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Impact of Materials Waste Reuse Methods on Effectiveness of Construction Wastes Management In Jos Metropolis

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ABSTRACT
This study is aimed at assessing the impact of materials waste reuse methods on effectiveness of construction waste management in construction sites of Jos metropolis with a view to come-up with the most adopted reuse method of construction waste materials. A Quantitative survey research design was adopted to randomly collect data from construction firms' professionals currently working in Jos metropolis using a structured questionnaire. Two hundred (200) questionnaires were distributed out of which 140 were valid and used for analysis The data collected was analysed using descriptive statistical tools (frequency, percentage, mean & standard deviation) and multiple regression model analysis with the aid of statistic package for social science (SPSS) The research reveals that: The research found reveals that (a): timber, roof sheets, marine board, asbestos (sheet), wood (MDF, Plywood), blocks, metal, ceiling board were the main construction waste materials which are moderately generated on construction site which are rank 1st to 8th (b): also refurbishment and repair were the major reuse methods normally adopted while recycling and disposal of waste management strategy were found to be the most effective construction waste management strategy (c); lastly the general implementation of waste reuse methods by construction firm's professionals in the study area significantly affect the effectiveness of construction waste management with repair and remanufacture as the reuse methods with significant effect. Thee study recommended that there is need for both government and all bodies concern to make effort toward proper reuse methods implementation so as to improve the effectiveness of construction waste management.

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I. Introduction

Globally, the role of construction to the development and advancement of any nation cannot be overemphasized. This is due to its multitude of effect on the economy such as employment of labour, provision of the critical national infrastructures, the shelter needs of the people, building organizational spaces these directly and indirectly enhances the quality and standard of living of the citizenry (Adewuyi, Idoro, & Ikpo, 2015). According to Yuan, Shen and Wang (2011) posted that construction and demolition wastes are waste which arises from construction, renovation and demolition activities including land excavation or formation, civil and building construction, site clearance, demolition activities, roadwork, and building renovation. The C&D is often a significant component, representing 20–30 % and sometimes more than 50 % of the total municipal solid waste. C&D waste is composed mainly of wood products, asphalt, drywall, concrete and masonry. Other components often present in significant quantities include metals, plastics, earth, shingles, insulation and paper and cardboard (Yeheyis, Hewage, Alam, Eskicioglu and Sadiq, 2013).

Reuse usually indicates using the same material in construction more than once, including utilizing materials again for different functions, such as structural steel and wooden shuttering and doors. Waste materials that cannot be reused will either be recycled for new construction or end up in landfill. Reuse is the most preferable choice for waste reduction due to the minimal requirement for processing and energy (Yuan & Shen 2011). Reuse of construction waste is more effective than recycling as recycling involves energy-intensive processes that generate pollutants (Park & Tucker, 2016). Reducing, reusing and recycling waste are profitable alternatives that will increase the lifetime of landfills, eliminate the environmental hazards of dumping, reduce exploitation of natural resources and according to (Poon Yu and Jaillon 2004) help to conserve natural resources and reduce the cost of waste treatment prior to disposal.

Construction industry gives less concern to waste reduction due to the complex nature of reuse and recycling which is a top priority in curbing waste generation. Effective implementation of waste management plan (WMP) is a major means of reducing waste on construction projects. A waste management plan represent

waste issues on the map and identification of existing waste problems is of top priority; it then pinpoint the volume of waste for reduction, salvage, reuse or recycling (Olatunji, 2008). In developing countries like Nigeria, unlike the advanced nations, the management of C&D waste is poor and need a lot of improvement (Dania, Kehinde & Bala, 2007). After morethan a decade, the situation is yet to improve. This is evident by the submission of Yusuf, Kamaruddeen, & Bahaudin (2016) opine that efficient construction and demolition waste management is very limited in Nigeria due to various constraints. Mudashiru, Oyelakin, Oyeleke& Bakare (2016) revealed that most construction wastes on site occur due to poor management and lack of awareness of effective waste management. In Jos metropolis, Nigeria, C&D waste are visibly seen in landfills and open areas.

Waste from sources such as, solvents or chemically treated wood can result in soil and water pollution. With concerns over scarce landfills, construction waste has been identified as a potential source of landfill reduction, other adverse consequences include environmental degradation (Lu & Yuan, 2011); adverse impact on construction cost, contractor's profit margin, construction duration and can be a possible source of dispute among parties to a project (Adewuyi, Idoro, & Ikpo 2015); high rates of morbidity and mortality, and a source of anxiety to Nigeria's public health, aesthetics, self-worth and human well-being (Yusuf, Kamaruddeen, & Bahaudin, 2016).

II. Methodology

The study adopts quantitative research methodology in which a structural questionnaire was developed and administered to construction professionals in Jos metropolis Plateau State. A total of two hundred and thirty (230) questionnaires were administered, 140 of the returned questionnaire were valid and used for the analysis. The sample size was determined using Kretcie and Morgan (1970). The sampling technique adopted was purposive simple random in which gives each construction professionals equal chance for selection. After a considerable data collection, the study adopts multiple regressions as a method for data analysis with the aid of SPSS software.

III. Data Result and Discussion

Table1 below shows the analysis of construction waste materials generated on a construction site in Jos metropolis of plateau state. The analysis reveals that timber, roof sheets, marine board, asbestos (sheet), wood (MDF, Plywood), blocks, metal, ceiling board, were the main construction waste materials which are moderately generated on construction site with a mean values of 3.02, 2.80, 2.74, 2.74, 2.73, 2.71, 2.64 and 2.64 respectively which are rank 1st to 8th, while mortal, concrete, aluminium, tiles(wall and floor), glass, fittings reinforcement/steel, doors, paint, and plastic were found to be the waste which are not often generated on construction site with a mean scores of 2.54, 2.52,2.45, 2.44, 2.21, 2.19, 2.08, 2.07, 1.91 and 1.88 accordingly and they are rank 9th-18th. It can be deduced that most of the construction waste materials were moderately and not often generated on a construction site in Jos metropolis of Plateau state.

Table1: Construction waste materials

Waste Materials	Mean	Std. Deviation	Remark	Rank
Timber	3.02	.993	Moderate	**1st**
Roof Sheets	2.80	1.177	Moderate	**2nd**
Marine Board	2.74	1.178	Moderate	**3rd**
Asbestos (Sheet)	2.74	1.084	Moderate	**4th**
Wood (MDF; Plywood)	2.73	1.124	Moderate	**5th**
Blocks	2.71	.909	Moderate	**6th**
Metal	2.64	1.127	Moderate	**7th**
Ceiling Board	2.62	.940	Moderate	**8th**
Mortal	2.54	.992	Not often	**9th**
Concrete	2.52	.925	Not often	**10th**
Aluminium	2.45	1.075	Not often	**11th**
Tiles (Wall and Floor)	2.44	.899	Not often	**12th**
Glass	2.21	1.069	Not often	**13th**
Fittings	2.19	1.097	Not often	**14th**
Reinforcement/steel	2.08	1.018	Not often	**15th**
Doors	2.07	1.110	Not often	**16th**
Paint	1.91	1.076	Not often	**17th**
Plastic	1.88	1.014	Not often	**18th**

The table below reveals the result for the adaptation of reuse methods of construction waste materials in the study area. Based on the analysis it shows that refurbishment and repair were the major reuse methods normally adopted with mean of 4.04 and 3.69 respectively which are rank 1st and 2nd. Furthermore, repurpose and remanufacture reuse methods of construction waste were found to be moderately adopted. The analysis finally shows that only salvage method was found to be the reuse method which is not adopted. It can be concluded that aggregately the reuse methods was found to be adopted.

Table 2: Reuse Methods

Reuse Methods	Mean	Std. Deviation	Remark	Rank
Refurbishment	4.04	.970	Adopted	**1st**
Repair	3.69	1.010	Adopted	**2nd**
Repurpose	2.80	1.114	Moderate	**3rd**
Remanufacture	2.75	1.026	Moderate	**4th**
Salvage	2.49	.956	Not adopted	**5th**
Aggregated RMCW	**3.56**	**1.015**	**Adopted**	

Table3 below present the result of the effectiveness of construction waste management in Jos metropolis. On aggregate, waste reduction and waste reuse management were found to be moderately effective waste construction management with a mean of 3.39 and 2.89 respectively while, waste recycling and waste reduction were found to be the effective construction waste management in the study area with a mean value of 3.57 and 3.64 accordingly. It concluded that the effectiveness of construction waste management was said to be moderate.

Table3: Effectiveness of Construction Waste Management

Statement	Mean	Std. Deviation	Remark
Aggregated Waste Reduction	**3.39**	**.757**	**Moderate**
Developing an effective waste management system (WMS)	3.58	1.157	Effective
Adoption of low-waste construction technologies	3.56	.954	Effective
Reducing waste by project design	3.46	1.277	Effective
Improving major stakeholders' attitudes toward waste reduction	3.33	1.365	Moderate
Reducing waste through governmental legislations	3.03	.974	Moderate
Aggregated Waste Reuse	**2.89**	**.633**	**Moderate**
Minimum energy involve	3.15	.786	Moderate
Less stakeholder involvement	2.92	1.032	Moderate
Minimum processing	2.62	.985	Moderate
Aggregated Waste Recycling	**3.57**	**.780**	**Effective**
Preserving areas of land for future urban development	3.81	1.205	Effective
Cutting down transport and energy production cost	3.66	1.122	Effective
Utilizing waste that would otherwise be lost to landfill sites	3.53	1.089	Effective
Economically viable	3.52	.772	Effective
Improving the quality of the environment	3.51	1.049	Effective
Reducing the demand for new resources	3.38	.999	Moderate
Aggregated Waste Disposal	**3.64**	**.825**	**Effective**
Avoid environmental pollution	3.73	1.180	Effective
Willingness to dispose of waste properly	3.70	.942	Effective
Accordance to government regulation	3.48	.978	Effective
Aggregated Waste Management	**3.37**	**.749**	**Moderate**

Table4 shows the model summary and the ANOVA result. The model produced an overall R value of 0.718 and R square value of 0.516 with F-statistics of 28.526 which are significant as indicated by p value of .000 far below the recommended maximum of 0.05 (Pallant, 2011). This shows that the model predicts about 52 per cent variance in effectiveness of construction waste management. In other words, about 52 per cent changes in effectiveness of construction waste management can be explained by changes in the reuse methods of construction waste. The model as a whole is good for the analysis as it produced a strong R square value.

Table4: Model Summary and ANOVA

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig.
1	.718[a]	.516	.498	.43794	28.526	.000[b]

The table5 below which is the coefficients table shows the magnitude of the effect of each reuse methods on the effectiveness of construction waste management. The result shows that the waste reuse methods with significant effect on effectiveness of construction waste management are repair and remanufacture as

indicated by t-statistics values of 6.96 and 4.72 accordingly with p-values of 0.00, 0.000 respectively. The reuse methods with negative effect on the effectiveness of construction waste management was repurpose as indicated by negative standardized coefficient beta value of -0.014. The other reuses method with least effect was refurbishment as produces a p values above the recommended maximum value of 0.05.

Table5: Coefficients Table

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.410	.196		7.181	.000
	Remanufacture	.208	.044	.345	4.715	.000
	Salvage	.087	.045	.134	1.933	.055
	Repurpose	-.008	.039	-.014	-.201	.841
	Repair	.316	.045	.516	6.959	.000
	Refurbishment	.008	.047	.013	.171	.864

IV. Conclusion

Reuse methods of construction waste materials is the most durable option for waste management on construction sites and enhances the conversation of resources in any economy (Sapuay, 2016). Hence, reuse and recycling of waste on construction sites will lead to zero waste (Yates, 2013). Despite this advantage, there is a limited effort for implementation the reuse methods by construction firm's professionals. Accordingly, this research assesses the impact of materials waste reuse methods on effectiveness of construction waste management by construction firms' professionals in Jos metropolis Plateau state. The research found that timber, roof sheets, marine board, asbestos (sheet), wood (MDF, Plywood), blocks, metal, ceiling board were the main construction waste materials which are moderately generated on construction site with a mean values of 3.02, 2.80, 2.74, 2.74, 2.73, 2.71, 2.64 and 2.64 respectively which are rank 1st to 8th. Also refurbishment and repair were the major reuse methods normally adopted while recycling and disposal of waste management strategy were found to be the most effective construction waste management strategy. The general implementation of waste reuse methods by construction firm's professionals in Jos metropolis significantly affect the effectiveness of construction waste management with repair and remanufacture as the methods with significant effect. This research has practical implication to policy makers, construction industry and contributes to the body of knowledge on construction waste reuse methods implementation.

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