BLOCKLAYING AND CONCRETE WORK PRACTICES OF BUILDING CRAFTSMEN IN RURAL AREAS OF ZAMFARA STATE, NIGERIA

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Abstract
This study investigated the blocklaying and concrete work practices adopted by building craftsmen in rural areas of Zamfara State, Nigeria. Descriptive survey research design was used for the study on a sample size of 322 master craftsmen comprising of 253 with educational qualification and 69 without educational qualification. A 13 item validated questionnaire with a Cronbach Alpha reliability of 0.84 was used for collecting data for the study. Mean and standard deviation was used to answer the research questions while t-test was used to test the null hypotheses at 0.05 level of significance. The findings of the study revealed that: blocklaying and concrete work practices are not highly adopted by building master craftsmen in rural areas. There was no significant difference between the mean responses of the respondents on the building construction practices adopted by building master craftsmen in rural areas. This implies that the incessant cases of building failures in rural areas could be attributed to the negligence towards adoption of standard building construction blocklaying and concrete work practices in rural areas. It was recommended that there is urgent need for all categories of building craftsmen to highly adopt blocklaying and concrete work practices stipulated by the standard building code to enhance the performance strength of buildings in rural areas as well as improve their blocklaying and concrete work practices.

Keywords: Building, Blocklaying, Concrete work practices, craftsmen, rural areas

Introduction

Human settlement can either be rural or urban depending on the infrastructural facilities available and population of people or inhabitants in such area. Rural areas are large and isolated areas with low population density. Major activities that form the foundation for any economic development are carried out in rural areas. Rural dwellers serve as the major base for the production of agricultural products. The rural area is also one of the major sources of revenue generation for the country, and a principal market for domestic manufacturers (Fagbenle & Oluwunmi, 2010). In spite of the key function of rural dwellers in national development, these rural areas are not attractive to live in as they lack adequate infrastructure facilities needed to improve the quality of life for comfortable living. In rural areas, there is absence of adequate drinkable water, electricity, good feeder roads and much higher rate of illiteracy among the populace.

The American Bureau of Census (ABC)(2014) classified a group of people living in a community having a population of not more than 2,500 people as rural. In Zamfara State, The rural people have low standard of living, unattractive and low quality building constructions. Olagunju et al (2013) stated that classifying rural areas apart from population include: the level of infrastructural development, such as road networks, educational institutions, water supply, electricity, health facilities, and communication among others. Other criteria used include craftsmen performance in building construction occupation, housing, extent of community planning and attractive building construction. These buildings are usually constructed by craftsmen residing in rural areas.

In the context of this study, craftsman can be described as a person that possesses skills in an

established occupational area and can perform a task with some level of expertise. Building craftsmen performs various building construction operations in both urban and rural areas. Some of the craftsmen in rural areas are educated to a level of been able to read and write while others are not. There is the likelihood that their level of education may influence their practices in the job as an educated craftsman can read and interpret building designs and regulations which may aid in improving his efficiency in his job. However, Yoon and Kang (2000) stated that the craftsman that is not educated may be practicing what is not appropriate due to lack of necessary knowledge and this is detrimental to the building construction industry as it could influence the quality of a constructed building.

A building is a relatively permanent enclosed construction over a plot of land having a roof and usually windows and often more than one level, used for any of a wide variety of activities, as living, entertaining, or manufacturing (Dimuna, 2010). Building construction is an ancient human activity that began with the purely functional need for a controlled environment to moderate the effects of climate. Building construction is a significant part of human existent. The building construction industry occupies a very critical position in the Nigerian economic landscape (Council of Registered Builders of Nigeria, 2015). It is a major contributor to the nation's gross domestic product (GDP) and one of the biggest employers of labour particularly in rural areas. The building construction sector is growing very fast in most parts of the world. Building construction trades practices include: building construction planning practices, foundation work practices, blocklaying practices, concreting work practices, floors and floor covering practices as well as wall finishing practices. This study however focused on the blocklaying and concrete work practices of building craftsmen in rural areas.

Blocklaying involves the use of blocks by craftsmen to construct block work walls and other forms of masonry. It is an ancient profession that even centuries later requires modern training. It is likely that as long as man seeks shelter from elements like block, there will be work for these skilled professionals (Walter, 2016). Blocklaying in construction is one of the major works during building operations. This can be done during construction of walls and other parts of the building and it has several functionalities, such as, durability, strength, structural stability, fire resistance, sound absorption, heat insulation, and so on. They are also economical because of the following reasons: The units are relatively large and true in size and shape. This ensures rapid construction so that more walls is laid per man than in other types of wall construction: Fewer joints result in considerable saving in mortar as compared to normal masonry construction; it also increases the strength of masonry. The true plane surfaces obtained obviate necessity to plaster for unimportant buildings situated in low rainfall areas; even when plaster is used for any reason. Through this practice, the quantity required for satisfactory coverage is significantly small and is one of the main characteristics influencing durability of any blocklaying is concreting (Awurum, 2005).

Concrete work practices characterized by concrete mix proportions shall be selected to ensure that the workability of fresh concrete is suitable for the conditions of handling and placing, so that after completion it surrounds all reinforcements and completely fills the formworks. When concrete is hardened, it should have the required strength, durability and surface finish. The strength of concrete depends on the mix proportions of cement, aggregates, and water. In most cases, the practice is to use a reliable measure for all aggregates. However, some craftsmen in some cases do not use a consistent measure for all aggregates (Hover, 1998). The durability of concrete depends on the use of right measure and its resistance to deterioration and the environment in which it is placed. The resistance of concrete to weathering, chemical attack, abrasion, frost and fire depends largely upon the quality and constituent materials. Susceptibility of corrosion of steel is governed by cover provided and the permeability of concrete (Bureau of Indian Standard, 1997).

Concrete has become the new flooring materials of choice for designers and homeowners across the globe. Several of the blocklaying and concreting works are not adequately carried out especially by craftsmen in rural areas. A poorly laid block and poor concreting works in a building structure could lead to sudden earth movement that can cause foundation failure and consequently building collapse. This calls for the need to investigate blocklaying and concreting work practices by craftsmen in rural areas of Zamfara State, Nigeria.

Statement of the Problem

Ideally, an appropriately constructed building is supposed to serve its purpose over a number of years. However, over the last two decades the number of building collapse and structural failures are increasing an alarming rate especially in rural areas. This increasing number of building collapse and structural failures may be partly due to poor productivity of craftsmen and inappropriate blocklaying and concreting practices carried out by these craftsmen. Even though, several researches have been carried out and directed towards investigating the cause of building failure in respect to quality of materials used and absence of professional building design, no study known to the researcher has been directed towards investigating the cause of building failure as a result of inappropriate blocklaying and concrete work practices by craftsmen in rural areas in Zamfara State. Hence, the problem of this study therefore is : what are the blocklaying and concrete work practices of craftsmen in rural areas in Zamfara State?

Research Questions

The following research questions were formulated to guide the study:

(i) What are the block laying practices adopted by craftsmen in rural areas in Zamfara State?

(ii) What are the concrete work practices adopted by craftsmen in rural areas in Zamfara State?

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance :

Ho_1: There is no significant difference in the mean ratings of the master craftsmen with educational qualification and those without educational qualification on the block laying practices adopted by craftsmen in rural areas in Zamfara State.

Ho_2: There is no significant difference in the mean ratings of the master craftsmen with educational qualification and those without educational qualification on the concrete work practices adopted by craftsmen in rural areas in Zamfara State.

Methodology

The descriptive survey research design was used for the study. The study was conducted in Zamfara State and covers nine local government areas that are located in rural areas on a target population of 2320 building construction master craftsmen in nine local government areas of Zamfara State excluding the major cities. The sampling technique used for this study is simple random sampling with the aid of National Statistical Service Sample Size Calculator. The sample size of each local government was computed to give a total of 322 master craftsmen comprising of 253 master craftsmen with Educational Qualification and 69 Building Master Craftsmen without Educational Qualification. A 13 item questionnaire was used for collecting data for the study. The questionnaire was validated by three experts. Cronbach Alpha statistics was used to determine the reliability coefficient of the pilot tested instrument which was found to be 0.84. Data collected for this study was analyzed using mean, standard deviation and t-test statistics. Mean and standard deviation was used to answer the research questions while t-

test was used to test the null hypotheses at 0.05 level of significance. All statistical analysis was done using the Statistical Package for the Social Sciences (SPSS) version 21. For the decision rule on the null hypotheses, if the t-probability value (Sig. 2-tailed) calculated by the computer is greater than 0.05, it means there is no significant difference, then the null hypothesis was upheld (accepted) but if the t-probability value (Sig. 2-tailed) is less than 0.05 then there is significant difference, therefore the null hypothesis is rejected. Decision on the research question items was based on Grand Mean ($\bar{x}_A$) with respect to the real limit of numbers on the five point rating scale used for the study {4.50 – 5.00 = Very Highly Adopted (VHA); 3.50 – 4.49 = Highly Adopted (HA); 2.50 – 3.49 = Moderately Adopted (MA); 1.50 – 2.49 = Lowly Adopted (LA); 0.5 – 1.49 = Not Adopted (NA).

Results

Research Question One: What are the block laying practices adopted by craftsmen in rural areas in Zamfara State?

Result that answered this research question is presented in Table 1.

Table 1: Mean ratings and Standard deviation of Respondents on the block laying practices adopted by craftsmen in rural areas in Zamfara State N1=253,N2=69, Total N=322

S/N	Items	$\bar{x}_1$	$\bar{x}_2$	$\bar{x}_A$	SD_1	SD_2	SD_A	D
1	Construct timbering to avoid side collapse	1.74	1.78	1.76	0.52	0.48	0.50	LA
2	Determine suitable size of block	3.43	3.45	3.44	0.50	0.50	0.50	MA
3	Record properly all dimensional specifications of blocks	3.43	3.45	3.44	0.50	0.50	0.50	MA
4	construct structure with different blocks properly without errors	2.61	2.62	2.62	0.48	0.49	0.49	MA
5	lay block properly on the wall	3.25	3.51	3.38	0.43	0.50	0.47	MA
6	manage blocks during construction without damage	1.77	1.74	1.75	0.53	0.53	0.53	LA
	Grand Mean	**2.71**	**2.76**	**2.73**				**MA**

Key: $\bar{x}_1$ = Mean of BMEQ; $\bar{x}_2$ = Mean of BMWEQ ; $\bar{x}_A$; Average Mean of respondents; SD_1 = Standard Deviation of MCEQ, Standard Deviation of MCWEQ; Average Standard Deviation of respondents. NA= Not Adopted, LA = Lowly Adopted, HA= Highly Adopted, MA = Moderately Adopted. D = Decision.

From Table 1, the respondents' response to items 2, 3, 4 and 5 with means ranges from 2.62 to 3.44 signify that the respondents moderately adopted these block laying practices in rural areas in Zamfara State. Items 1 and 6 with means ranges from 1.75 to 1.76 is an indication that the respondents lowly or rarely adopted these block laying practices in rural areas in Zamfara State or adopted them to a low level. The grand mean of MCEQ are 2.71 shows that the MCEQ moderately adopted the block laying practices in rural areas in Zamfara State while MCWEQ with grand mean of 2.76 also moderately adopted the block laying practices in rural areas in Zamfara State. The total grand mean of 2.73 is an indication that these block laying practices are moderately adopted by both MCEQ and MCWEQ. The average standard deviation of the six items ranged from 0.48 – 0.53. The standard deviation values indicated that the respondents were not too far from one another in their mean responses.

Research Question Two: What are the concrete work practices adopted by craftsmen in rural areas in Zamfara State?

Result that answered this research question is presented in Table 2.

Table 2: Mean ratings and Standard deviation of Respondents on the concrete work practices adopted by craftsmen in rural areas in Zamfara State N1=253,N2=69, Total N=322

S/N	Items	$\bar{x}_1$	$\bar{x}_2$	$\bar{x}_A$	SD_1	SD_2	SD_A	D
1	Mix concrete of specified standard ratios for use.	1.44	1.38	1.40	0.50	0.49	0.49	NA
2	Cure the concrete foundation to avoid cracking	3.46	3.46	3.46	0.50	0.50	0.50	MA
3	care of concreting tools during and after work	3.45	3.45	3.45	0.50	0.50	0.50	MA
4	adequate comportment during work	2.59	2.58	2.58	0.49	0.50	0.50	MA
5	identify different sizes of concrete	2.89	2.78	2.84	0.50	0.57	0.54	MA
6	use concrete for different stages of building	1.38	1.33	1.36	0.49	0.48	0.48	NA
7	construct concrete building	1.34	1.33	1.34	0.48	0.48	0.48	NA
	Grand Mean	**2.36**	**2.33**	**2.35**				**LA**

Key: $\bar{x}_1$ = Mean of BMEQ; $\bar{x}_2$ = Mean of BMWEQ ; $\bar{x}_A$; Average Mean of respondents; SD_1 = Standard Deviation of MCEQ, Standard Deviation of MCWEQ; Average Standard Deviation of respondents. NA= Not Adopted, LA = Lowly Adopted, HA= Highly Adopted, MA = Moderately Adopted. D = Decision.

Table 2 shows that the respondents moderately adopted the concrete work practices in items 2, 3, 4 and 5 with a means scores ranges from 2.58 to 3.46. Items 1, 6 and 7 with means ranges from1.34 to 1.40 signify that the respondents do not adopt these concrete work practices in rural areas in Zamfara State. The grand mean of MCEQ are 2.36 which shows that the MCEQ lowly or rarely adopted the concrete work practices in rural areas in Zamfara State while MCWEQ with grand mean of 2.33 also rarely adopted the concrete work practices in rural areas in Zamfara State. The total grand mean of is 2.35 is an indication that these concrete work practices are lowly or rarely adopted by both MCEQ and MCWEQ. The average standard deviation of the seven items ranged from 0.48 – 0.54. The standard deviation values indicated that the respondents were not too far from one another in their mean responses.

Testing of Hypotheses

Hypothesis One: There is no significant difference in the mean ratings of the master craftsmen with educational qualification and those without educational qualification on the block laying practices adopted by craftsmen in rural areas in Zamfara State.

Table 3: t-test analysis of the mean ratings of Respondents on the block laying practices adopted by craftsmen in rural areas in Zamfara State

Group	N	$\bar{x}$	SD	df	t-value	p-value	Alpha Level	Decision
BMEQ	253	2.70	0.012	320	1.96	0.052	0.05	Upheld(NS)
BMWEQ	69	2.76	0.025					

From Table 3, since the p-value, Sig. (2-tailed) (0.052) is greater than 0.05, it is an indication that there is no significant difference in the mean responses of the two groups of respondents. Thus, the null hypothesis one was upheld (accepted). This implies that, there is no significant difference in the mean ratings of the master craftsmen with educational qualification and those without educational qualification on the block laying practices adopted by craftsmen in rural areas in Zamfara State.

Hypothesis Two: There is no significant difference in the mean ratings of the master craftsmen with educational qualification and those without educational qualification on the concrete work practices adopted by craftsmen in rural areas in Zamfara State.

Table 4: t-test analysis of the mean ratings of Respondents on the concrete work practices adopted by craftsmen in rural areas in Zamfara State

Group	N	$\bar{x}$	SD	df	t-value	p-value,	Alpha Level	Decision
BMEQ	253	2.36	0.188	320	1.247	0.213	0.05	Upheld(NS)
BMWEQ	69	2.33	0.195					

From Table 4, since the p-value, Sig. (2-tailed) (0.213) is greater than 0.05, it is an indication that there is no significant difference in the mean responses of the two groups of respondents. Thus, the null hypothesis two was upheld (accepted). This implies that, there is no significant difference in the mean ratings of the master craftsmen with educational qualification and those without educational qualification on the concrete work practices adopted by craftsmen in rural areas in Zamfara State.

Findings of the Study

Based on the data collected and analyzed, the following findings emerged:

(i) Blocklaying practices such as : determination of suitable size of block; recording properly all dimensional specifications of blocks; constructing structure with different blocks properly without errors as well as laying block properly on the wall are moderately adopted by the respondents. However, the respondents rarely adopted construction of timbering to avoid side collapse as well as managing blocks during construction without damage.

(ii) Concrete work practices such as: curing the concrete foundation to avoid cracking; care of concreting tools during and after work; adequate comportment during work as well as identification of different sizes of concrete are moderately adopted by the respondents. However, the respondents do not adopt mixing concrete of different ratios for use; using concrete for different stages of building as well as construction of concrete building.

(iii) There was no significant difference between the mean responses of the master craftsmen with educational qualification and those without educational qualification on the block laying practices adopted by craftsmen in rural areas in Zamfara State.

(iv) There was no significant difference between the mean responses of the master craftsmen with educational qualification and those without educational qualification on the concrete work practices adopted by craftsmen in rural areas in Zamfara State.

Discussion

The result presented in Table 1 provided answer to research question one. The findings on moderate adoption of suitable size of blocks and non strict adherence to dimensional specifications of blocks in constructing structures has negative effect on the strength of the structural walls. This was supported by the findings of Ayininuola and Olalusi (2004) who in a

study on assessment of building failures in rural areas in Lagos State, attributed the causes of building failures to the use of wrong specifications of blocks as well as positioning of the blocks in situ. The use of different sizes of blocks along a structural member can cause uneven weight distribution as well as undulating strength along a structure. This reduces the overall weight of the entire building from which the structural members forms a part.

In a study on block laying practices, Chudley and Greeno (2005) revealed that the block laying error made by building craftsmen has great impact on the foundation strength of a structure and can fail from wrong estimation of the strength of the blocks wrongly laid. This affects the overall load bearing strength and weight distribution of the structural walls. Wrong laying of blocks can distort structural forms and reduces the load bearing capacity of the blocks. Furthermore, Ayininuola and Olalusi (2004) in a study on assessment of building failures in rural areas in Lagos State unveiled that the poor materials used in making blocks also have adverse effect on the maximum loads the block structure can withstand.

In addition, Emmitt and Gorse (2005) in a study on block quality and quantity in block construction on building sites revealed that most building contractors in an effort to cut corners and increase quantity of blocks produced resort to poor mixture ratios that can achieve large quantity of weak blocks. Poor block laying practices may also arise from underestimation of the load imposed on the soil. Similarly, failure may result from the quality of the material used to make the blocks, which may be of low quality or sub-standard.

The findings on hypothesis one presented in Table 3 revealed that, there was no significant difference between the mean responses of the master craftsmen with educational qualification and those without educational qualification on the block laying practices adopted by craftsmen in rural areas in Zamfara State. From Table 3, since the p-value, Sig. (2-tailed) (0.052) is greater than 0.05, it is an indication that there is no significant difference in the mean responses of the two groups of respondents. Thus, the null hypothesis one was upheld (accepted).

The result presented in Table 2 provided answer to research question two. The non adoption of the practice of mixing concrete of different ratios for use as well as the non utilization of concrete walls where needed in buildings could be attributed to the causes of several building collapse in rural areas in Nigeria. To buttress this, Dare (2001) in a study on effect of building design, buildability and site production in building construction attributed the use of wrong concrete construction methods and procedures; use of substandard materials for concretes walls and structures as well as the absence of proper supervision that will ensure total quality management in concrete works.

The non poor adoption of accurate mixture ratios for concrete is also affected by the soil type suitable and most appropriate in particular building construction area. In line with this, Dimuna (2010) in a study on effect of soil type on buildings found out that different soil types pose varying problems for built foundations and the structural integrity of an entire concrete building. Therefore to design a concrete structure, it is necessary to calculate the loads on the concrete structure and determine the nature of the sub-soil, its bearing capacity, likely behaviour under seasonal and ground water level changes and the possibility of ground movement.

Similarly, the components of the concrete structure should be able to resist deformation under loading conditions. According to Richard (2002), deformation implies a change in size and shape when a body is subjected to stress. This means that the concrete component should

possess adequate stiffness. Thus; the stiffness of a beam or column is a measure of its resistance to bending or buckling. The resistance of the concrete to bending or buckling has great effect on the quality of concrete work practices in building construction sites. To support this findings, Chinwokwu (2000) in a study on measures to avert building collapse in rural areas unveiled that bad concrete work practice leads to poor concrete mixture ratios which leads to production of poor quality of concrete structures which fail suddenly. Concrete structures may fail because of the following: wrong practices in curing the concrete foundation leading to cracking as well as wrong choice different sizes of concrete; wrongly mixing concrete of different ratios for use.

The findings on hypothesis two presented in Table 4 revealed that, there was no significant difference between the mean responses of the master craftsmen with educational qualification and those without educational qualification on the concrete work practices adopted by craftsmen in rural areas in Zamfara State. From Table 4, since the p-value, Sig. (2-tailed) (0.213) is greater than 0.05, it is an indication that there is no significant difference in the mean responses of the two groups of respondents. Thus, the null hypothesis two was upheld (accepted).

Conclusion

Strict adherence and high adoption of the standard building code of practice in the area of blocklaying and concrete work practices is a necessary factor in ensuring that building strength have adequate strength and are able to withstand the various loads imposed of them without sudden failure. However, the extent of adoption of the standard building code of practice in the area of blocklaying and concreting work practices varies and has great effect on the strength of the buildings constructed. Based on the findings of the study, it was concluded that none of the blocklaying and concrete work practices was very highly adopted by the building craftsmen. It is thus necessary to ensure strict and very high adoption of the standard building code of practice in the area of blocklaying and concrete work practices to ensure that constructed buildings have adequate strength to withstand the various loads imposed of them without failure.

Recommendations

Based on the findings from this study, the following recommendations are made :

(I) Zamfara State Ministry of Works should organize retraining programmes that will help in ensuring strict adherence and adoption of the standard building code of practice in the areas of blocklaying and concrete work practices.

(ii) The ministry of commerce, trade and industries should advise Zamfara State government on the need to set up monitoring team on residential and industrial building sites to ensure strict adherence and adoption of the Standard Building Code of Practice. This will reduce sudden building failures resulting from none adoption of the standard code of practice in the area of blocklaying and concrete work practices.

(iii) The building construction craftsmen in the various local governments in Zamfara State should cultivate positive building construction practices on building sites. This can be achieved by giving public orientation and awareness programme to building construction craftsmen on the dangers associated with not adopting the standard building code of practice in the area of blocklaying and concrete work practices.

(iv) The building construction contractors in Zamfara State should encourage the building construction craftsmen working as employees on the need to always adopt the stipulated standard building code of practice on all blocklaying and concrete work practices on building sites.

(v) The Nigeria Institute of Builders and other stakeholders in the building industries should organize public enlightenment campaigns for building construction craftsmen on the Standard Building Code of Practice necessary for adoption in the area of blocklaying and concrete work practices. This will go a long way to inprove craftsmen blocklaying and concrete work practices on the job.

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