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Comparing Occupational Health and Safety (OHS) Management Efforts and Performance of Nigerian Construction Contractors

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Abstract: The study compares the management efforts and performance of construction contractors in Nigeria with regard to Occupational Health and Safety (OHS). The purpose of the study is to help all categories of construction contractors in Nigeria to improve their management efforts related to OHS. Toward this end, a field survey was conducted with a sample of forty contractors selected via purposive sampling. The scope of operations of the contractors was designated as multinational, national, regional or local. Six OHS management parameters and seven OHS performance parameters were used, and data were collected using structured questionnaires and analysed using mean and analysis of variance. The results reveal that contractors' OHS-related management efforts are not correlated with the scope of their operations. The OHS performance of the contractors remains the same in terms of six performance indicators but differs in terms of the rate of accidents per worker. The study results also reveal that the accident and injury rates in the Nigerian construction industry are high. Thus, the results reveal the challenges facing Nigerian contractors and other stakeholders working to improve the OHS performance of the industry. The findings indicate the need for effective risk management and regulation and control of OHS in the Nigerian construction industry.

Keywords: Multinational contractors, National contractors, Nigeria, OHS management efforts, OHS performance

INTRODUCTION

Contractors occupy a significant position in the construction industry and, as a group, are regarded as one of the major players in that industry. Researchers regard contractors as one of the most important participants in the industry (Mayaki, 2003; Idoro, 2004). Contractors produce the majority of construction products in Nigeria (Ministerial Committee on Causes of High Government Contracts, 1982; Federal Ministry of Works and Housing, 2003), and because they execute the construction projects and employ the workers for those jobs, they are one of the parties that influence OHS conditions in the industry.

Nigerian construction contractors can be sorted into categories based on the scope of their operations. There are four categories of contractors: local, regional, national and multinational. The scope of operations

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of local contractors is the narrowest, whereas that of multinational contractors is the widest. Local contractors operate within one of the thirty-six states in Nigeria, whereas regional contractors operate within a geo-political zone made up of five or six states. National contractors operate within the six geo-political zones or 36 states and the Federal Capital Territory (FCT) in Nigeria, whereas multinational contractors operate in Nigeria and other countries. Because of the differences in the scope of their work, these four categories of contractors also tend to differ in other ways, including their financial/managerial structures, technical capabilities, and level of patronage (Federal Ministry of Works and Housing, 2003). It is also supposed that the four categories of contractors may differ in terms of their degree of OHS management and their performance in this area. A previous study examined the OHS management efforts and performance of Nigerian contractors (Idoro, 2008). Although the study findings reveal the level of management efforts made by Nigerian contractors seeking to maintain a healthy and safe work environment and analyse their impact, the study did not investigate OHS management efforts or the performance of the different categories of contractors in Nigeria. It is important for contractors and other stakeholders in the Nigerian construction industry to understand the efforts made by the different categories of contractors seeking to maintain a healthy and safe construction environment. This study attempts to fill this gap by using the parameters employed in the earlier study. The study evaluates OHS management efforts by construction contractors in Nigeria and determines the effects of those efforts. The objective of the study is to compare the OHS management efforts and performance of four categories of Nigerian construction contractors.

OHS REGULATIONS

Galbraith (1989) and Fellows et al. (2004) opine that OHS regulations for the construction industry are based on those in the United Kingdom. In Nigeria, almost all existing OHS regulations originated in foreign countries (Idoro, 2004). The existing Factory Act of 1990 is an adaptation of the UK Factory Act of 1961. The Occupation Safety and Health Act of 1970 was originally an American regulation. The Control of Substances Hazardous to Health Regulations of 1988, the Personal Protective Equipment at Work Regulations of 1992, and the Management of Health and Safety at Work Regulations of 1999 are all British regulations and are in force in European countries. The Manual Handling Operations Regulations of 1992 and the Construction Design and Management (CDM) Regulations of 2007 are also UK regulations. Apart from the Factory Act of 1994, which was enacted by the legislative arm of the Nigerian government, no other OHS regulations that exist in European and other foreign countries have yet been put into force in Nigeria.

The term PPE describes any device or appliance designed to be worn or held by an individual for protection against one or more OHS hazards (HMSO, 2002). Two notable regulations, the Factory Act of 1990 and the Personal Protective Equipment (PPE) Regulations of 2002, are specifically concerned with regulating the use of PPE. The Factory Act of 1990 is the Nigerian version of the Factory Act of Britain. It was enacted and came into force in 1990. Articles 47 and 48 contain regulations governing the provision of PPE for workers. The provisions of the Act do not apply to the construction industry because Article 87 defines a factory as including only premises in which articles are made or prepared incidentally to the carrying on of construction work; this definition does not extend to premises in which such work is being conducted overall (Federal Government of Nigeria, 1990). Thus, construction sites and the activities conducted therein are not covered under the Act. The PPE regulation of 2002 is a European Community directive that came into force on 15 May 2002. The directive took the place of four others before it: the PPE (EC Directive) of 1992 and its amendments in 1993, 1994 and 1996. It applies to the member states of European Union (HMSO, 2002). The directive is only a reference document in Nigeria; a Nigerian version does not exist. The provisions of the directive mainly address the design and manufacture of PPE but do not specifically cover construction activities (Idoro, 2007b).

Overall, neither the Factory Act of 1990 nor the PPE (EC Directive) of 1992 adequately cover construction sites and their operations. Thus, in terms of OHS, the work of construction contractors and other employees is therefore unregulated.

LITERATURE SURVEY

Contractors' Scope of Operation

Construction contractors are usually categorised using several criteria. In Nigeria, the scope of operations of contractors is a common criterion used. Researchers use this criterion to categorise contractors as either national or multinational (Edmonds, 1979; Ogunpola, 1984; Olateju, 1991; Samuel, 1999). National contractors are those contractors whose scope of operations is limited to Nigeria, whereas multinational contractors are those who operate in foreign countries and in Nigeria. As a result, the former operate within existing Nigerian regulations and standards, which can be referred to as local regulations, whereas the latter operate under both local and foreign regulations and standards. Some multinationals even prefer to employ international regulations and standards such as British standards (BS), US standards and International Standard Organisation (ISO) and International Labour Organisation (ILO) standards.

Researchers also use the scope of operations to classify contractors as local, regional, national and multinational (Idoro, 2007a). In terms of its political structure, Nigeria is divided into 774 local governments, 36 states and a Federal Capital Territory (FCT), all of which are made up of varying numbers of local governments and 6 geo-political zones. Local contractors are those whose operations are limited to one state in Nigeria. Regional contractors operate within one of the six geo-political zones in Nigeria, whereas national contractors operate in more than one zone in Nigeria.

OHS Performance

Safety performance is the OHS conditions at a construction site. Researchers use several measures of OHS performance. The most common measure is the accident rate (HSS, 2001; 2003; Bhutto et al., 2004). Another common measure used by researchers is the rate of fatal injuries (Kartam, 1997; OSHA, 1999; Koehn et al., 2000; HSS, 2001; 2003; HSE, 2006; Bhutto et al., 2004; Carrigan, 2005). Marosszeky et al. (2004) maintain that safety management systems have largely been developed in response to statutory requirements and OHS reporting focuses mostly on mandatory information related to accidents and injuries. These two parameters are part of the category of OHS performance indicators called negative performance indicators (NPIs), lead time indicators (LTIs) or lag factors. The importance of these two factors is emphasised in several OHS regulations, including the Factory Act and the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) of 1995, which stipulate that such cases should be reported. The Factory Act of 1994, which is operational in Nigeria, requires that accidents and injuries that occur in factories be reported to the relevant authority, which in the Nigerian case is the Ministry of Labour and Productivity. RIDDOR 1995 requires the 'responsible person' to notify the relevant enforcing authority of any death, reportable injury, disease or dangerous occurrence. In addition to their emphasis on accident and injury records, the two parameters are important because together, they constitute a yardstick for comparing the OHS performance of different industries and countries (Kartam, 1997; Koehn et al., 2000; Bhutto et al., 2004; Carrigan, 2005; Check, 2007; Enshassi et al., 2007). Dingsdag et al. (2008) consider them to be reliable, comparable, standardised indicators of safety performance which also regarded as objective measures of safety performance because personal judgement is not required here. The standards developed for measuring these factors are used across industries and countries and can be used as reliable indicators of the OHS status of every work environment. The above studies and regulations show that accident and injury records and rates are the most reliable and objective indicators of how healthy and safe a work environment is. Indeed, because OHS status of construction work environments, accident and injury rates are the most common measures of OHS performance.

Although research studies such as the one presented in this paper inevitably use accident and injury rates as parameters of OHS performance, the two parameters have several limitations. Dindsdag et al. (2008) describe lag indicators as negative indicators because they are concerned with measuring negative performances or failures. The main weakness of lag factors is that they do not indicate how to improve OHS performance. Another limitation of lag factors is that they may be under-reported. In EU countries in which RIDDOR 1995 applies, contractors are unlikely to report all accidents and injuries that occur on their construction sites because they view such reports as having a negative effect on their image. In other countries (particularly developing ones) in which RIDDOR 1995 does not apply, there are limitations on the reliability of records of accidents and injuries because there are no regulations in place that mandate the reporting of such incidents and no authority to which the incidents can be reported. In Nigeria, the provisions of the Factory Act of 1994 and the activities of factory inspectors who enforce them do not cover the construction industry. RIDDOR (1995) describes the responsible individuals as employers or clients (or the contractors for self-employed individuals), but the regulation does not apply to non-EU countries such as Nigeria. Trethewy et al. (2000) and Mohammed also (2003) criticise these measures and suggest the use of subjective measures. They observe three issues with these measures. The first is that they measure what happens after an event; they provide for only a reactive management response. The second is that in the absence of proactive measures, causal relationships cannot be established. The third is that they are negative in nature and are acknowledged as unsuccessful measures of safety performance. Given these drawbacks, Marosszeky et al. (2004) suggest a shift of focus towards detailed management-oriented measurements such as the subjective performance rating used by Jasekris (1996), the Site Safety Meter based on traditional site inspection developed by Trethewy et al. (2000) and the measures of exposure to heights, housekeeping and availability of personal protective equipment used by Marsh et al. (1995).

All of these considerations have the potential to influence a project and the behaviour of the workers involved. Marosszeky et al. (2004) classify performance measurement in the 'lean movement' in construction into two broad categories: outcome- and process-based performance measurements. Typical examples of outcome-based performance measurement are measures of safety issues, quality and environmental failures, productivity, delivery reliability, customer satisfaction, cost and schedule variations, design/documentation deficiencies and management dimensions such as leadership and training. Typical examples of process-based performance measurement are measures of waste as defined in lean construction, look-ahead planning and plan percentage complete (PPC), safety process improvements, quality process

improvements and use of lean ideas. The limitations on the use of accidents and injuries examined above show that research studies on OHS cannot rely exclusively on these two parameters; instead, they should also use subjective measures such as the ones reviewed above.

Apart from management-oriented measures, researchers also advocate the use of positive performance indicators (PPIs) or lead factors. PPIs or lead factors reflect the OHS culture of an organisation. They focus on organisation and work processes and structures that can influence OHS performance. Sweeney (1994) suggests that the processes measured include the effectiveness of training programmes, OHS structures, and OHS representatives, as well as return to work rates. The development and implementation of PPIs has been strongly advocated because they have the capacity to generate improvements in safety performance. Despite the general endorsement of PPIs, their development and implementation are also challenging. The first challenge has to do with their measurement. Researchers have made attempts to develop acceptable guidelines for measuring PPIs. Choudhry et al. (2007) observe that traditionally, organisational culture is measured using qualitative methods such as observations and interviews. Costigan and Gardner (2000) identify three dimensions of safety culture: psychological, situational and behavioural. These, they say, can be measured using a combination of qualitative and quantitative methods. Dingsdag et al. (2006a; 2006b) devise a matrix of safety-related cultural competencies including safety-related behaviours and safety management tasks (SMTs) for the Australian construction industry. Despite these and several other efforts made at workshops, seminars and conferences, Shaw (1994) and Dingsdag et al. (2008) maintain that there are still no standard national and international PPIs or other lead indicators measuring OHS culture or OHS performance that are accepted by the construction industry or any other industry. They also assert that although PPIs are linked to non-behavioural processes and measure the number of OHS-oriented activities, there are no indications of the measurability of these activities themselves.

Another shortcoming of PPIs that is caused by the measurability problem is parameter standardisation. Blewett (1994) and Shaw (1994) opine that PPIs may not be generalised because there is no standardised application of PPIs. Dingsdag et al. (2008) report that a series of workshops and papers commissioned by the National Occupational Health and Safety Commission (NOHSC) of Australia indicated that individual organisations should use an industry-wide framework to develop PPIs and achieve improved OHS performance. Common limitations of PPIs identified by Dingsdag et al. (2008) are that they may not directly reflect actual success in preventing injury and/or disease, they cannot not be easily measured, they are difficult to use for benchmarking or comparative purposes, they are time-consuming to collect and collate, they may be subject to

random variation, they may encourage under- or over-reporting depending on how they are measured, they only measure the number of events without providing any indication or measure of the effectiveness of each measured event and the relationship between them and LTIs are arbitrary.

Another parameter that could also be used as a measure of OHS performance is the level of compliance with PPE regulations. PPE is seen as a tool for reducing possible injuries as a result of accidents. Because injury rates are widely accepted as OHS performance indicators, the level of compliance with PPE regulations may be important as a factor influencing the rate of injury. However, as a factor in OHS performance, the level of compliance with PPE regulations has its limitations. In a study of the influence of PPE usage levels on OHS performance in the Nigerian construction industry, Idoro (2007a) reveals that the usage levels of six PPEs have no significant correlation with injury rates. The results of the study show that the PPE usage levels are not a good measure of OHS performance. Compliance with PPE regulations should be a measure of last resort.

OHS Management Efforts and Their Performance

Contractor efforts at planning and controlling OHS are numerous, and each has an influence on OHS performance. In a study on this subject, Idoro (2008) examines six types of OHS management efforts by Nigerian contractors. Three of these were measured at very high levels: efforts to provide PPE to workers, comply with OHS regulations and provide OHS facilities. These effort types ranked 1, 2 and 3, respectively, in terms of the level of effort extended by managers. The remaining three types of effort (to maintain structures for managing OHS at head and site offices and to provide OHS incentives to workers) were measured at low levels. The effort levels associated with these activities were ranked 4, 5 and 6, respectively. The evaluation of the influence of these efforts revealed that five of these types of efforts have a minimal or no influence on OHS performance. The study results indicate that these strategies only affect contractor perceptions of how efficient the structures are that they put in place at their head and site offices to manage OHS. They do not influence actual OHS performance (i.e., accident or injury rates). However, efforts to manage OHS on site have a greater influence than the remaining five types of effort. These activities were discovered to have an influence both on contractor perceptions of structure efficiency and on the level and frequency of occurrence of injuries.

RESEARCH METHODS

Two research hypotheses were postulated in this study. The first hypothesis states that multinational, national, regional and local contractors in Nigeria do not differ significantly in their OHS management efforts. This hypothesis was postulated to determine whether or not the four categories of contractors in Nigeria invest the same levels of effort into ensuring that their construction sites are healthy and safe for workers. The second hypothesis states that multinational, national, regional and local contractors in Nigeria do not differ significantly in their OHS performance.

The variables used in the study were sorted into two groups: variables measuring OHS management efforts and variables measuring OHS performance. Six variables were used to measure OHS management efforts: compliance with OHS regulations, the provision of OHS facilities, structures for managing OHS at head and site offices, the provision of Personal Protective Equipment (PPE) and OHS incentives. Both subjective and objective measures were used as parameters of OHS performance. Subjective OHS performance parameters include respondent assessments of the performance of structures for managing OHS at head and site offices, whereas objective OHS performance parameters include the number of accidents, the number of injuries, the rate of accidents per worker, the rate of injuries per worker and the rate of injuries per accident in 2006.

A questionnaire survey approach was used in the study. A field survey was distributed to a sample of forty-two construction contractors. In selecting the population for the study, we did not have the correct data for contractors in Nigeria because the information was not available. A preliminary survey was therefore conducted. Based on the preliminary survey, ninety-six multinational, national, regional and local contractors were identified who were used as the population of the study.

Contractor compliance with 16 OHS regulations was investigated in this study. Those regulations are as follows: the Factory Act (1979), OHS at Work Act (1974), OHS Act (1992), Manual Handling Operations Regulations (1993), Personal Protective Equipment at Work Act (1993), Construction Design and Management Regulations (2007), Control of Substances Hazardous to Health Act (1998), Construction (Head Protective) Regulations (1989), Construction (Lifting Operations) Regulations (1961), Construction (General Provisions) Regulations (1961), Construction (Working Place) Regulations (1996), Provisions & Use of Work Equipment Regulations (1992), Safety Representatives and Committees Regulations (1977), Noise at Work Regulations (1989) and Construction (Health & Welfare) Regulations (1966). These regulations are the notable ones related to OHS that are applicable in Britain. They were used for this study because Nigeria as a former British colony does not yet have its own OHS regulations in the construction industry and still relies

mainly on British regulations and standards.

To evaluate PPE, six types of protective equipment were analysed in this study: protective clothing, helmets, safety boots, hand gloves, eye and ear protectors. Subjective measurements were used to evaluate the level of compliance with the regulations and the level of PPE provided. For this purpose, five score categories were used: nil, low, average, above average and high. These categories were assigned scores of 0.2, 0.4, 0.6, 0.8 and 1.0, respectively. The ratings were used to assign a ratio to represent each compliance level, with 1.0 as the highest compliance level. The level of compliance with OHS regulations was the sum of the respondent's levels of compliance with the 16 regulations divided by the number of regulations (16). This was expressed as $\sum$(RLC) n/16, where RLC represents the respondent's level of compliance with OHS regulations and *n* is 1–16. This evaluation was conducted to determine the level of compliance with each regulation by each respondent. The level of PPE provision was the sum of the scores for the respondent's level of provision of each PPE divided by the number of PPEs (6). This was expressed as $\sum$(RLP) n/6 where RLP represents the respondent's level of provision of PPE and n is 1–6. This measurement was also used to derive the mean level of provision of PPE.

Seven types of facilitates that can affect OHS (toilets, canteens, water supply, waste disposal, first aid facilities, site cleanliness and work environment) were evaluated. The provision of these facilities was also evaluated using subjective measurements. Five rankings were used: poor, fair, average, good and excellent. The rankings were assigned the same weights (0.2, 0.4, 0.6, 0.8 and 1.0, respectively) as they were when we measured the level of compliance with OHS regulations. Again, this made it possible to compute a ratio for each level of provision of OHS facilities, with the highest level of provision assigned a score of 1.0. A respondent's level of provision of OHS facilities was the sum of his/her scores for the seven types of facilities divided by the number of the facilities. This was expressed as $\sum$(RPF)n/7, where RPF represents respondent's level of provision of OHS facilities and where *n* is 1–7.

Five variables evaluating the OHS budget, OHS committee, OHS medical department, OHS training and awareness department and OHS emergency department for each manager were used to analyse OHS management at the head office. Another five variables evaluating the OHS representative, OHS committee, OHS plan, work method statement and OHS awareness programme unit for each manager were used to analyse structures for managing OHS on site. Four variables measuring safety bonuses, safety awards, safety gifts and promotions were used to evaluate what OHS incentives were provided. Where a particular element was present or absent, a 'yes or no' score was recorded, and the variable was weighted as 1 or 0, respectively. Respondents' levels of structures put

in place to manage OHS at head and site offices were calculated as the total score/5, whereas respondents' level of provision of OHS incentive was derived as total score/4.

Respondent assessments of the performance of OHS management structures at head and site offices were measured using five rankings: poor, fair, average, good and excellent. The rankings were also assigned the same weights (0.2, 0.4, 0.6, 0.8 and 1.0, respectively) as previously discussed for the same reason. The perceived performance of respondent structures for managing OHS at head and site offices was the sum of the rankings of the performance of each of the five structures divided by the number of the structures. This calculation was expressed as $\sum(PSM)n/5$ where PSM represents the respondent's assessment of the performance of structures for managing OHS and where *n* is 1–5.

To evaluate accident and injury rates, the study used cases reported by workers to the OHS department, the contract manager or the site manager. In many cases, medical treatment was given or an employee was excused from work as a result of the accident or injury. The data can be considered reliable because they covered major incidents.

The research instrument used in the study was a structured questionnaire. The questionnaires were completed by contractor staff members who were the heads of their respective OHS departments when the scope of their work was multinational, contract managers when the scope of their work was national or regional, or site managers when the scope of their work was local. The questionnaire included questions that covered the selected OHS regulations, PPEs, management structures, incentives and facilities, and the applicable rankings were selected to measure their performance. The respondents were requested to indicate those complied with, maintained or provided by their organisations. They were also required to select the rankings that represented their assessments of the level of compliance with the sixteen selected regulations, the level of provision of the seven selected OHS facility styles and six selected PPEs and the performance level of each of the five selected OHS management structures at their head offices and construction sites. The respondents were also requested to state the number of workers employed and the number of accidents and injuries reported by workers at their organisations in 2006. The instrument was administered to a population of 96 contractors, and a sample of 42 of the respondents (including 13 multinational contractors, 20 national contractors, five regional contractors and four local contractors) was selected for the study via purposive sampling based on the level of response and the accuracy of the data supplied in the completed questionnaires. Respondents who did not indicate the category of contractor that their organizations belonged to and others who indicated it but did not supply other

data required for the study were not used for the study. Additionally, only injuries that required medical attention at or outside the construction sites or those that required permission to be absent from work were used in the study. Contractors without medical records were excluded. The data collected were analysed using mean analysis of variance.

RESULTS AND DISCUSSION

The analysis of the data collected and the results obtained are presented and discussed as follows:

OHS Management Efforts of Construction Contractors

The OHS management efforts of contractors are defined by their levels of compliance with OHS regulations, the OHS facilities provided on site, the structures put in place for managing OHS at head and site offices, and the provision of PPE and OHS incentives to workers. The data collected were analysed according to the four categories of contractors. The levels of compliance with OHS regulations were derived as explained above, as were the levels of provision of PPE, OHS facilities and incentives and structures for managing OHS at head offices and site offices. The mean level of OHS management effort by respondents in each category of contractors was derived and ranked. The results are presented in Table 1.

The results presented in Table 1 show that the level of compliance of regional contractors with OHS regulations ($\overline{X}$=0.86) is the highest ranked. The level of compliance with OHS regulations of multinational contractors ($\overline{X}$=0.82) is ranked second, whereas those of national ($\overline{X}$=0.77) and local ($\overline{X}$=0.76) contractors rank third and fourth, respectively. The results indicate that regional contractors claim higher levels of compliance with OHS regulations than do either multinational or national contractors. The results tend to imply that the wider scope of operations of multinational and national contractors does not cause them to comply with OHS regulations more than their regional counterparts do.

Table 1 above also shows that the level of provision of OHS facilities on site by multinational contractors ($\overline{X}$=0.39) rank first. The level of provision of OHS facilities on site by national contractors ($\overline{X}$=0.37) rank second while those of regional ($\overline{X}$=0.28) and local ($\overline{X}$=0.20) contractors rank third and fourth respectively.

The results presented in Table 1 show that the structures for managing OHS in head office maintained by multinational contractors ($\overline{X}$=0.39) rank first, whereas those of national ($\overline{X}$=0.37), regional ($\overline{X}$=0.28) and local ($\overline{X}$=0.20) contractors rank second, third and fourth, respectively. These results also imply that contractors with

Table 1. Ranking of OHS Management Efforts by Selected Construction Contractors in Nigeria

OHS Management Variable	N	Mean	Rank	OHS Management Variable	N	Mean	Rank
OHS regulation compliance				**Head office OHS structures**			
Regional	4	0.86	1	Multinational	13	0.39	1
Multinational	12	0.82	2	National	20	0.37	2
National	20	0.77	3	Regional	5	0.28	3
Local	2	0.76	4	Local	4	0.20	4
OHS facilities				**Provision of PPE**			
Multinational	13	0.39	1	Multinational	13	0.90	1
National	20	0.37	2	National	19	0.90	2
Regional	5	0.28	3	Regional	5	0.82	3
Local	4	0.20	4	Local	4	0.70	4
Site office OHS structures				**OHS incentives provided**			
National	20	0.47	1	Multinational	13	0.35	1
Multinational	13	0.39	2	National	19	0.33	2
Local	4	0.35	3	Local	5	0.31	3
Regional	3	0.28	4	Regional	4	0.20	4

N=Number; OHS=Occupational Health and Safety

a wider scope of operations maintain more structures for managing OHS at their head offices than do their counterparts with a narrower scope of operations. The implication is that the level of contractor efforts to provide structures for managing OHS at head offices is a reflection of the scope of their operations.

Table 1 shows that the structures for managing OHS on site maintained by national contractors ($\overline{X}$=0.47) rank first, whereas those of multinational ($\overline{X}$=0.39), local ($\overline{X}$=0.35) and regional ($\overline{X}$=0.28) contractors rank second, third and fourth, respectively. The results indicate that the level of contractor efforts to provide structures for managing OHS at head offices differs from the level of

efforts made to provide structures for managing OHS on site. Contractor structures for managing OHS on site do not reflect the scope of their operations because national contractors whose operations are limited to Nigeria claim to have put in place more structures for maintaining a healthy and safe work environment on site than do their multinational counterparts who operate within and outside the country. Also, local contractors who operate within one Nigerian state claim to have more of such structures than their regional counterparts who operate in more than one state in Nigerian.

Table 1 also shows that the level of provision of PPE to workers on site by multinational ($\overline{X}$=0.90) and national ($\overline{X}$=0.90) contractors is ranked first, whereas the provision levels of regional ($\overline{X}$=0.82) and local ($\overline{X}$=0.70) contractors are ranked third and fourth, respectively. The results imply that multinational and national contractors perform equally well (and better than regional and local contractors) in providing PPE to workers. Because PPE is provided to prevent workers from sustaining injuries in the event of an accident, these results indicate that workers employed by multinational and national contractors enjoy the same protection from injury when at work. The results also indicate that the level of protection provided to workers employed by contractors in these two categories is greater than the level of protection provided to workers employed by regional and local contractors.

The results indicating what OHS incentives are provided to workers, as presented in Table 1, show that multinational contractors provide the most OHS incentives to workers ($\overline{X}$=0.35). National contractors ($\overline{X}$=0.33) rank second in this regard, whereas local ($\overline{X}$=0.31) and regional ($\overline{X}$=0.20) contractors rank third and fourth, respectively. The results indicate that multinational contractors operate more OHS incentive schemes than their counterparts whose operations are limited to Nigeria. Similarly, national contractors operate more OHS-related incentive schemes than do either regional or local contractors. If the incentive schemes provided are effective and influence the work attitudes and habits of workers with regard to OHS, multinational contractors should exhibit better OHS performance than their national, regional and local counterparts. Similarly, national contractors should perform better than regional and local contractors with regard to OHS performance.

Test of Hypothesis for Differences in OHS Management Efforts by Construction Contractors

The study was also intended to determine the significance of the variation in the OHS management efforts of contractors. The analysis involved testing the first hypothesis of the study, which states that multinational, national, regional and local contractors in Nigeria do not differ significantly in their OHS management efforts. The hypothesis was tested using the analysis of variance (ANOVA) at $p \leq 0.05$. When the p-value > 0.05, the

Table 2. Analysis of Variance in OHS Management Efforts of Selected Construction Contractors

Variable	N	F-value	df	p-value	Decision
OHS regulation compliance	38	1.595	3	0.209	Accept
OHS facilities	42	0.689	3	0.564	Accept
Head office OHS structures	42	0.977	3	0.414	Accept
Site office OHS structures	42	0.795	3	0.504	Accept
Provision of PPE	42	1.973	3	0.134	Accept
OHS incentives	41	0.419	3	0.740	Accept

N=Number of respondents; df=Degree of freedom; OHS=Health and Safety

hypothesis was accepted, but when the p-value ≤ 0.05, the hypothesis is rejected. The results are presented in Table 2.

The results in Table 2 show that the p-values for testing differences in levels of compliance with OHS regulations (0.209), provision of OHS facilities (0.564), structures for maintaining OHS at head (0.414) and site offices (0.504), provision of PPE (0.134) and provision of OHS incentive schemes (0.740) for the four categories of contractors are greater than the critical p-values (0.05). Therefore, the hypothesis is accepted. The results indicate that the levels of compliance with OHS regulations, the levels of provision of OHS facilities, the structures provided for managing OHS at head and site offices and the provision of PPE and OHS incentive schemes do not differ significantly for the four categories of contractors. The results of the ranking procedure indicate that four categories of contractors exhibit different degrees of effort to maintain a healthy and safe work environment. However, the results of the analysis of variance of these differences indicate that the differences are actually insignificant. The results therefore imply that the efforts of construction contractors to ensure a healthy and safe work environment do not reflect the scope of their operations. The advantages of multinational contractors operating in foreign countries are not reflected in greater efforts, concern and/or consciousness regarding OHS than their nationally, regionally or locally based counterparts exhibit.

OHS Performance of Construction Contractors

To investigate the OHS performance of the respondents, the six variables detailed above were used. Data were collected on the respondents' assessments of the performance of the various structures they had put in place at head and site offices to help maintain a healthy and safe work environment. Data were also collected regarding the number of workers employed and the accidents and injuries recorded in 2006. The accident per worker, injury per worker and injury per accident rates for each respondent were derived from the data. The mean performance of the respondents in the four categories of contractors with regard to each of the six indicators of OHS performance were derived and ranked to compare their OHS performance. The results are presented in Table 3.

The results in Table 3 show that according to respondent assessments, multinational contractors do the best job of providing structures for managing OHS in head offices ($\overline{X}$=0.77) ranks first. Also according to respondent assessments, national contractors rank second in this regard ($\overline{X}$=0.73), whereas local ($\overline{X}$=0.71) and regional ($\overline{X}$=0.65) contractors rank third and fourth, respectively. The results indicate that the structures maintained by multinational contractors for the management of OHS at head offices are the most effective, despite the findings in Table 1 indicating that the structures maintained by contractors in this category do not differ from those offered by indigenous contractors. The structures provided by national and local contractors are less (but not substantially less) effective, whereas those of regional contractors are the least effective. Consistency is observed between the effort and performance rankings with regard to this variable. This finding indicates that the performance of the OHS structures put in place by multinational and national contractors at head offices is as a result of their efforts.

The results in Table 3 show that according to respondent assessments, the performances of structures used by multinational ($\overline{X}$=0.77) and national ($\overline{X}$=0.77) contractors to manage OHS on site rank first, whereas those of regional ($\overline{X}$=0.76) and local ($\overline{X}$=0.76) contractors rank third. These results imply that the efforts of multinational and national contractors to ensure a healthy and safe on-site environment have the same degree of effectiveness. The same is true of the efforts of regional and local contractors.

The results presented in Table 3 show that the mean number of accidents recorded in 2006 by regional contractors ($\overline{X}$=7) ranks first. The mean number of accidents recorded in 2006 by local contractors ($\overline{X}$=4) ranks second, whereas of the scores for national ($\overline{X}$=3) and multinational ($\overline{X}$=2) contractors rank third and fourth, respectively. These results indicate that multinational contractors, having recorded the least

Table 3. Ranking of OHS Performance of Selected Construction Contractors

Variable	N	Mean	Rank	Variable	N	Mean	Rank
H/O OHS structures performance				**Accident per worker**			
Multinational	13	0.77	1	Local	1	0.27	1
National	20	0.73	2	National	5	0.11	2
Local	3	0.71	3	Regional	2	0.03	3
Regional	4	0.65	4	Multinational	8	0.02	4
S/O OHS structures' performance				**Injury per worker**			
Multinational	13	0.77	1	National	9	0.41	1
National	19	0.77	1	Multinational	8	0.37	2
Local	3	0.76	3	Local	2	0.21	3
Regional	5	0.76	3	Regional	2	0.05	4
Number of accidents				**Injury per accident**			
Regional	2	7	1	Multinational	6	13.03	1
Local	1	4	2	National	5	6.98	2
National	5	3	3	Local	2	1.71	3
Multinational	8	2	4	Regional	1	1.25	4
Number of injuries							
Multinational	8	31	1				
National	9	13	2				
Local	2	11	3				
Regional	3	4	4				

N=Number; H/O=Head office; S/O=Site office; OHS=Occupational Health and Safety

number of accidents for the year, achieved the best OHS performance. They are closely followed by national and local contractors, whereas regional contractors exhibited the worst performance.

The accident records of the respondents were further investigated via an analysis of accident per worker rates for 2006. The results presented in Table 3 show that the accident per worker rate for local contractors in 2006 ($\overline{X}$=0.27) is the highest, whereas that of national contractors ($\overline{X}$=0.11) and regional contractors ($\overline{X}$=0.03) are the second and third highest, respectively. The accident per worker rate for multinational contractors in 2006 ($\overline{X}$=0.02) is the lowest. These results indicate that multinational contractors, who are categorised as large contractors because they employ more workers than other contractors, have the best performance in terms of their accident per worker rate. In this regard, they are closely followed by regional contractors. National contractors are ranked third, and local contractors exhibited the worst performance in terms of their accident per worker rate.

The results indicating the injuries sustained by workers in 2006 in Table 3 show that the mean number of injuries sustained by workers employed by multinational contractors ($\overline{X}$=31) is the highest, whereas the corresponding figures for national contractors ($\overline{X}$=13), regional contractors ($\overline{X}$=11) and local contractors ($\overline{X}$=4) rank second, third and fourth, respectively. The results indicate that multinational contractors recorded the highest average number of injuries per respondent. National contractors recorded the second highest number of injuries per respondent, whereas regional contractors recorded the third highest number of injuries per respondent. Local contractors recorded the least number of injuries per respondent. These results are the reverse of those for structures for managing OHS and accident rates.

To determine possible reasons for these results, it was important to analyse the number of injuries per worker and the number of injuries per accident as reported by the respondents for 2006. These results, as recorded in Table 3, show that the injury per worker rate for national contractors ($\overline{X}$=0.41) is the highest. The injury rates per worker for multinational contractors ($\overline{X}$=0.37) and local contractors ($\overline{X}$=0.21) rank second and third, respectively, whereas the corresponding figure for regional contractors ($\overline{X}$=0.05) ranks fourth. These results indicate that workers employed by national contractors are most prone to injuries at work, followed by workers employed by multinational contractors. Surprisingly, the results indicate that workers employed by regional and local contractors are less prone to injuries than are workers employed by national and multinational contractors. This finding is also not in agreement with respondent assessments of the performance of structures used to

manage OHS or with accident rates.

The injuries per accident rates for 2006 were also analysed. The results in Table 3 show that the injury per accident rate for multinational contractors ($\overline{X}$=13.03) ranks first. The injury per accident rate of national contractors ($\overline{X}$=6.98) ranks second while the injury per accident rates of local contractors ($\overline{X}$=1.71) and regional contractors ($\overline{X}$=1.25) rank third and fourth respectively. These results indicate that the injury per accident rate for construction contractors in Nigeria increases with the scope of their operations. Because the injury per accident rate can indicate the level of risk associated with the construction methods adopted by contractors, the results thus imply that the construction methods of multinational contractors are the most risky and likely to result in worker injury, followed by those of national, regional and local contractors.

The findings of the study also show that the best accident per worker rate is 0.02 (this is the mean accident per worker rate for multinational contractors). The best injury per worker rate among Nigerian contractors is 0.05 (this is the mean injury per worker rate for regional contractors). These results indicate that the best accident per worker rate among Nigerian contractors in 2006 was 2 accidents per 100 workers, whereas of the best injury per worker rate for that year was 5 injuries per 100 workers. These rates are certainly on the high side and tend to indicate poor OHS status. Furthermore, the results that show that the injury per worker rate for regional contractors is the best indicate that the OHS performance of multinational contractors operating Nigeria who are discovered to be European firms (Samuel, 1999; Idoro, 2004) cannot be regarded as better than that of their indigenous counterparts who operate only in Nigeria.

Test of Hypothesis of Differences in OHS Performance of Construction Contractors

Additional attempts were also made to determine whether the differences between the OHS performance of the four categories of contractors (as presented in Table 3) are significant. Toward that end, a test of the differences in their OHS performance was conducted. The analysis made it possible to test the second hypothesis of the study, which states that multinational, national, regional and local contractors in Nigeria do not differ significantly in their OHS performance. The hypothesis was tested using the analysis of variance (ANOVA) method at $p \leq 0.05$. When the p-value > 0.05, the hypothesis was accepted, but when the p-value ≤ 0.05, the hypothesis is rejected. The results are presented in Table 4.

The results presented in Table 4 show that the p-values for the performance of structures used to manage OHS at head offices (0.441) and on site (0.999),

Table 4. Analysis of Variance in OHS Performance of Selected Construction Contractors

OHS Performance Indicator	N	F-value	Df	p-value	Decision
Head office OHS management structures	41	0.920	3	0.441	Accept
Site office OHS management structures	40	0.006	3	0.999	Accept
Accidents recorded in 2006	16	2.533	3	0.106	Accept
Accident per worker rate in 2006	16	3.882	3	0.038	Reject
Injuries recorded in 2006	21	2.682	3	0.080	Accept
Injury per worker rate in 2006	21	0.191	3	0.901	Accept
Injury per accident rate in 2006	14	1.049	3	0.413	Accept

N=Number of respondents, Df=Degree of freedom, OHS=Occupational health and safety

those for accident rates (0.106) and injury rates (0.080), and those for injury per worker rates (0.901) and injury per accident rates (0.413) for the four categories of contractors are greater than the critical p-value (0.05). Therefore, the hypothesis is accepted. The results show that there is no significant difference between the respondents' assessments of the performance of structures for managing OHS at head and site offices or between accident, injury, injury per worker and injury per accident rates for multinational, national, regional and local construction contractors in Nigeria. This finding indicates that the scope of operations of the contractors is not reflected in their OHS performance based on these parameters.

However, Table 4 shows that the p-value for the accident per worker rates (0.038) for the four categories of contractors is less than the critical p-value (0.05). Therefore, the hypothesis is rejected. This finding indicates that the 2006 accident per worker rates for multinational, national, regional and local contractors differed significantly. The OHS performance of the respondents indicates multiple differences between their performance levels. However, the results of the analysis of variance for these differences indicate that the differences besides that between the accidents per worker rates are insignificant. These results indicate that the effectiveness of the OHS-related management efforts made by the four categories of contractors in Nigeria is the same except in this one case. The results

show that multinational contractors perform best with regard to the accident per worker rate, followed by regional, national and local contractors. This finding is a reflection of the management efforts made by contractors seeking to develop a healthy and safe work environment. The earlier steps in the study procedure indicated that the efforts made by the four categories of contractors with regard to OHS are essentially the same. Based on these results, the performance of the contractors should also be expected to be the same.

In this study, two subjective measurements of OHS performance were evaluated: respondent assessments of the performance of structures used to maintain a healthy and safe work environment at head and site offices. The purpose of this step was to determine the reliability of the five objective measurements of OHS performance used in the study. The results in Table 4 tend to imply that according to respondent assessments, the performance of the structures that contractors have put in place to foster a healthy and safe work environment are consistent with the corresponding accident and injury rates. These results imply that contractor accident and injury rates are likely to be reliable despite the absence of regulations governing the reporting of accidents and injuries at construction sites.

CONCLUSION

This study has revealed that multinational, national, regional and local contractors in Nigeria do not differ with regard to their compliance with OHS regulations, structures put in place for OHS management at both head and site offices, or the provision of PPE, OHS facilities and related incentives. This finding indicates that even local and regional contractors in Nigeria invest the same management efforts as their multinational counterparts in seeking to achieve a safe and healthy construction work environment. The results of these efforts, as revealed in the OHS performance of the respondents sampled in this study, show that the four categories of contractors do not perform better than each other except in terms of their accident per worker rates. These results indicate that measures should be used by all stakeholders in the Nigerian construction industry (especially contractors, consultants and governments) to bring about improvements in OHS performance within the industry. Specifically, the rates of injury per worker and injury per accident reported by multinational and national contractors indicate the use of production methods by those contractors that promote high injury rates. Effective risk management practices should be used to identify the risks associated with various production methods, and measures should be put in place to prevent or minimise such risks before

these practices are adopted. Furthermore, the effective regulation and control of OHS practices in the Nigerian construction industry are extremely important and desirable because of the high accident and injury rates.

In an attempt to determine the reliability of accident and injury rates given the dearth of regulations regarding accident and injury reporting by construction contractors in Nigeria, the study adopted subjective measurements of OHS performances that are based on respondent assessments. However, the respondents are employees of the contractors being evaluated. In this study, it was not possible to use other stakeholders because of the nature of the other data collected for the study, which could only be supplied by the respondents. Further evaluations of OHS performance by Nigerian contractors will therefore be necessary. In these studies, other stakeholders such as consultants and clients should be used as the respondents.

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