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Repositioning Activities of Building Industry Professionals towards Cleaner and Sustainable Housing in Nigeria

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The main goal of building industry professionals is to provide affordable housing that supports sustainable neighbourhood, and promotes cleaner environment. The professionals apply the philosophy of waste management in the discharge of their responsibilities. However, certain factors like choice of materials, culture, supervision technique, environment, human differences, thinking ability of the professionals in the building industry, teamwork and others influence the aim of housing provision. Therefore, this paper describes ways of restructuring the activities of the building industry professionals for the effective reduction of waste towards cleaner housing that encourages sustainable neighbourhood in Nigeria. Research data are derived from questionnaire survey. The questionnaire seeks opinions of 648 building professionals on their activities that influence waste management, impact of the activities on waste management, and ways of channelling building professional activities for effective waste reduction towards sustainable housing. The data are analysed using the Relative Contribution Index (RCI). The findings indicate that review of building drawings, supervising building project, procuring construction materials and arranging workmen are the construction activities that have the highest influence on waste management with RCI higher than 0.8. Also, intensifying site supervision, proper quantification of materials on site, minimising design changes and revisions, use of trained workmen and the use of value engineering strategy, which have RCI of 0.8 and above are the most significant ways of repositioning building professional activities for effective reduction of waste in the Nigerian building industry.

1. Introduction

Building professionals consist of experts from different academic disciplines. They include the architects, engineers, builders, quantity surveyors, town planners and estate managers (Anyanwu, 2013). Although, their academic disciplines might be interrelated, the experts received and do receive professional trainings that are specifically relevant to their fields of study. The professionals often carryout activities, which are aimed at providing affordable housing that supports cleaner and sustainable neighbourhood. Some of the activities are building design, cost evaluation of housing project, procurement of building materials, building construction, services, and maintenance, contract and contracting activities, including building appraisal. However, the incessant abandonment of building projects (Olalusi and Otunola, 2012), increasing record of building failure and collapse (Adewole et al., 2014), growing housing project disputes (Alade et al., 2016), and the environmental risk from accumulated waste generated by the construction industry (Mah et al., 2017), especially in Nigeria have attracted research attentions in the recent times.
Consequently, Omoniyi and Okunola (2015) analysed the quality of four main brands of cement that are used for building construction in Nigeria. Their quest was to ascertain how the cement brands in the Nigeria market contribute to failure and collapse of buildings. They conducted tests for the physical and chemical parameters of the cements. The results show that though there are variations in the physical and chemical properties of

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the brands of cement, the products comply with the American and British standard specifications for cement. The findings imply that material of construction might not be the major cause of building failure and collapse. On the issue of waste management for sustainable environment, Khankhaje et al. (2017) disclosed that reuse of waste materials in concrete minimises the undesirable effects of concrete on the environment. Also, good choice of naturally friendly finishing and decoration material like paint enhances cleaner and sustainable environment (Dodo et al. 2015)

On the other hand, Dania et al. (2007) reaffirmed the proposition of the Department of the Environment, Transport and Regions (2000) that a significant way of achieving sustainable housing and neighbourhood is to reduce generation of building construction waste. They added that quality and cost of building construction coupled with timely delivery of project are important issues of building construction that need proper management for effective reduction of waste. Adewuyi and Odesola (2015) measured the extent of impact of certain factors to generation of material waste in the building industry. They concluded that waste due to demolitions and reworks, waste from cutting building members to shapes, and waste as a result of design alterations and revisions have average relative impact index of 0.801, 0.791, and 0.773 respectively. In addition, Wahab and Lawal (2011) reported that client choice, requirements and decisions influences design alterations and should be considered as factors in waste management and control. Idris et al. (2015) conducted research on assessment of material waste in Nigeria construction sites. They attributed causes of material waste to environmental factors, poor storage, and double handling of the materials. Further, overestimation of construction materials by the subcontractors leads to material waste sometimes (Odusami et al. 2012). Also, Eze et al. (2017) opined that majority of the material waste during building construction emanate from rendering and blockwork mortar, and wood formwork. Moreover, poor management and ignorance of effective way of managing waste contribute significantly to material waste (Akinkurolere and Franklin, 2005).

Be that as it may, there is insufficient research on building professionals' factors for effective waste management. Therefore, this paper is aimed at repositioning the activities of professionals of the building industry for reduction of waste towards cleaner and sustainable housing. The objectives are: to identify the building professional activities that influence waste management, evaluate the impact of *the* activities on waste management, and to determines ways of restructuring building professional activities for effective waste reduction towards cleaner and sustainable housing.

2. Methodology

The survey research approach was used. A questionnaire survey was designed to collect data from the opinions of the respondents on building professional activities that influence waste management, impact of the activities on waste management, and ways of channelling building professional activities for effective waste reduction towards sustainable housing. The activities of the building professionals were grouped into three categories: pre-construction, construction and post-construction activities. The target population is all building construction professionals in Nigeria. 114 professionals were randomly and carefully drawn across each of the six geopolitical zones of Nigeria to achieve good representation of the population. Respondents that are full members of any of the professional bodies are tagged registered, while those yet to be enlisted into full membership are tagged unregistered. The professional bodies considered are the Architect Registration Council of Nigeria (ARCON), the Council for the Regulation of Engineering in Nigeria (COREN), and the Council of Registered Builders of Nigeria (CORBON). Others are the Quantity Surveyors Registration Board of Nigeria (QSRBN), the Town Planners Registration Council of Nigeria (TOPREC), and Estate Surveyors and Valuers Registration Board of Nigeria (ESVARBON). The questionnaire copies were administered to 864 respondents. A total of 648 copies of answered questionnaire were returned, found fit, and utilized for data analysis. The demography of the respondents is presented in Table 1.

Table 1: Demography of the respondents

Characteristics	Status		Gender		Years of practice		Total
	Registered	Unregistered	Male	Female	< 20 years	> 20 years	
Architects	48	60	90	18	78	20	108
Engineers	42	66	84	24	72	36	108
Builders	54	54	96	12	66	42	108
Quantity surveyors	36	72	86	22	68	40	108
Town planners	30	78	80	28	84	24	108
Estate managers	18	90	76	32	80	28	108
Total	228	420	512	136	448	200	648

The Relative Contribution Index (RCI) technique was used to analyse the data. The RCI was calculated using the formula shown in Eq(1).

$$RCI=\frac{\Sigma w}{A\times N} \quad (1)$$

Where; w represents the weight assigned to a variable by a respondent (w ranges from 1 to 5), A denotes the highest weight, and N signifies total number of respondents.

3. Analysis and results

3.1 Demographic analysis of the respondents

The analysis of the demography of the respondents shown in Table 1 indicates that 35 % of the total respondents were registered professional. Among the respondents, builders have the highest registered members with a 50 % score. 79 % of the total respondents were males, and 31 % have been into practice for more than 20 y.

3.2 Analysis of influence of building professional activities on waste management

The analysis of the building professional activities that influence waste management is presented in Table 2. It also contains the impact of the activities on waste management. The impacts are measure with RCI.

Table 2: Building professional activities and their impacts on waste management

Categories	Building professional activities	Architects		Engineers		Builders		Quantity Surveyors		Town planners	
		RCI	Rank	RCI	Rank	RCI	Rank	RCI	Rank	RCI	Rank
Pre-construction activities	Feasibility study of project	0.70	6	0.78	3	0.73	6	0.71	7	0.74	5
	Visiting site of proposed project	0.68	7	0.73	7	0.71	8	0.71	7	0.76	3
	Design of the building	0.80	1	0.83	1	0.78	2	0.81	2	0.77	2
	Conducting relevant tests	0.72	5	0.77	4	0.74	4	0.74	6	0.71	6
	Developing building drawings	0.76	2	0.81	2	0.81	1	0.82	1	0.79	1
	Preparing day work schedule	0.66	8	0.73	7	0.74	4	0.69	10	0.71	6
	Market survey	0.61	15	0.71	9	0.69	10	0.78	4	0.65	10
	Cost estimation of the project	0.76	2	0.78	3	0.76	3	0.81	2	0.76	3
	Preliminary design meetings	0.74	4	0.75	6	0.73	6	0.76	5	0.67	8
	Review of building documents	0.66	8	0.71	9	0.71	8	0.71	7	0.67	8
	Preparing bidding documents	0.62	14	0.66	14	0.65	12	0.64	13	0.62	13
	Advising clients	0.65	11	0.68	12	0.67	11	0.66	12	0.63	12
	Preparing contract documents	0.64	12	0.63	15	0.62	13	0.62	15	0.62	13
	Meeting with the client	0.66	8	0.70	11	0.62	13	0.67	11	0.64	11
	Kick off meeting at site	0.63	13	0.68	12	0.61	15	0.64	13	0.62	13
Construction activities	Interpreting building drawings	0.83	2	0.82	2	0.80	4	0.80	4	0.81	4
	Arranging workmen	0.83	2	0.80	4	0.81	1	0.82	2	0.84	1
	Procuring construction materials	0.83	2	0.80	4	0.80	4	0.84	1	0.81	4
	Storing construction materials	0.72	7	0.70	8	0.80	4	0.75	6	0.74	6
	Supervising building project	0.85	1	0.82	2	0.81	1	0.80	4	0.82	3
	Site decision making	0.68	9	0.65	9	0.67	9	0.61	10	0.70	8
	Progress review site meetings	0.79	6	0.75	6	0.76	7	0.69	8	0.66	9
	Revision of building drawings	0.83	2	0.83	1	0.81	1	0.82	2	0.83	2
	Settling of site disputes	0.68	9	0.62	10	0.65	10	0.64	9	0.63	10
	Quality, cost and time control	0.72	7	0.73	7	0.72	8	0.71	7	0.74	6
Post-construction activities	Certifying the work	0.48	2	0.46	3	0.45	2	0.47	2	0.45	3
	Cleaning up the site	0.45	4	0.44	2	0.45	2	0.46	4	0.48	2
	Preparing construction report	0.52	1	0.54	1	0.51	1	0.52	1	0.53	1
	Preparing completion certificate	0.46	3	0.46	3	0.43	4	0.47	2	0.43	4
	Handing over to client	0.43	5	0.40	5	0.42	5	0.46	4	0.41	5

3.2.1 Pre-construction activities

Builders, quantity surveyors, and town planners considered the development of building drawing as the pre-construction activity that has the highest influence on waste management. The architects and engineers ranked it the second highest factor. On the other hand, design of building is ranked the highest pre-construction activity that influence waste management by the architects and engineers. The results imply that design of building and the development of building drawing are very essential aspects of pre-construction activities in the building industry. Any slight error could lead to substantial waste of materials, fund, time, and labour. The findings are in line with the report of Kelly and Dowd (2015) that poor design drawings is one of the major causes of waste. Other pre-construction activities that have high influence on waste management are cost estimation of the project, conducting relevant tests, feasibility study of the project, visiting site of proposed project, preliminary design meetings, and preparing day work schedule with average RCI of 0.77, 0.74, 0.73, 0.72, 0.72, and 0.71 respectively. Review of building documents, and market survey have the same average RCI of 0.69. Meeting with the client, and advising client to have similar average RCI of 0.66. Preparing of bidding documents, and kick off meeting at site have the same average RCI of 0.64. The average RCI of the activity of preparing contract document is 0.63. The fact that all the pre-construction activities listed in Table 2 have RCI above 0.6 indicates that the activities have appreciable influence on waste management in the building industry.

3.2.2 Construction activities

Engineers are of the opinion that review of building drawings is the construction activity that has the highest influence on waste management, while architects believe that supervising building project possess the highest influence. Procuring construction materials is ranked the construction activity that has the highest influence on waste management by quantity surveyors, while town planners are of the view that arranging workmen has the highest influence. Moreover, builders are of the opinion that supervising building project, review of building drawings, and arranging workmen share the same highest rank as the construction activities that influence waste management. The four construction activities mentioned above have average RCI of 0.82, which imply that they have enormous impacts on waste management and control. The findings agree with the submission of other researchers that the use of untrained workmen encourages material waste (Alwei et al., 2002), use of inadequate material causes construction waste (Al-Moghany, 2006), design changes and revision enhance material waste (Ekanayake and Ofori, 2004), and inadequate supervision of building project promotes construction waste (Adewuyi and Odesola, 2016). Another construction activity that has high influence on waste management is interpreting of building drawings with an average RCI of 0.81. Storing construction materials, progress review site meetings, including quality, cost and time control have average RCI of 0.74, 0.73 and 0.72 respectively. Site decision making, and settling of site disputes have average RCI of 0.66 and 0.64 respectively. All the construction activities listed in Table 2 have significant influence on waste management in the building industry.

3.2.3 Post-construction activities

All the professionals of building construction industry share the same view that post-construction activities listed in Table 2 do not have substantial impact on building construction waste management. Certifying the work, cleaning up the site, preparing construction report, preparing completion certificate, and handing over to client have average RCI of 0.46, 0.46, 0.52, 0.45, and 0.42.

3.3 Ways of restructuring building professional activities

The analysis of ways of restructuring building professional activities is presented in Table 3. The analysis reveals that architects, builders, and quantity surveyors share the opinion that intensifying site supervision, proper quantification of materials on site, minimising design changes and revisions, including use of trained workmen are the most significant ways of repositioning building professional activities for effective reduction of waste in the building industry. Engineers and town planners have the same view with other professionals, but added the use of value engineering strategy to the list of the most significant means of achieving meaningful waste management. The five factors mentioned above have average RCI of 0.8 and above. The results support the findings of Eze et al. (2017) on measures of minimising waste of materials in construction site.
Other promising ways of enhancing building professional activities towards effective waste management are compliance to design specifications, encouraging teamwork, checking formwork carefully before concreting, and the use of trust as a management resource with average RCI of 0.78, 0.77, 0.76, and 0.76. The results are in line with the findings of Egba (2012) that the use of trust as a management resource promotes teamwork towards effective compliance to design specification.

Table 3: Ways of restructuring building professional activities for waste reduction

Restructuring strategy	Architects		Engineers		Builders		Quantity Surveyors		Town planners	
	RCI	Rank	RCI	Rank	RCI	Rank	RCI	Rank	RCI	Rank
Encourage teamwork	0.82	4	0.80	7	0.74	9	0.72	10	0.79	5
Avoid professional egocentrism	0.67	16	0.68	15	0.62	17	0.69	12	0.67	15
Adhere to administrative procedure	0.65	18	0.62	20	0.61	19	0.63	19	0.64	17
Use of trust as a management resource	0.82	4	0.77	10	0.68	12	0.73	9	0.79	5
Effective management of supply chain	0.78	7	0.75	11	0.72	10	0.68	13	0.75	10
Integrating culture of the people into project planning	0.69	15	0.72	13	0.66	14	0.65	16	0.68	14
Intensify site supervision	0.85	1	0.82	4	0.81	1	0.84	1	0.80	4
Select environmentally friendly construction material	0.78	7	0.75	11	0.70	11	0.75	7	0.77	8
Arrange for proper storage of materials	0.76	11	0.80	7	0.75	8	0.68	13	0.71	13
Use of trained workmen	0.82	4	0.81	5	0.78	5	0.77	6	0.81	2
Use value engineering strategy	0.78	7	0.84	1	0.79	4	0.82	2	0.83	1
Proper quantification of materials on site	0.85	1	0.84	1	0.80	3	0.80	4	0.79	5
Shun favouritism	0.67	17	0.66	16	0.61	19	0.64	17	0.66	16
Design specifications compliance	0.78	7	0.81	5	0.77	6	0.79	5	0.77	8
Encourage good site supervisor/workmen relationship	0.72	13	0.66	16	0.62	17	0.70	11	0.72	12
Respect opinion of other individuals	0.71	14	0.70	14	0.65	15	0.64	17	0.63	18
Check formwork carefully before concreting	0.74	12	0.80	7	0.76	7	0.74	8	0.74	11
Encourage workplace learning	0.64	19	0.64	18	0.67	13	0.62	20	0.61	19
Minimise design changes and revisions	0.85	1	0.84	1	0.81	1	0.81	3	0.81	2
Effective decision-making process	0.61	20	0.63	19	0.64	16	0.66	15	0.61	19

In addition, selection of environmentally friendly construction material, effective management of supply chain, and arrangement of proper storage facility have average RCI of 0.75, 0.74, and 0.74, which agrees with the finding of Dodo et al. (2015) that the choice of environmentally friendly paint promotes green building. Furthermore, encouraging good site supervisor/workmen relationship, integrating culture of the people into project planning, adhering to administrative procedure, respecting opinion of other individuals, and avoiding professional egocentrism have average RCI of 0.68, 0.68, 0.68, 0.67, and 0.67. The RCI on ways shunning favouritism, encouraging workplace learning, and effective decision-making process could reposition activities of building professionals are 0.65, 0.64 and 0.63. The fact that all the measures of restructuring building professional activities listed in Table 3 have RCI above 0.6 indicates that they are essential for adequate waste management towards cleaner and sustainable housing.

4. Conclusions

This paper presents the analysis of measures of repositioning the activities of building professionals in Nigeria for effective waste reduction towards cleaner and sustainable housing. It also looked at the impacts of various activities of the building professionals on waste management. The results demonstrate that design of building and the development of building drawing are very essential aspects of pre-construction activities that influence waste management. Review of building drawings, supervising building project, procuring construction materials and arranging workmen are the construction activities that have the highest influence on waste management.

On the other hand, intensifying site supervision, proper quantification of materials on site, minimising design changes and revisions, use of trained workmen and the use of value engineering strategy are the most significant ways of repositioning building professional activities for effective reduction of waste in the building industry. In addition, compliance to design specifications, encouraging teamwork, checking formwork carefully before concreting, and the use of trust as a management resource are other promising ways of enhancing building professional activities towards effective waste management.

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