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CRITICAL SUCCESS FACTORS INFLUENCING PRODUCTIVITY OF CONSTRUCTION ARTISANS IN THE BUILDING INDUSTRY

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ABSTRACT

Artisans are crucial in the delivery of building projects, due to the input of their skills in installations and can affect time, cost and ultimately quality of the final product. In order to address the negative perception of the building industry and contribute to the low stock of housing, there is the need to maximize the productivity of major players in the construction industry. The study aimed at assessing the critical success factors influencing productivity of construction artisans in the building industry. Using a questionnaire instrument targeted at professionals on construction sites in Lagos State, the study found out that availability of equipment and materials is the most critical success factor influencing the productivity of construction artisans. The result revealed that on time payment of workers is the most suitable control measure to improve productivity of artisans on construction sites. It is worthy to note that age of artisan does not affect the overall labour productivity of a project, rather construction professionals should be concerned at other motivating factors to improve productivity. Lack of onsite transportation, lack of equipment and materials, inappropriate scheduling of activities, and misunderstanding between artisan and site supervisors are the most significant challenges artisans face on construction sites. It is recommended that project managers should make an early planning and scheduling of the project so as to know the required materials and equipment in order to create an easy/systematic work flow. An appropriate and workable cash flow of the building project should not be neglected.

Keywords: Artisan, Building, Construction Industry, Critical Success Factors, Productivity
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1. INTRODUCTION

Based on the numerous manual activities involved in the construction of buildings, the construction sector requires high concentration of labour which makes it one of the chief employer of workforce (Afolabi *et al.,* 2018). In addition, the construction sector contributes greatly to any nation's economy by increasing the housing and infrastructural supply (Fagbenle, Adeyemi and Adesanya, 2004). The strategic importance of the industry means that issues that would engender improved productivity needs to be researched. Especially in an industry that heavily depends on human effort, improving productivity should be a critical success factor in achieving project goals (Amusan *et al.,* 2018; Afolabi *et al.,* 2018). Productivity, or lack of productivity is a very common and occurring problem in the construction industry. Increased productivity can have a great impact on the overall construction process and therefore result in substantial cost and time saving.

Construction productivity depends on manpower and performances of artisans. Construction productivity as it relates to human performance can be measured in terms of output per work hour achieved by the worker on site – the labour productivity on site. Maximizing site productivity on artisans is very important in order to reduce the capital cost of a construction project as site labour contributes about 30% of the overall project cost. In the study by Borcherding, Palmeter and Jansma (1986), they mainly focused on time lost on construction projects due to productivity loss. This time loss can be due to transportation and production inefficiencies. Although, there are many challenges that have been experienced on construction projects due to non-productive efforts of stakeholders in the construction process (Afolabi and Oyeyipo, 2017).

The Nigerian construction industry has turned a corner and taken up more challenging and complex designs in new construction projects and with new plants and equipment, materials and other factors push contractors to work at high risks with low profit margins. The Nigerian construction industry is plagued by cost overrun, time overrun, rework, quality deficiencies, low margin profit of contractors building collapse etc. Coupled with these challenges, Shehata and El-Gohary (2011) opined that the most problematic scenarios the construction sector must urgently deal with are in the areas of lack of standards on productivity and declining rate of productivity. The low productivity of artisans on building sites is now a serious worry to the client, the contractor and the construction manager who manage the building production processes. This study is particularly pertinent for developing countries such as Nigeria where most of the building processes are less-mechanized requiring sufficient labour force (Alinaitwe, Mwakali and Hansson, 2007; Tunji-Olayeni *et al.*, 2018). One of the major causes looks to be towards the area of ineffective management of building craftsmen on construction sites. Looking at the construction resources-money, men (labour), materials, machines and management, men are the most important, because through the activities of men, other resources are coordinated and managed to achieve organizational goals of improved productivity. However, they are the most difficult to manage. Ajato (2000) stated that poor attention to productivity has led to workers producing less output per day. Generally, artisans' productivity on building sites is a striking universal problem in construction industry in which the contractor and the professionals in the built environment should give serious consideration, and provide a sustainable solution. Several literature and texts have addressed the issue of productivity in construction industry, but this study is limited to artisans on building sites. Despite the extensive development of Nigerian construction industry, productivity of artisans in the industry is below the national average of many developed countries. The most important asset an organization has are the people working in the organization and their effective management is key to its success (Tunji-Olayeni *et al.*, 2017). Therefore, this research intends to assess the critical success factors influencing productivity

of construction artisans in the building industry. This study posed the following research questions:

- What are the critical successes factors influencing productivity of artisans on a building construction project?
- What are the measures that can enhance productivity of artisans on construction sites?

2. RESEARCH METHOD

This section discusses the methods adopted in gathering and analyzing data relevant to assessment of critical success factors influencing productivity of construction artisans in the building industry. For this research, the cross-sectional survey research design based on survey instruments e.g. questionnaire and observations were used. Variables that related to critical success factors influencing construction productivity of artisans and measures to improve productivity of artisans on construction sites were derived from an extensive literature review. For the purpose of this study, the population of study used were professionals working on building construction sites in Lagos State that have firsthand information about artisans. This is a list of people that form the group from which a sample is chosen. A purposive-quota sampling method was used in selecting the sample size for the study. For the purpose of this research work, the project managers, the supervisors or site engineers and other construction professionals were used to determine the sample for this research. Data was collected through primary and secondary sources. Questionnaires were administered to construction sites to collect data as required for the study. The questionnaire was developed in line with the research questions with the primary aim of gathering quality data. The data obtained from the survey was analyzed by using a statistical tool, commonly known as Statistical Package for Social Science (SPSS). The study contains descriptive statistics which are presented in frequency tables and mean score while inferential statistics were analyzed using Pearson Correlation and Analysis of Variance (ANOVA).

3. RESULT AND DISCUSSION

This study is aimed at assessing the critical success factors influencing productivity of construction artisans in the building industry. The statistical methods used in analysis of the data were Frequencies, Percentages and, mean scores (MS) and ranking index was used to analyze the objectives. Pearson Correlation and Analysis of Variance (ANOVA) were used to analyze the hypotheses. A total number of 60 responses were collected from 80 questionnaires distributed. This represents 75% response of the total questionnaires distributed and this can be termed adequate return of received questionnaires.

3.1. Participants' characteristics

This section described the characteristics of the construction professionals that participated in the study. Basically, Table 1 showed that 47 (78.3%) the gender of the respondents were male and 13 (21.7%) of the respondents were female. In Table 1, 4 (6.7%) of the respondents were in the age range of 18 - 24, 19 (31.7%) of the respondents were in the age range of 25 - 34, 25 (41.7%) of the respondents were in the age range of 35 - 44, 9 (5.0%) of the respondents were in the age range of 45 - 54 and 3 (5.0%) of the respondents were in the age range of 55 and above. Table1 showed that 19 (31.7%) of the respondents were Builders, 6 (10%) of the respondents were Site engineers, 11 (18.3%) of the respondents were Project managers while 24 (40.0%) of the participants had other roles on the construction sites. Others in this research referred to architects, civil engineers, etc. The highest educational qualification of the respondents showed that 4 (6.7%) had PhD degrees, 2 (3.3%) had Masters of Project

Management (MPM) degree, 10 (16.7%) had Master of Science (MSc), 25 (41.7%) had Bachelors' degree inform of B.Sc/B.Tech., while 19 (31.7%) had Higher National Diploma (HND) degree. The professional affiliations of the construction professionals showed that 23 (38.3%) were members of the Nigerian Institute of Building (MNIOB), 4 (6.7%) of the respondent were members of the Nigerian Society of Engineers (MNSE), 4 (6.7%) of the respondent were members of the Nigerian Institute of Quantity Surveyors (MNIQS), 10 (16.7%) were members of the Nigerian Institute of Architects (MNIA) while 19 (31.7%) had other professional qualifications not listed in the questionnaire instrument. Table 1 showed that 5 (8.3%) of the construction professionals had 26 - 30years of working experience, 4 (6.7%) had 21 - 25years of working experience, 3 (5.0%) had 16-20years of working experience, 11 (18.3%) had 11 - 15years of working experience, 18 (30.0%) had 6 - 10years of working experience, while 19 (31.7%) had 1 - 5years of working experience.

Table 1 Participants' characteristics

Participants' characteristics	Frequency	Percent	Cumulative Percent
Gender			
Male	47	78.3	78.3
Female	13	21.7	100.0
Age Range (in Years)			
18-24	4	6.7	6.7
25-34	19	31.7	38.3
35-44	25	41.7	80.0
45-54	9	15.0	95.0
55 and above	3	5.0	100.0
Designation			
Others	24	40.0	40.0
Builder	19	31.7	71.7
Site engineer	6	10.0	81.7
Project manager	11	18.3	100.0
Highest Educational Qualification			
PhD	4	6.7	6.7
MPM	2	3.3	10.0
MSc	10	16.7	26.7
BSc/B.TECH	25	41.7	68.3
HND	19	31.7	100.0
Professional Affiliation			
Others	19	31.7	31.7
MNIOB	23	38.3	70.0
MNSE	4	6.7	76.7
MNIQS	4	6.7	83.3
MNIA	10	16.7	100.0
Working Experience (in Years)			
26-30	5	8.3	8.3
21-25	4	6.7	15.0
16-20	3	5.0	20.0
11-15	11	18.3	38.3
6-10	18	30.0	68.3
1-5	19	31.7	100.0

3.2. Critical success factors influencing productivity of construction artisans

This section presented the critical success factors influencing productivity of construction artisans in the building industry. Table 2 showed that availability of equipment and material had a mean score (MS) of 4.17, supervision had a mean score (MS) of 4.15, payment method had a mean score (MS) of 4.07, welfare on site had a mean score (MS) of 3.98, weather condition had a mean score (MS) of 3.95, time had mean score (MS) of 3.92, site condition

and availability of manpower both had a mean score (MS) of 3.90, construction method had a mean score (MS) of 3.87, availability of safety plan on site had a mean score (MS) of 3.85, crew interference had a mean score (MS) of 3.82, quality of work had a mean score (MS) of 3.73, inaccurate drawings/specification had a mean score (MS) of 3.65, type of project had a mean item score mean score (MS) of 3.43, availability of site layout had a mean score (MS) of 3.35, age of artisans had a mean score (MS) of 3.22 and lack of lighting had a mean score (MS) of 3.08.

Table 2 Critical success factors influencing productivity of construction artisans

Critical success factors (CSF)	Mean Score (MS)	Ranking Index
Availability of equipment and material	4.17	1
Supervision	4.15	2
Payment method	4.07	3
Welfare on site	3.98	4
Weather condition	3.95	5
Time	3.92	6
Site condition	3.90	7
Availability of manpower	3.90	7
Construction method	3.87	9
Availability of safety plan on site	3.85	10
Crew interference	3.82	11
Quality of work	3.73	12
Inaccurate drawings/specification	3.65	13
Type of project	3.43	14
Availability of site layout	3.35	15
Age of artisans	3.22	16
Lack of lighting	3.08	17

It is noticed that availability of equipment and material was ranked 1st, supervision was ranked 2nd, payment method was ranked 3rd and welfare on site was ranked 4th respectively. The findings in this study revealed that construction professionals/contractors must ensure that construction materials and equipment needed to carry out building activities are made available on time and in the right quantities. Unavailability can lead to delay and reduced productivity from the artisans. Fagbenle, Ogunde and Owolabi (2011) found out that this is a challenge most Nigerian construction sites grapple with. They noted that this challenge affects the morale of workers who were prepared to work and can be traced to cause discrepancies between contract sum and the final construction sum. This is an inefficiency which the construction professional/contractor needs to tackle through adequate project management/planning. The use of information and communication technologies can also aid the process of planning which would ensure that sufficient quantity of materials and equipment are available for proposed activities in the building process (Aduwo *et al.*, 2016; Ibem *et al.*, 2016; Afolabi *et al.*, 2017). Shortage of materials has dire consequences which can lead to delay of the construction process. One way the client can help is to ensure that financial commitment is made promptly to the construction organization during the construction process.

3.3. Measures to improve productivity of artisans on construction sites

It is pertinent in order to deliver the required number of housing units within the study area; Lagos State. There is need to increase the productivity of artisans on construction sites. Clients and contractors also have benefits to gain when artisans' productivity are improved. Improved productivity of artisans would ultimately affect the project outcomes in terms of client satisfaction, time, cost and quality. In Table 3, on time payment of workers had a mean score (MS) of 4.68, motivation of workers had a mean score (MS) of 4.60, improved on site

welfare package had a mean score (MS) of 4.58, systematic flow of work had a mean score (MS) of 4.55, maintaining work discipline had a mean score (MS) of 4.47, maximum use of machinery and automation system had a mean score (MS) of 4.40, providing onsite accommodation had a mean score (MS) of 4.38, proper training to labourers had a mean score (MS) of 4.37, prompt material procurement and management had a mean score (MS) of 4.30 and advance equipment planning had a mean score (MS) of 4.28. It is noticed that on time payment of workers is ranked 1st, motivation of workers is ranked 2nd, improved on site welfare package is ranked 3rd and systematic flow of work is ranked 4th respectively. In the study by Oseghale *et al.* (2015), artisans have often complained about the meagre wages generated from craftsmanship in the construction industry. This is buttressed by Oluwale *et al.* (2013) study, where over thirty-five percent of artisans have changed profession to riding 'okada' or 'Napep' due to complains on the low remuneration schemes in the construction sector. In addition, this becomes more challenging when the payment is not prompt. Therefore, for construction professionals to increase the productivity of artisans, there is need for timely payment of wages to the artisans. Although, there is still huge clamor for an increase in the wage scheme for artisans, construction professionals/contractors should ensure that no artisan is owed wages as this may have adverse effect of the construction productivity.

Table 3 Measures to improve productivity of artisan on construction sites

Measure	Mean Score (MS)	Ranking Index
On time payment of workers	4.68	1
Motivation of workers	4.60	2
Improved on site welfare package	4.58	3
Systematic flow of work	4.55	4
Maintain work discipline	4.47	5
Maximum use of machinery and automation system	4.40	6
Providing on site accommodation	4.38	7
Proper training to labourers	4.37	8
Properly and in advance material procurement and management	4.30	9
Advance equipment planning	4.28	10

4. HYPOTHESES TESTING

In this section, inferential statistics was carried out to test two (2) hypotheses;

4.1. Hypothesis One

H_{01}: There is no relationship between age of artisans and the overall labour productivity.

H_1: There is a relationship between age of artisans and the overall labour productivity.

This hypothesis was tested using Pearson correlation test. Table 4 showed the relationship between the age of artisans and the overall labour productivity.

Table 4 Pearson Correlation between age of artisans and the overall labour productivity

		Age of artisans	Overall labour productivity
Age of artisans	Pearson Correlation	1	.014
	Sig. (2-tailed)		.917
	N	60	60
Overall labour productivity	Pearson Correlation	.014	1
	Sig. (2-tailed)	.917	
	N	60	60

The decision rule states that if the probability (Asymp. sig.) is less than 0.05, the null hypothesis is rejected and accept the alternate hypothesis but if the probability is greater than 0.05, the null hypothesis is accepted and the alternate hypothesis is rejected. Therefore, Table

4 showed that the probability is greater than 0.05 at 0.917. This means that the null hypothesis is accepted which stated that there is no relationship between the age of artisan and their overall labour productivity and therefore reject the alternate hypothesis. The researchers opined that for a high rate of artisan productivity, age should not be a determining factor. Rather, construction professionals should focus on motivating factors that can engage artisans to give more on construction projects. As the artisans' age group is increasing, there is need to encourage the younger generation in skill acquisition in the construction field through an attractive wage scheme. The study concludes that even though there are more aged people involved in craftsmanship in the building industry, this does not guarantee improved productivity.

4.2. Hypothesis Two

H_{02}: There is no agreement on the challenges facing artisans on construction sites.

H_2: There is an agreement on the challenges facing artisans on construction sites.

Table 5 Analysis of variance (ANOVA) on challenges facing artisans on construction sites

Challenges		Sum of Squares	Df	Mean Square	F	Sig.
Non-incentive/low incentive	Between Groups	3.623	3	1.208	1.031	.386
	Within Groups	65.627	56	1.172		
	Total	69.250	59			
Low patronage of trade by Construction firms	Between Groups	3.291	3	1.097	1.268	.294
	Within Groups	48.442	56	.865		
	Total	51.733	59			
Lack of training and retraining	Between Groups	.264	3	.088	.099	.960
	Within Groups	49.470	56	.883		
	Total	49.733	59			
Lack of manpower	Between Groups	9.037	3	3.012	1.888	.142
	Within Groups	89.363	56	1.596		
	Total	98.400	59			
Discrimination	Between Groups	9.749	3	3.250	2.512	.068
	Within Groups	72.435	56	1.293		
	Total	82.183	59			
Education	Between Groups	.285	3	.095	.122	.947
	Within Groups	43.648	56	.779		
	Total	43.933	59			
Lack of onsite transportation	Between Groups	13.935	3	4.645	3.647	.018
	Within Groups	71.315	56	1.273		
	Total	85.250	59			
Language barrier (poor communication)	Between Groups	5.517	3	1.839	1.205	.316
	Within Groups	85.466	56	1.526		
	Total	90.983	59			
Lack of equipment and materials	Between Groups	13.470	3	4.490	3.107	.034
	Within Groups	80.930	56	1.445		
	Total	94.400	59			
Poor or inappropriate designs	Between Groups	7.654	3	2.551	2.256	.092
	Within Groups	63.329	56	1.131		
	Total	70.983	59			
Complex designs	Between Groups	5.685	3	1.895	1.873	.145
	Within Groups	56.648	56	1.012		
	Total	62.333	59			
Inappropriate scheduling of activities	Between Groups	20.948	3	6.983	6.476	.001
	Within Groups	60.385	56	1.078		
	Total	81.333	59			
Inadequate experience and supervision	Between Groups	10.984	3	3.661	2.464	.072
	Within Groups	83.199	56	1.486		
	Total	94.183	59			

Misunderstanding between artisans and site supervisors	Between Groups	7.105	3	2.368	2.778	.050
	Within Groups	47.745	56	.853		
	Total	54.850	59			
Poor supervision	Between Groups	6.342	3	2.114	1.505	.223
	Within Groups	78.642	56	1.404		
	Total	84.983	59			
Availability of space	Between Groups	3.898	3	1.299	1.240	.304
	Within Groups	58.686	56	1.048		
	Total	62.583	59			

Table 5 showed that the probability (Asymp. sig) of non-incentive/low incentive, low patronage of trade by construction firms, lack of training and retraining, lack of manpower, discrimination, education, language barrier, poor or inappropriate designs, complex designs, inadequate experience and supervision, poor supervision, and availability of space is greater than 0.05, therefore the null hypothesis is accepted, that there is no agreement on these challenges facing artisans on construction sites. While the probability (Asymp. sig) of lack of onsite transportation, lack of equipment and materials, inappropriate scheduling of activities, and misunderstanding between artisan and site supervisors is less than 0.05, therefore the alternate hypothesis is accepted that there is an agreement on these challenges facing artisans on construction sites among the respondent. Wahab (2005) stated that the factors affecting the productivity in Nigerian construction industry are many and varied, namely, shortage of building materials, lastly failure of contractors to recognize the importance of plants, tools and workers training as means of increasing their productivity. Dalhatu, Ali and AbdulAzeez (2012) opined that inadequate tools and equipment need to be address for productivity of artisans on construction site can be increased.

5. CONCLUSION AND RECOMMENDATION

This study was aimed at assessing the critical success factors influencing productivity of construction artisans in the building industry. Availability of equipment and materials is the most critical success factor influencing the productivity of construction artisans. On time payment of workers is the most suitable control measure to improve productivity of artisans on construction sites. It is worthy to note that age of artisan does not affect the overall labour productivity of a project. Lack of onsite transportation, lack of equipment and materials, inappropriate scheduling of activities, and misunderstanding between artisan and site supervisors are the most significant challenges artisans face on construction sites.

The study recommended the following:

- There is need to provide onsite transportation for construction artisans on large scale construction projects.
- The project manager should make an early planning and scheduling of the project so as to know the required materials and equipment needed in quantity and quality in order to provide for them as early as possible for easy/systematic work flow. Scheduling of activities are very necessary for organization and a smooth systematic flow of work. The project manager should also have a good relationship with the suppliers and dealers, this can result in less delay of materials and equipment delivery to the work site.
- For avoidance of cost overrun on a project, site supervisors must ensure that there is no idle time in the schedules of the artisans. This is necessary for a fast-paced work especially when the activities of work are aligned appropriately, this will reduce delay of project. The project managers or the construction company must ensure that their artisans are well trained and they attend re-training workshops that ensures that rework is reduced i.e. less or no wastage of materials that could

possible lead to eradicating cost overrun of a project. In addition, construction processes must be monitored and controlled and corrective measures taking when deviation occurs.

- Maintaining of work discipline on site is very essential amongst artisan and site supervisors, site supervisors should give listening ears to whatever the artisan brings forward.
- The researcher recommends that construction companies should provide on time financial package for the artisans. This is a form of incentive that acts as a motivating factor for construction artisans.

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