Evaluation of Health and Safety Cost in Building Projects in Nigeria

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***Absract*:** Empirical evidence exist that construction contract documents contain scanty emphasis on health and safety requirements and budgeting in developing countries. This has affected the implementation of health and safety components and the sustainable delivery of construction projects. A number of studies have addressed the cost of construction health and safety. However, studies documenting the cost of the various components of health and safety seem scanty in construction literature. Consequently, the aim of this study was to evaluate the cost of implementing the health and safety components of buildings and the relationship with project cost. Using purposive sampling technique, 33 cost data for health and safety components of building projects were collected from a sample size of 25 out of a sampling frame of 57 Quantity Surveying consulting firms registered with the Lagos State Chapter of the Nigerian Institute of Quantity Surveyors. The data collected were analysed using mean and percentage. Findings from this study indicated that the three top health and safety components of building projects were scaffolding, staff safety training and personal protective equipment. The study concluded that the cost of implementing health and safety components in the study area was 1.69% and 2.02% for low-rise and high-rise buildings, respectively.

Keywords: Building, cost, health, project, safety.

Introduction

The construction industry is one of the largest contributors to global economy (Famakin et al., 2012). It is claimed to be a driver of economic growth in developing countries through the provision of infrastructure for other sectors of the economy to flourish thereby stimulating national development (Adebayo & Emoh, 2019; Alhajeri, 2011). It is hence described as the barometer for gauging the level of development of any country. The industry contributes about 11% to the gross domestic product (GDP) in most developing countries (Giang & Pheng, 2010). In Nigeria, Adeyemo and Smallwood (2017) reported that the industry accounts for 5.8% of the GDP and 1.88% of the employed population.

Health and safety are usually used together to express concern for the physical and mental well being of individuals at the work place. Muiruri and Mulinge (2014) described construction health and safety to include both physical and psychological well being of people who are likely to be adversely affected by construction activities. This includes workers, practitioners, end users and the general public. Alhajeri (2011) defined health as the protection of people from illness and safety as the protection of people from accident (physical injury or death).

Similarly, Hughes and Ferret (2008) described occupational health as the protection of body and mind of people from illness resulting from materials, processes or proceeding used in the work place while safety is the protection of people from physical injury. Safety means a state in which no danger of a damage causing accidents exists.

Construction is a high risk business because: its production processes are labour-intensive (Lessing et al., 2017; Yilmaz & Celebi, 2015); safety is perceived as unnecessary extra cost (Bilir & Gurcanli 2015; Okoye & Okolie, 2014); and heavy plants and equipment and workers with unproven capability are frequently engaged (Alhajeri (2011). The construction industry has been labelled to have a poor record of occupational health and safety (OH&S). Windapo (2013) reported that construction workers are six times more likely to be killed at work than those in other industries. Similarly, Muiruri and Mulinge (2014) claimed that construction workers are two to three times more likely to die on the job than workers of other industries with the risk of serious injuries almost three times higher. Abdul Rahim et al. (2008) concluded that the industry has one of the highest statistics of accidents and injury compared to other sectors due to poor budget allocation.

According to Latib (2014), the nexus between the health and safety performance of a construction project and budgeting is that, the higher the amount invested on safety, the higher the safety performance of the project. Marleno and Tjendani (2019) opined that OH&S system will effectively reduce accidents if supported by sufficient funding. Latib et al. (2016) found that most contract documents contain scanty requirements and budgeting with regard to H&S. Consequently, since implementation is not free, H&S must be properly budgeted for in construction contracts by inclusion in bills of quantities. However, it seems that the cost of implementing the components of construction H&S has not been adequately documented in the literature. The fore goings necessitate an investigation into the cost of H&S components in building projects and the relationship between the cost of H&S and total construction cost of building projects in Nigeria.

To achieve the aim of this study, cost data on H&S for 33 executed building projects were collected from QSFs in lagos State, Nigeria. The data collected were analysed using mean and percentage.

Previous Studies

Marleno and Tjendani (2019) affirmed that a good OH&S management system will enhance wellness and reduce accidents in the workplace. Similarly, Famakin et al. (2012) opined that adequate emphasis on H&S will enhance the effectiveness of the construction industry and hence, project performance. Latib et al. (2014) affirmed that the amount of safety investment on a project determines the level of safety performance of the project. However, Latib et al. (2014) observed that the implementation of H&S in construction contracts are not well spelt out both in terms of requirements and cost. Moreever, Hefer (2016) alleged that studies on the cost of implementing CH&S are scarce. A number of studies have been conducted on the cost of CH&S around the world. This includes Smallwood (2004), Windapo (2013), Okoye and Okolie (2014), Hefer (2016), Marleno and Tjendani (2019), among others. Smallwood (2004) reported the cost of implementing CH&S in South Africa to be between 0.5 and 3%. Windapo (2013) investigated the relationships of the degree of risk, cost and level of compliance with CH&S and safety regulations in South Africa. The study found that contractors' tendency to comply with H&S requirements decreases with increase in the cost of compliance.

Latib et al. (2014) studied the work breakdown structure and cost of H&S components in Malaysia and reported that the cost of CH&S in multistorey buildings is 1.67% of contract value. The study however called for building contractors to increase their safety investment in construction projects. Okoye and Okolie (2014) explored the cost and legal implications of H&S performance of building contractors in South East Nigeria. The study recommended that contractors should look beyond the cost of implementation of CH&S rather on the monetary and non-monetary values accruing from its compliance. Hamid et al. (2014) assessed the cost and benefits of H&S management systems adopted by contractors in Malaysia. The study found that the average cost of complying with CH&S is 0.41% of project value. Moreover, the study reported that the hierarchy of expenditure on CH&S is: personal protective equipment (PPE), safety tools, safety consultants, H&S officers and workers' training, in descending order. The study concluded that the benefits of compliance with H&S outweigh the cost.

This outcome is in agreement with Enhassi (2003) which concluded that the benefits of providing adequate CH&S include less injuries, property damage and downtime; improved morale and efficiency; enhanced industrial relations and quality; increased productivity; and reduced project cost. Similarly, Pellicer et al. (2014) evaluated the method employers use to estimate the cost of H&S at the design stage of projects in Spain and reported the cost of accidents to be 6.5% of total cost as against the 5% cost of implementing H&S. Bilir and Gurcanli (2015) studied an approach to the estimation of H&S at the bidding stage of construction projects in Turkey. The authors opined that contractors cut down on the hazard-prevention components of H&S expenditure in a bid to maximise profit. The study however concluded that H&S cost 2.6% of building cost in the study area.

In South Africa, Hefer (2016) investigated the cost of implementing CH&S regulatory framework and found that contractors do not track the cost of implementing CH&S accurately. The study reported that implementing CH&S framework increases construction cost by 10%. Similarly, Akawi et al. (2017) reported that contractors price H&S using itemised breakdown structure and that H&S cost between 3 and 5% for civil engineering projects. Marleno and Tjendani (2019) compared the cost of OH&S in building and civil engineering projects executed in Indonesia and reported that CH&S cost 1.71% and 1.01% for building and civil engineering projects, respectively.

The foregoing reviews show wide variations in the cost of implementing CH&S in country contexts. This could be as a result of differences in either existing legislations, level of enforcement or both. It is however clear that the cost of implementing CH&S in Nigeria seem not to have been well documented in the literature, hence, this paper. It is necessary to have empirical evidence on the cost of CH&S in Nigeria not only to bridge the knowledge gap but also to provide veritable records on this aspect of the Nigerian construction industry which is labelled to be largely unregulated (Idoro, 2008, 2011). Consequently, this paper evaluated the cost of implementing H&S in building projects and the influence factors in Nigeria. Building projects were selected because of the need to access robust data upon which generalisations to wider contexts can be based. In Nigeria, Civil Engineering projects are not adequately documented like building projects.

Methodology

The aim of this study is to evaluate the H&S cost in building projects executed in Nigeria with a view to determining the

expenditure on H&S components and the relationship between H&S cost and project cost. Questionnaire survey technique via research pro-formas were used to collect archival cost data from Quantity Surveying Firms (QSFs) based on the research objectives. This method was also adopted by Marleno and Tjendani (2019) to determine H&S costs of building and civil engineering projects in Indonesia. For the first objective, a research pro-forma comprising ten H&S components was used to collect cost data on H&S components on 25 executed building projects as shown in Appendix A. The components were synthesised a priory from a pilot survey of contracting and consulting firms in the study area. Respondents were required to provide the expenditure on each of the components in the executed projects handled by their firms for both high rise and low rise buildings.

Similarly for the second objective, a research pro-forma was used to collect cost data on the contract sums and H&S costs of 33 executed projects from the responding firms as shown in Appendix B. This was to enable the computation of the H&S cost as a percentage of project cost. Respondents were also required to state the factors which influenced their costing of H&S in building projects. It is important to note that during the data collection, several respondents were not able to provide separate cost data for the H&S components because they adopted the percentage lump sum method for their pricing. This experience align with Famakin et al. (2012), Smallwood (2013), Yilmaz and Celebi (2015), Latib et al. (2016) and Durdyev et al. (2017). Famakin et al. (2012) claimed that construction H&S is under-emphasised in Nigeria. Smallwood (2013) reported H&S cost using provisional sum in South Africa. Yilmaz and Celebi (2015) and Durdyev et al. (2017) concluded that H&S costs are not adequately considered and recorded in Turkey and Cambodia, respectively. Similarly, Latib et al. (2016) affirmed that because most contract documents in developing countries contain scanty information on H&S, the components are rarely implemented by contractors. The data collected for both objectives were analysed using mean and percentage.

Data Analysis and Results

Table 1 which is a summary of Appendix A presents the results of the first objective of this study on the cost of H&S components in building projects. The Table shows that the most expensive H&S component in the execution of building projects is scaffolding for both high and low rise buildings. It is followed by staff safety training and personal protective equipment (PPE). The three H&S components with the least costs for high rise buildings are fire extinguishers, temporary fire alarms and safety signage, in descending order. Similarly, for low rise buildings, the least expensive H&S component is temporary fire alarms, followed by safety signage and scaffolding safety nets. Above findings from this study are partly aligned with Akawi et al. (2014), Latib et al. (2016) and Marleno and Tjendani (2019). Akawi et al. (2014) found that the cost drivers of H&S elements in South Africa were PPE, safety equipment, staff training and signage, in descending order. Latib et al. (2016) reported that the major H&S expenditures of contractors in Malaysia were on training and PPE, safety tools, safety consultants and officers, in descending order. Similarly in Indonesia, Marleno and Tjendani (2019) concluded that PPE, work protective equipment (WPE) and safety signage, in descending order were the major cost components of H&S.

It is however pertinent to note that some of the findings in Nigeria are quite revealing with regard to the emphasis on construction H&S. For instance, expenditure on scaffolding safety net and temporary balustrades rank six and seven, respectively, far below the cost of

scaffolding. This implies that contractors are more interested in the provision of the facilities to do the work than the safety of the operatives. It is expected that the expenditures on scaffolding safety net and temporary balustrades will be higher to ensure adequate protection of workers against accidents especially falling from highrise buildings. Similarly, findings also show that contractors in Nigeria pay less attention to workers' wellness. Components like first aid box and medicals are not emphasised at all.

Table 1: Cost of Health and Safety Components in Building Projects

		Highrise Building		Lowrise Building	
S/N	**Components**	**Cost**	**Rank**	**Cost**	**Rank**
1	Scaffolding	17,578,827.72	1	2,719,221.08	1
2	Staff Safety Training	5,155,120.21	2	2,002,103.73	2
3	Personal Protective Equipment	4,566,136.26	3	1,473,124.82	3
4	Lift Shaft Protective/Safety Equipment	3,820,359.86	4	-	
5	PPE for Multi-Service Gangs	3,120,025.00	5	1,403,026.43	4
6	Scaffolding Safety Net	2,635,847.38	6	709,553.06	7
7	Temporary Balustrades	2,614,738.79	7	943,071.38	5
8	Fire Extinguishers	1,846,689.83	8	769,426.07	6
9	Temporary Fire Alarms	1,302,390.75	9	508,552.66	9
10	Safety Signage	1,106,021.55	10	515,520.91	8

Source: Summary of Appendix A (Archival cost data on H&S components collected from QSFs

Regarding cost relationship between contract sum and H&S cost, Table 2 (summary of Appendix B) shows that for high rise buildings, the average cost of H&S is 2.02% of project cost. Similarly, H&S cost an average of 1.69% of project cost for low rise buildings. Findings above partly align with Wells and Hawkins (2009), Smallwood and Emuze (2014), Bilir and Gurcanli (2015), Latib et al. (2016) and Marleno and Tjendani (2019). Those studies reported the following H&S costs as percentage of project cost: Wells and Hawkins (2009) - 1% and 2% for big and small projects, respectively; Smallwood and Emuze (2014) – 2.5% allowance for H&S in tenders; Bilir and Gurcanli (2015) -2.6% in Turkey; Latib et al. (2016) – 0.21 to

Table 2: Summary of Health and Safety Cost as Percentage of Building Cost

S/N	Highrise Buildings (%)	Lowrise Buildings (%)
1	1.09	3.00
2	0.19	5.22
3	4.20	3.76
4	2.00	0.09
5	0.08	0.19
6	1.01	0.20
7	3.11	3.00
8	4.24	0.25
9	6.00	0.02
10	4.23	2.00
11	4.24	2.44
12	0.04	0.25
13	2.00	1.57
14	0.03	
15	0.03	
16	4.19	

17	0.59	
18	0.56	
19	1.86	
20	0.67	
Sum	**40.36**	**21.99**
Average	**2.02**	**1.69**

Source: Summary of Appendix B (cost data from QSFs)

1.99% in Malaysia; Marleno and Tjendani (2019) – 1.71% in Indonesia. On the other hand, findings from this study are partly not aligned with Pellicer et al. (2014) and Akawi et al. (2014). Pellicer et al. (2014) concluded that H&S cost 5% of project value in Spain while Akawi et al. (2014) reported 3.4% cost of project value in South Africa.

It is however pertinent to note that findings from this study on H&S cost as percentage of project value show a wider range (5.2%) in low rise buildings than high rise which has a range of 5.02%. This implies that there is a wider variability in pricing H&S components for low rise than high rise buildings in Nigeria. Moreover, it would have been expected that the percentage cost of H&S to reduce as project cost increases and the vice versa. The reverse is the case with the findings from this study which shows a higher average percentage cost in high rise (2.02%) than in low rise buildings (1.69%).

Conclusion

This study evaluated H&S cost in building projects with a view to ascertaining the cost of implementing H&S components and its relationship with project cost in Nigeria. A review of extant Literature indicates that there is knowledge gap in the area of the cost of implementing construction H&S in developing countries. To achieve the objectives of the study, archival cost data were collected from QS consulting firms operating in the study area using a list of H&S items (components) synthesised from a pilot survey. Data collected were computed to find the average cost of each component and the cost relationship between H&S and project value. From the findings of this study, it is concluded that that more cost is allocated to safety components than health in the execution of building projects in the study area. It is also concluded that cost relationships between H&S and project value is 2.02% and 1.69% in high rise and low rise buildings, respectively.

Based on the conclusions on this study, it is recommended that adequate cost should be allocated to cater for construction workers' wellness and welfare. This is because studies have established that enhanced workers' welfare will not only increase productivity but also reduce accidents and injuries in the workplace. It is also recommended that the cost of H&S components should not rise with project cost. In other words, the percentage cost of H&S should reduce as project cost increase.

. Although findings from this seminal study may have limited application due to the number of projects used and variations in H&S practices of different organizations, this study, nevertheless, provides implications for enhancing the costing of H&S in the Nigerian construction industry.

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