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EFFECTS OF PROJECT-RELATED FACTORS ON CONSTRUCTION LABOUR PRODUCTIVITY IN BAYELSA STATE OF NIGERIA

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Abstract

Construction labour productivity has continued to be researched into because of its importance in nations' economy. This study assesses and compares the relative effects of project-related factors on construction labour productivity in Bayelsa State of Nigeria from the perspectives of building craftsmen and project supervisors/engineers. A field survey involving a stratified random sample of 146 building craftsmen and 81 project supervisors/engineers was conducted. Data were collected through structured questionnaires and analysed using Mean Item Score and Mann-Whitney U-test. The result shows that there is no significant difference between building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity (p = 0.646 > 0.05). In addition, the selected project team members ranked specification and standardisation, availability of material, project goals and milestones, high quality of required works and availability of drawings as the first five significant project-related factors affecting construction labour productivity respectively. The study therefore, recommends that construction managers should make more explicit project specifications; address the effects of availability of materials, high quality of required works and non-availability of project documents on construction labour productivity with clients and motivate craftsmen with realisable goals and milestones.

Keywords: *Construction, craftsmen, effects, labour, factors, productivity*

Introduction

The construction industry is very important to the economy of every nation. This importance stems from a wide range of reasons associated with certain peculiar features of the industry such as its products being investment-goods (Kazaz and Ulubeyli, 2004). It covers half of the whole field of fixed capital accumulation (Fagbenle, 2009) therefore; it constitutes the most single sector of capital formulation in any national economy (Ayandele, 1996). In Nigeria, construction investment accounts for over 60% of the Gross Fixed Capital Formation (GFCF) i.e. the total national investment (Dlakwa and Culpin, 2010). The industry is also seen as the barometer for the performance of the economy in most developing countries (Kazaz and Ulubeyli, 2004; Chitkara, 2006). Adedeji (2008) observes that building industry being a subset of the construction industry is one of the most important sectors of the Nigerian economy.

Productivity is considered as one of the most important factors affecting the success and overall performance of every organization, whether large or small, in today's competitive market (Ersoz, 1999; Sweis *et al*., 2009). According to Nkado (1995) and Walker (1995), construction productivity is traditionally identified as one of the three main critical success factors together with cost and quality for a construction project. There are different classifications of construction works in the literature. Chitkara (2006) classifies major construction projects under four broad groups namely; building construction, infrastructure construction, industrial construction and special-purpose projects.

However, it has been observed that construction productivity is a cause of great concern in both the construction industry and

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academia (Park *et al*., 2005). Many researchers have reported the decline in construction productivity (Veiseth *et al*., 2003; Hewage and Ruwanpura, 2006). Lawal (2008) reports that construction workers in the Nigerian public service have almost zero productivity. Therefore, poor productivity of craftsmen have been identified as one of the most daunting problems that construction industries especially those in developing countries face (Kaming *et al*., 1997).

In view of this, there is a growing and continuous interest in productivity studies all over the world because of its importance in the management and control of project cost. Motwani *et al*. (1995) opined that identifying and evaluating the factors that influence productivity are critical issues facing construction managers. Hendrickson and Au (2003) states that 'good project management in construction must vigorously pursue the efficient utilization of labour, material and equipment and that improvement of labour productivity should be a major and continuous concern of those who are responsible for cost control of constructed facilities'.

Enshassi *et al*. (2007) observe that despite the intensive investigations made into the factors affecting labour productivity, researchers have not agreed on a universal set of factors with significant influence on productivity; or any agreement reached on the classification of these factors. The authors however, group factors affecting construction labour productivity under ten headings, namely: manpower, leadership, motivation, time, materials/tools, supervision, project, safety, quality and external. Kazaz et al. (2008) consider productivity factors under four groups namely; organisational factors, economic factors, physical factors and socio-psychological factors based on the theory of motivation. Durdyev and Mbachu (2011) consider key constraints and improvement measures for on-site labour productivity using 56 sub-factors. The factors were identified under eight broad categories of internal and external constraints namely: project management/project team characteristics, project finance, workforce, project-related factors, unforeseen events, technology/process, statutory compliance and other external factors. Odesola (2012) identified 75 factors affecting construction labour productivity from literature and focus group discussions with masonry artisans and project supervisors/engineers. These factors were classified into five groups namely: management-related factors, labour-related factors, environmental factors, project-related factors and natural factors.

Nevertheless, only few studies have considered the relative effects of project-related factors on construction labour productivity by comparing the views from building craftsmen and site supervisors who are important project team members directly involved with construction labour productivity matters. The project team often comprises the design team and the building team (Bender and Darlene 2002). Depending on the size of the project, the project team usually consists of architects, engineers and other consultants that produced the construction documents; the owner who can be a public or private entity that specifies the project requirements and makes available funding for design and construction; and the main contractor and subcontractors who are responsible for the physical construction of the project.

Construction labour productivity is mostly affected by the management of the labour directly involved with on-site activities. In view of this, Maloney (1983) remark that craft workers as the major player executing construction processes and activities, have a significant influence on construction labour productivity. In the same vein, Dai et al. (2009) consider craft workers to be in the ideal position to know where and how much of site's productivity is lost or could be gained. Since labour productivity involved the management of labour, project supervisors/engineers often regarded as middle level managers are responsible for the coordination of the instructions from upper level managers for implementation by the craftsmen. These instructions equally affect construction labour productivity. Therefore, project

supervisors/engineers are considered to be an important member of the project team who relates and implements management's issues and decisions that affect construction labour productivity. Hence, United States Agency for International Development (USAID) (2005) posit that project supervisor/engineer supposed to be a jack of all trades as the success or failure of a project depends largely on their knowledge and experiences. Therefore, comparing building craftsmen and site supervisors/engineers' perception of the relative effects of factors affecting construction labour productivity will either reveal that there is agreement or not in the way the two groups view the degree to which productivity factors affect construction labour productivity. Their agreement will help to emphasis factors that should be focused upon to improve productivity.

On the other hand, since building craftsmen are the group directly involved with the issue of productivity, their disagreement may help to identify factors that are probably being neglected by the project supervisors/engineers who are their supervisors. Acknowledging and addressing such factors by the project supervisors/engineers will help in providing a holistic approach to tackling construction labour productivity problems on construction sites which will lead to improved labour productivity. It is in response to this gap in literature that this study assesses and compares the relative effects of project-related factors on construction labour productivity as perceived by building craftsmen and project supervisors/engineers in Bayelsa state of Nigeria. Project-related factors in this study refer to the set of factors affecting construction labour productivity attributable to the project and as a result could be regarded as project specific. In other words, these factors could be peculiar to a project and may therefore not be generalised for all projects. Eighteen project-related factors affecting construction labour productivity were identified from previous studies and assessed for their influence on construction labour productivity. Therefore, the objectives of this study are to: evaluate the relative effects of project-related factors from the perspective of building craftsmen, evaluate the relative effects of project-related factors from the perspective of project supervisors/engineers and to compare building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity for agreement or disagreement. Considering that project supervisors/engineers represent management's views on factors affecting construction labour productivity their perceptions may be the same or different from that of the building craftsmen. To achieve the objectives of the study an hypothesis was postulated namely:

Building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity do not differ significantly.

Study Area

Bayelsa state of Nigeria is located between latitudes 4o52' and 5o00' North of the Equator and longitudes 6o15' and 6o 22' East of the Greenwich Meridian. The area is characterised by alternate wet and dry seasons with high annual average temperature and relative humidity of about 27oC and above 80% respectively (Nwankwoala et al., 2011). It has one of the largest crude oil and natural gas deposits in Nigeria resulting into extensive oil exploration and production activities in the area. Figure 1 shows the map of Bayelsa state.

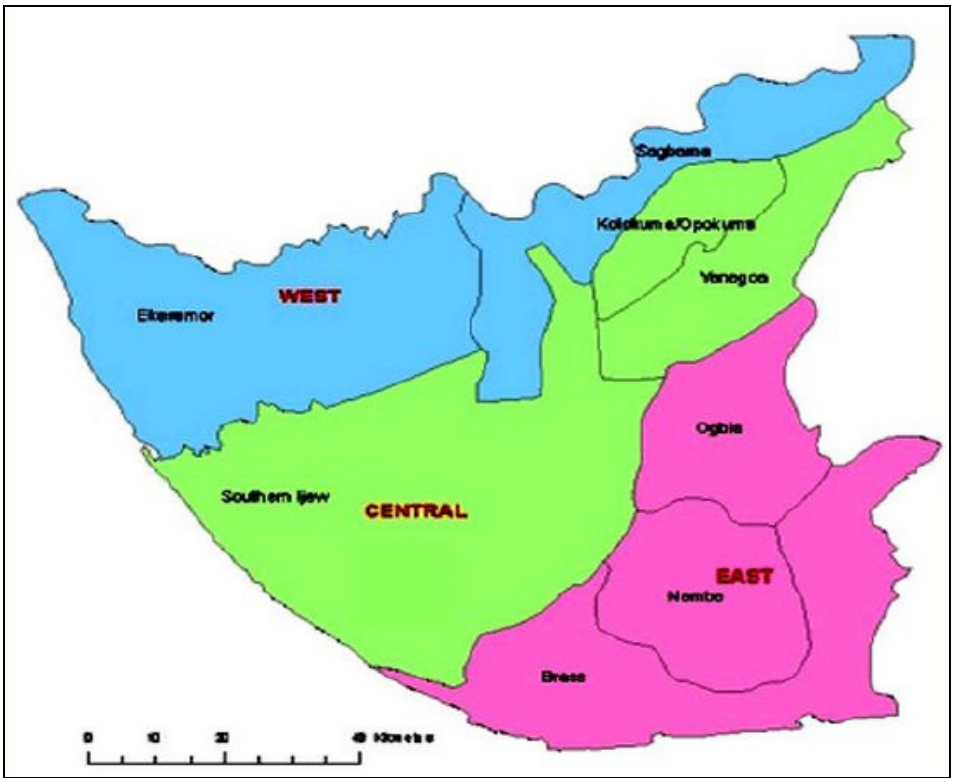

Figure 1 Map of Bayelsa state, Nigeria

Research Methods

Exploratory survey research design approach involving the use of a structured questionnaire and focus group discussion was employed in this study. The population for the study is categorised into three namely: public building projects completed between 2007 and 2012 and executed by small and medium sized contractors, construction project supervisors/engineers and building craftsmen in the study area. Reliable data from which the theoretical population frame can be obtained was not available therefore; a pilot study was conducted to ascertain the projects completed between 2007 and 2012 and the contractors who executed the projects. A second pilot study was conducted to identify the number of building craftsmen and project supervisors/engineers under the employment of the contractors. From the pilot studies conducted, 74 building projects executed by 20 contractors, 146 building craftsmen and 81 project supervisors/engineers were identified. These were adopted as the study population frame.

Structured questionnaires were used to collect data on the effects of 18 identified project-related factors from two selected project team members who constitute respondents for the study. The effect of each factor on construction labour productivity was measured on a five point Likert-scale namely: nil, low, moderate, high and very high. Weights were assigned to the scale as follows: nil=1, low=2, moderate=3, high=4 and very high=5. Out of 174 questionnaires administered on the study population through stratified random sampling technique, 156 correctly completed questionnaires comprising of 93 building craftsmen and 63 project supervisors/engineers were used for the statistical analysis. This sampling technique was adopted to ensure an unbiased representation of the two distinct categories of respondents for the study.

Data Analysis

Statistical Package for Social Sciences (SPSS) version 18 was used to analyse the data collected. The relative effects of the project-related factors on construction labour productivity and test of difference between building craftsmen and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity were analysed using Mean Item Score (MIS), and Mann-Whitney U test respectively. Mann-Whitney test being the non-parametric alternative to the t test was selected as the statistical tool for data analysis because the data were collected on an ordinal scale. Therefore, non-parametric statistic was considered most suitable for the statistical analysis of such data (Pallant, 2007; Udofia, 2011). MIS was obtained by dividing the total score by the number of respondents for each factor. A baseline of MIS = 2.5 was used to determine the significance of the effect of the factors. Factors having MIS $\geq$ 2.5 were considered as having significant effect while factors with MIS < 2.5 as having insignificant effect. This is consistent with the approach adopted in related previous studies (Adamu *et al*., 2011; Durdyev and Mbachu, 2011).

Results

Building Craftsmen and Project Supervisors'/Engineers' Perceptions of the Relative Effects of Project-Related Factors on Construction Labour Productivity

The perceptions of building craftsmen and project engineers/supervisors of the relative effects of project-related factors on construction labour productivity are presented in Table 1. The result indicates that building craftsmen and site supervisors/engineers consider 17 project-related factors having MIS $\geq$ 2.5 to have significant effects and only one as having insignificant effect on construction labour productivity. The ranks of the effects of the factors on construction labour productivity as perceived by building craftsmen and site supervisors/engineers are as presented in Table 1.

Difference between Building Craftsmen' and Project Supervisors'/Engineers' Perceptions of the Relative Effects of Project-Related Factors on Construction Labour Productivity

In order to achieve the second objective of the study the perceptions of building craftsmen and project supervisors/engineers of the relative effects of project-related factors on construction labour productivity in the study area were compared for agreement or disagreement. For this purpose, the research hypothesis states as follows:

H_o: There is no significant difference between building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity

The results of the test of the hypothesis are presented in Table 2 and it shows that building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity are statistically the same ($p < 0.05$). This, therefore, implies that views of craftsmen and project supervisor/engineers could be considered when considering measures to mitigate the effects of significant project-related factors on construction labour productivity.

Selected Project Team Members' Perceptions of the Relative Effects of Project-Related Factors on Construction Labour Productivity

Having concluded that building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity are the same, data collected from the two selected project team members were combined. The combined data were analysed to determine the perceptions of selected project team members on the relative effects of project-related factors on construction labour productivity in the study area. Table 3 shows the result. The result indicates that out of seventeen factors having MIS greater than or equal to 2.5, 'specification and standardisation', 'availability of material', 'project goals and milestones', 'high quality of required works' and 'availability of drawings' are the first five significant project-related factors affecting

construction labour productivity respectively. On the other hand, 'stoppages because of disputes with owners/consultants' is the only insignificant project-related factor with MIS of 1.76 and is ranked the least of all the factors.

Discussion

This study has shown that building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity are statistically the same. This implies that the selected project team members who constitute respondents for the study agree on factors that significantly and insignificantly affect construction labour productivity. Based on this, the selected project team members considered 'specification and standardisation', 'availability of material', 'project goals and milestones', 'high quality of required works' and 'availability of drawings' as the first five significant project-related factors affecting construction labour productivity respectively.

The ranking of 'specification and standardisation' as one of the first significant factors affecting construction labour productivity is in agreement with the study carried out by Makulsawatudom *et al*. (2004) on critical factors influencing construction productivity in Thailand where it was identified as one of the critical factors. In addition, Nigeria being a developing country where the use of prefabricated material on building projects is not common, hence lack of experience in the use of such technology may also have accounted for this factor being ranked first. Problems with adverse material management conditions that involve supplying and shipping have been noted among major causes of productivity losses (Kazaz *et al*. 2008). Non availability of material has been identified as one of the frequently occurring productivity factors on construction sites (Dai *et al*. 2009). Goal setting has been noted as one of the motivational strategies used to improve workers' productivity (Appelbaum 2004). In view of this, Dai *et al*. (2009) identified project goals and milestones as a factor capable of affecting the productivity of construction workers. It follows also that the absence of it could as well affect productivity negatively. Odesola (2012) opined that the nature of project under construction may require high quality of both workmanship and material of which meeting this requirement could affect the productivity of labour. Concurring with this, Enshassi *et al*. (2007) observed that high quality of required work is one of the factors affecting construction labour productivity in the Gaza strip. It is not uncommon for some projects to begin without a working drawing, probably because of the need to start the project quickly. Research has shown that non-availability of drawings affects labour productivity (Mourgues and Fischer, 2008). In the same vein, Dai *et al*. (2009) identified non-availability of drawings as one of the frequently occurring factors affecting construction labour productivity on construction sites. It could however, be inferred that commencement of construction projects without the required project documents is prevalent in the study area and may have accounted for this factor ranking among the first five significant project-related factors affecting the productivity of construction labour.

Conclusion/Recommendations

This study concludes that building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity are the same. Therefore, they agree on project-related factors that significantly and insignificantly affect construction labour productivity. In view of this 'specification and standardisation', 'availability of material', 'project goals and milestones', 'high quality of required works' and 'availability of drawings' were considered to be the first five significant project-related factors affecting construction labour productivity respectively. The study observes that commencement of construction projects without the availability of the required project documents has significant effect on construction labour productivity. In addition, it was also noted that the effects of project specifications, availability of material and

high quality of required works on construction labour productivity could be significant enough for appropriate measures to be taken at the pre-construction stage in order to enhance project performance. It is therefore recommended that construction managers should make more explicit project specifications; address the effects of availability of materials, high quality of required works and non-availability of project documents on construction labour productivity with clients and motivate craftsmen with realisable goals and milestones.

Table 1 Building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity

	Building Craftsmen' Perceptions			Project Supervisors'/ Engineers' Perceptions		
Project-Related Factors Affecting Construction Labour Productivity	Sum	MIS	Rank	Sum	MIS	Rank
Availability of material	374	4.02	2	262	4.16	1
Specification and standardisation	404	4.34	1	248	3.94	2
High quality of required works	354	3.81	4	233	3.70	3
Availability of drawings	333	3.58	8	220	3.49	4
Project goals and milestones	374	4.02	2	218	3.46	5
Working overtime	278	2.99	14	216	3.43	6
Working within a confined space	302	3.25	10	211	3.35	7
Construction method	342	3.68	6	209	3.32	8
Poor access to work area (e.g. poor scaffolds)	286	3.08	11	206	3.27	9
Design complexity	235	2.53	17	204	3.24	10
Change orders	283	3.04	12	200	3.17	11
Needed information not on drawings	282	3.03	13	196	3.11	12
Drawing legibility	353	3.80	5	192	3.05	13
Interference	323	3.47	9	191	3.03	14
Not receiving directives due to size of the project	248	2.67	15	189	3.00	15
Drawing errors	245	2.63	16	176	2.79	16
Poor material quality	339	3.65	7	165	2.62	17
Stoppages because of disputes with owners/consultants	171	1.84	18	104	1.65	18

*N = 93 for building craftsmen, N = 63 for project supervisors/engineers

Table 2 Mann-Whitney U test for difference in building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity

Parameter tested	N	U-value	Z-value	p-value	Decision
Building craftsmen' and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity	36	147.500	-.459	0.646	Accept

*BYS = Bayelsa

Table 3 Selected project team members' perceptions of the relative effects of project-related factors on construction labour productivity

Project-related factors Affecting Construction Labour Productivity	1	2	3	4	5	Sum	MIS	Rank
Specification and standardisation	0	0	25	78	53	652	4.18	1
Availability of material	0	0	18	108	30	636	4.08	2
Project goals and milestones	0	11	32	91	22	592	3.79	3
High quality of required works	0	6	55	65	30	587	3.76	4
Availability of drawings	0	6	59	91	0	553	3.54	5
Construction method	0	0	73	83	0	551	3.53	6
Drawing legibility	0	13	63	70	10	545	3.49	7
Interference	0	7	103	39	7	514	3.29	8
Working within a confined space	0	0	118	31	7	513	3.29	9
Poor material quality	0	24	83	38	11	504	3.23	10
Working overtime	0	34	71	42	9	494	3.17	11
Poor access to work area (e.g. poor scaffolds)	0	0	132	24	0	492	3.15	12
Change orders	0	14	113	29	0	483	3.10	13
Needed information not on drawings	0	44	58	54	0	478	3.06	14
Design complexity	0	44	97	15	0	439	2.81	15
Not receiving directives due to size of the project	7	45	76	28	0	437	2.80	16
Drawing errors	0	78	53	19	6	421	2.70	17
Stoppages because of disputes with owners/consultants	43	107	6	0	0	275	1.76	18

*N = 156

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