipality. M.Tech Dissertation, Department of Building Science, TSHWANE UNIVERSITY OF TECHNOLOGY, PRETORIA, South Africa.

Oladiran, O.J. (2009), Causes and Minimisation Techniques of Materials Waste in the Nigerian Construction Process. *Fifth International Conference on Construction in the 21st Century (CITC-V).* Istanbul, Turkey, pp. 20-22.

Osmani, M., J. Glass, & A.D.F. Price. (2008), Architects 'Perspectives on Construction Waste Reduction by Design. *Waste Management* 28, pp. 1147–1158.

Osmani, M. (2011), Construction Waste. In: Letcher, T.M. & Vallero. D. (Eds). *Waste: A handbook for management*. San Diego: Academic Press an imprint of Elsevier, 207-218.

Saidu, I.& Shakantu, W.M.W. (2015), A Relationship between Quality-of-Estimating, Construction Material Waste Genration and Cost Overrun in Abuja, Nigeria. *Fourth Construction Management Conference, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa.* Edited Emuze, F.A.; 95-104, 30 November-1st Dec., 2015.

Saidu, I. & Shakantu, W.M.W. (2016a), A Study of the Relationship between Material Waste and Cost Overrun in the Construction Industry. *The 9th cidb Postgraduate Conference Cape Town, South Africa. "Emerging trends in construction organisational practices and project management knowledge area.* Edited Windapo, A.O.,124-134, Feb, 2-4, 2016.

Saidu, I. & Shakantu, W.M.W. (2016b), A Conceptual Framework and a Mathematical Equaion for Managing Construction-Material Waste and Cost Overruns. World Academy of Science, Engineering and Technology. *International Journal of Social, Behavioural, Educational, Economic, Business and Industrial Engineering,* 10 (2), pp. 555-561

Subramani, T., Sruthi, P. S. & Kavitha, M. (2014), Causes of Cost Overrun In Construction. *IOSR Journal of Engineering (IOSRJEN)* 4 (6), pp. 2278-8719.

Tam, V.W.Y., Shen, L.Y., & Tam, C.M. (2007), Assessing the Levels of Material Wastage Affected by Sub-Contracting Relationships and Projects Types with their Correlations. *Building and Environment* 42, pp. 1471–1477.

Zewdu, Z.T., & Aregaw, G.T. (2015), Causes of Contractor Cost Overrun in Construction Projects: The Case of Ethiopian Construction Sector. *International Journal of Business and Economics Research,* 4 (4), pp. 180-191.