

## CHAPTER (X)

### AD-HOC AND POST-HOC ANALYSIS OF CONTRACTORS' SAFETY RISKS DURING PROCUREMENT IN NIGERIA

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#### **SUMMARY**

*Poor safety culture is a systemic issue regarding construction workers in Nigeria. Evidence suggests workers' rights to safe work and dignity are abused frequently. Although extant Nigerian laws compel contractors to maximize work safety, media reports are rife with incidences of collapse of structures, site accidents and hazards. Fatalities, and consequential losses from these, are significant. In context, the Nigerian procurement law requires contractors to be pre-qualified before contract awards. Through a systematic literature review (SLR), this study examines pre-award assessment processes and standards relating to contractors' compliance with workers' health and safety. In addition, pre-award assessment objectives are compared with normative objectives of health and safety standards during construction. A significant gap is found between the two: pre-award assessment is incapable of translating into considerable safety outcomes in workers and projects. As a result, a new framework for assessing contractors' safety capability is proposed. The study also argues the significance of the proposed framework to extant prequalification framework used in Nigeria. Rather than being prescriptive, the framework can measure health and safety capabilities quantitatively. Conclusions are elicited from these on how to reform the Nigerian procurement landscape in terms of health and safety standards, and the cost benefits therefrom.*

## **Introduction**

Safety is the single most paramount objective of a construction project. A clear consensus amongst construction management researchers is as though there is no success in projects unless completion and operations are achieved and certified as truly safe – that is, safe for the builders and their workers, as well as to owners, end-users and the environment (Chan *et al.*, 2004; Gido & Clements, 2003; Gunduz & Yahya, 2015; Prabhakar, 2009) . The works of Love *et al.* (2015) and Wanberg *et al.* (2013) are instructive on the relationship between project quality and safety. There is little to argue against the import of their conclusions: poor quality of work is unsafe, wasteful and unsatisfactory; and unsatisfactory works are just what they are – project owners do not pay intensively for projects so they can be dissatisfied. Thus, a significant challenge before every project owner is how to ingrain success in its true meaning into their decisions across project development processes and post-construction operations. A way to do this is to ensure true success is enunciated clearly as the primary objective of their projects right from conception, and that this is further defined clearly by safety values rather than speed and short-sighted economic gains.

The cost of doing otherwise is dire. Unsafe projects come at a cost to all stakeholders, even the innocent. In most developing economies, workers' fatalities and bodily injuries on construction sites have little or no recompense. Impacted families (innocent wives, children, parents and dependant relatives) often suffer from such irreparable losses without help. Also humongous are psychological costs and costs related to remediation (such as rehabilitations of work and persons, rework and social reengineering), disruptions to work, interventions by public administrators, and legal costs arising from dysfunctional relationships. Despite the obvious, construction industries in developing countries do not have records. Where records exist, they are awful; could reflect only a fraction of actual occurrences, and most times wrongly so. For example, Okoye (2018) is quite clear about the poor health and safety culture and lack of safety records in the Nigerian construction industry. The seriousness of this cannot be underestimated. Issues do occur, however the industry has had a culture of getting away with its poor records. Only major incidents such as building collapses are reported in the media, and these occur several times in a year. Actual costs beyond fatality figures are never known. Other major observables such as performance issues relating to shoddy workmanship and debacles of poor material application are commonplace occurrences which seldom make it to the media or government's official records (if any). Project owners are not interested in such records either

(this will become clearer in this course of this study). Meanwhile, ignoring the issues does not improve the outturn situation of projects nor the safety reputation of the construction sector.

Most construction workers in Nigeria do not wear protective gears (Olatunji *et al.*, 2007). Whilst work is largely primitive and risk exposure is huge, high risk items such as false work, scaffolds are of the lowest quality possible. This is because contractors often make the wrong sense of the commercial reality of safety, as though safety adds to project costs, costs which are unrewarded, unwarranted and avoidable (El-Rayes and Khalafallah, 2005). Nonetheless, the factual objective reality is that safety cost is sublime (Goetsch and Goetsch, 2003). It carries more to it than the simplistic cost of materials and labour. Project owners who are keen for their projects to succeed must consider this carefully (Egan, 1998).

Prequalification is a legal requirement for all public projects in Nigeria (Aje, 2012; Olatunji, 2008). It is a mechanism enforced by regulators to ensure projects are executed only by competent bidders, and that project owners are able to achieve value for their investments through competitive bidding processes. Safety is one crucial criterion focused on by project owners during prequalification. Project stakeholders often want to be sure that their contractors are able to deliver projects safely, and to cost, on time and at the appropriate quality. This approach is in line with previous arguments in literature where project owners have been challenged to get involved in the evolution of their projects rather than leaving important primary decisions about their project outcomes to other parties (Kometa *et al.*, 1995). There are two key questions regarding this. First, what is in prequalification regarding construction safety and the safety culture of the Nigerian construction industry as a whole? In spite of the obvious, how has prequalification policy performed in ingraining the appropriate safety outcomes in construction projects in Nigeria?

This study seeks to ameliorate the endemic nature of poor safety considerations in Nigerian procurement systems. Ad-hoc considerations that precede contractor selection are reviewed. A framework for actual safety performance measurement is developed by synthesising empirical evidence from literature regarding what stakeholders from the Nigerian construction industry should be doing to meet global standards. In addition, the study elicits the relationship between ad-hoc safety considerations and post-hoc (post-award) outturn safety performance of construction projects. Recommendations are drawn on closing the gap between world's best practices and the praxis gap between ad-hoc and post-hoc safety considerations in the Nigerian

construction industry. Reviews aligning with these objectives are set in three parts. First, a review of literature on the variables of ad-hoc safety considerations. Second, a review of literature on the variables of post-hoc safety considerations. Third, the study delineates the relationship between ad-hoc and post considerations towards eliciting the doctrine of absolute safety and global best practices. Implications of these will explain measurements and outturn situation of construction projects regarding project safety.

### **Ad-hoc safety considerations**

There are several initiatives in construction management research regarding planning considerations that are focused on safety prior to commencing construction. An example of this is design for safety (Behm, 2005; Hadikusumo & Rowlinson, 2002). Gambatese *et al.* (2005) conclude such an initiative motivates positive safety outcomes during project implementation. If design motivates positive safety outcomes, procurement and operation cultures have significant roles to play. This is where most construction management research on safety consideration during procurement has failed. Findings that support health and safety as a critical component of contractors' competence, and how it should be assessed, are few and inclusive (Idoro, 2004). For example, Ogunsemi and Aje (2006) surveyed 74 participants to identify key selection criteria used by project owners for selecting construction contractors. 22 of such criteria, including safety, were identified, and were ranked accordingly. The analysis presented in the study is inconclusive and can only be applied with great care. This is because *Health and Safety policy of contractors*, the only variable relating to safety in their study, was ranked 11<sup>th</sup>, though most participants rated the criterion significant [3.86/5]. Surprisingly, when the variables were narrowed down into a regression model, an absolute selection model was created without any consideration for health and safety. The caution in the application of the model is premised on the fact that a measured variable of considerable significance should not be discarded in a system without noticeable impact.

Similarly, Aje (2012) compares the views of project owners, consultants and contractors regarding prequalification criteria. 194 respondents and 77 construction projects were analysed. Findings from the study suggests, health and safety was least ranked by all the respondents across domains. Despite this, the criterion was one of the two considerations that are significant statistically in the model [p-value = 0.009] - only behind Past Performance [p-value = 0.001]. Other criteria prompted in Ogunsemi and Aje's (2006) model as significant are found in Aje (2012) as statistically insignificant [p-value > 0.05]. Though, obscured in the

study, other findings of the study established a strong correlation between both criteria [Safety and Past Performance], work quality and time performance of projects.

A way to go is to examine how Health and Safety are measured, and see how this defines people's perception about their importance. For example, where financial capability is measured in such ad-hoc considerations, contractors are judged on the basis of their turnover, working capital, audited accounts, financial statements, bank balance, bonding arrangements and records of project completion (Hatush & Skitmore, 1997). Similarly, technical competence is measured by the strength of experience of key personnel, quality of equipment and past performance history (Ng and Skitmore, 1999). The objectives of these variables is such that contractors who are able to provide convincing documentation about each criterion are assumed by project owners as appropriate and competent to deliver on project objectives accordingly. Holt (2018) argues such assumption is misleading, spurious and superficial; in that, they are not often tied to actual project objectives. For example, it is a commonplace assumption that a contractor is only stable to deliver a project to cost if they have a considerable bank balance that is relative to the proposed project cost. Meanwhile, if at all, the bank balance of a contractor often does not show the true financial situation of their business. Proceeds reported in such accounts could have been payments made in advance for projects not yet done, supplies and subcontractors' work not yet paid, unpaid wages of workers, loans and debentures, and unacquainted work.

Even if misleading, very limited of such breakdown regarding project owners' assessments of contractors' safety capability is available in the Nigerian construction research literature. Ogunsemi and Aje (2006) mention *Health and Safety policy* only vaguely. Aje (2012) has no such breakdown. Ajayi (2010) is instructive in their list of sub-criteria for assessing contractors' safety capabilities before contract award. The variables listed in Ajayi's study include:

- 'safety' [perhaps use of personal safety equipment],
- 'experience modification rating' [perhaps value engineered and earned through organizational learning in the context of safety],
- 'administration of occupational health and safety' [perhaps policy settings in terms of self-regulation and legislative conformance],
- 'incidence rate' [in terms of previous records of injuries and fatalities] and

- ‘management safety accountability’[perhaps whether management has been accountable to reported safety issues in the past].

There is no record of validation of these variables. They were not defined in any particular context either. However, it is partly logical to assume they are applied somewhere in Nigeria and have been used. Without putting the popularity of such applications into question, it is rational to assume that having a metric to measure safety during construction is always a good way to go, and that it is possible to learn from such a framework.

### **Post-hoc safety considerations**

Safety objectives are difficult to measure unless there is a clear understanding about the goals for which such measurements are made. For example, what do project owners want to achieve with their safety considerations before, during and after construction? Do clients really care about a safe artefact, built deliberately safe by a safe workforce, and that their contractors and workmen are able to leave a safe environment behind, and that they are able to possess a safe artefact to be used and to enhance the safety of occupants and users? Answers to these questions are best imagined. However, it is often difficult to set all these as an achievable all-in objective in developing countries, especially Nigeria. However, the appropriate thing to do is to ensure safety objectives are well-rounded systemistically and must consider the interest of all stakeholders. Davis (2014) and Littau *et al.* (2010) identify such stakeholders to include project owners, workers and their families, contractors, suppliers, people in the neighbourhood and the general public. Minimal safety considerations for each of these domains of stakeholding may be defined in extant legislations, regulations, contract forms and nature of project. Regardless, safety provisions should be taken beyond basic requirements, together and systemically.

As Olatunji (2005) reports, the single most important requirement of a typical Nigerian project owner is contractors’ performance. The details of such expectation are often ill-defined. At the minimum, it means project owners expect contractors to deliver projects not minding how they achieve their outcomes. Safety is neither measured nor paid for, but is assumed to be an embodiment of performance. Injuries and dehumanisation underlying such outcomes attract no recompense also. This entrenched culture of feigned ignorance and indifference has no justification and should be discarded. The only way to go is to prioritise safety and to enhance the dignity of the human persons involved in construction processes and the environment where projects are sighted.

Safety management is measurable. Lin and Mills (2001) write about a continuous improvement matrix published by Australia's Construction Industry Development Agency [CIDA] for benchmarking Occupational Health and Safety (OHS) performance of construction contractors (Table 1). The overarching goal of the CIDA tool is to ensure stakeholders are able to measure safety management during construction in a form that is assessable during contractor selection. Accordingly, contractors who are unable to demonstrate adequate commitment to safety both in their work histories and in their proposals for future jobs are unworthy to remain in business. CIDA's model, as adapted by Lin and Mills (2001), suggests safety is measurable through management responsibility, in that sites should be inspected and assessed regularly for safety integrity. In addition, contractors' health and safety systems can be assessed on the basis of nature and context of inspection regimes and outcomes of safety examinations. For example, where a project fails on safety integrity tests, project owners can assume such a project is of low quality and will only trigger unsatisfactory outcomes.

Table 1: CIDA's benchmark of OHS performance of construction contractors

<b>CIDA System Element Descriptions</b>	<b>Measurement</b>
management responsibility	safety inspections, safety compliance assessment and integrity of test equipment.
health and safety system	inspection regime and test status
contract review	control on non-compliance
design control	corrective and preventive safety actions
document control	safety integrity of handling, storage, packaging and delivery
purchasing	health and safety records
purchaser supplied product	health and safety auditing
product identification and traceability	training and servicing
work method control	statistical control, inspection and testing

\*Adapted by Lin and Mills (2001)

Non-compliance with safety regulation and work quality are measurable elements of the CIDA safety assessment model also. Besides governance provided by government inspectorates, safety compliance in construction contracts is also policed by labour unions and contractors' self-regulation mechanisms (Nnedinma, 2016). According to Behm (2005) and Gambatese *et al.* (2005), safety initiatives that are specified and designed for construction projects can be monitored for corrective and preventive outcomes. This objective can be measured to determine the appropriateness of design options and the benefits realizations thereof. In addition, CIDA's model also measures the integrity of material handling, storage, packaging and delivery. For example, the findings of Stern *et al.* (2001) regarding the harmful effects of cement on construction workers show workers who are exposed to cement-based materials

often have elevated risks of lung and stomach cancer. Mohler *et al.* (1998) report on how workers' exposure to polyvinyl chloride (PVC) and cement causes peculiar liver and vascular diseases also. Fatima *et al.* (2001) found workers who are exposed to cement dust and particulate matters are at a high risk of DNA deformation. Evidence from the works of Akanbi *et al.* (2009) and Faremi *et al.* (2014) suggests workers are poorly protected against these harmful materials and the environment that exacerbate them in Nigeria.

Furthermore, CIDA's model suggests health and safety can be measured through contractors' purchasing record. For example, contractors who are averse to safety procurement of materials and human capital are unlikely to have dignity for safety ethos on and off their projects. If such contractors are unable to imbibe appropriate safety culture in their procurements, their suppliers are unlikely to do better. Manufacturers that produce to such contractors' and suppliers' demands are unlikely to do much better either. CIDA's model suggests safety can be traced from source and that someone can be held responsible for unsafe materials and how they find their ways to construction sites. In particular, contractors can be held responsible for unsafe resources on their projects, and in the supply chains they have ingained into the development processes of a project.

In summary, it is possible to measure contractors' safety compliance through control mechanisms in designs and contract documentations, organizational leadership and the safety integrity of contractors' material handling and supply chains. Safety does not end with these. Significant number of incidences are often caused by workers' state of mind. Gillen *et al.* (2002) conclude a dissatisfied worker is potentially an accident waiting to happen. According to Ajayi and Olatunji (2017), worker's job satisfaction is defined by their motivation to succeed, the quality of their relationship with their colleagues, organizational leadership, the reward and benefits they receive, their work-life balance and the impact of their job on their physical and mental health and well-being. These are often poorly researched, if at all, in relation to construction workers, their safety and the safety of their outturn projects.

### **Implications for Practice and Research**

Contractors and their workers are the most important agents of outturn safety in construction projects. Both of them are regarded in normative literature as project stakeholders. However, contractors are responsible for the safety of their workers and the projects they deliver. As a result, project owners and contractors are the most influential determinants of project safety.

Where owners fail to pay for a safe project but expect performance, contractors are unlikely to deliver safe projects. This is indeed an endemic problem in developing countries, Nigeria in particular. Project owners often want to achieve more in their projects than as premised in the value of their projects; they often underestimate the role of safety in their considerations – or the lack thereof. Even where incidences are not reported, an unsafe site is unlikely to be a high quality site, and owners tend to pay for their lack of safety discretion during construction throughout the lifecycle of their projects.

Objectives of construction safety are not vague, and are measurable – an instrument that is potentially effective for developing countries is shown in Table 2. The instrument was synthesised from the extensive review of literature that this current study is based on. Clients desire safe projects for themselves, end-users and the environment of their built assets throughout project life. One way to make this happen is to ensure they select contractors with appropriate commitment to safety, and to ensure that such commitment is policed sufficiently during construction. Unlike other ad-hoc selection criteria that often do not deliver their objectives during construction (Holt, 2018), safety can be measured before and during construction, and the impact of such measurement is such that projects benefit in quality and in lifecycle costs.

As shown in Table 2, contractors can be assessed through the safety attributes of their workers, whether on-site or management workers. In essence, project owners must ensure contractors' workers are adequately trained and that they are well motivated to work safely. This is measurable by their experience, training, personal values, self-leadership, safety integrity of own equipment and insurances. No worker or project is safe without these (Langford *et al.*, 2000). In line with Aje (2012), an assessment of contractor's management capability is insufficient without some assurances that they are safe, and their sense of responsibility can be taken as reliable. This is measurable by their compliance to specified safety standards, and that they have been tested with appropriate instruments. In addition, their proposed work method can be tested for safety issues. Akanmu *et al.* (2016) have developed an autonomous system that combines digital design and construction planning platforms by using building information modelling, smart tags and genetic algorithm to model on-site movements. Safety could be modelled the same way (Zhao and Lucas, 2015).

Table 2: Assessment instrument for construction contractors in developing countries regarding project safety

<b>Measures</b>	<b>Descriptors</b>
A. Workers	
<i>Safety qualifications of key personnel</i>	<i>formal and ongoing trainings</i>
<i>Motivation to commit to safety ethos</i>	<i>Experience</i>
<i>Job satisfaction</i>	<i>relationship with employers</i>
<i>Safety leadership</i>	<i>self-regulation</i>
<i>Safety responsibility</i>	<i>outcomes of inspection assessments</i>
	<i>equipment integrity tests</i>
<i>Securitization</i>	<i>personal safety</i>
	<i>Insurance</i>
B. Contractor's management responsibility	
<i>Safety inspections</i>	<i>safety compliance assessment</i>
	<i>integrity of test equipment</i>
<i>Health and safety system</i>	<i>inspection regime and test status</i>
<i>Work method</i>	<i>control statistics</i>
	<i>inspection and testing</i>
<i>Safety design</i>	<i>corrective safety actions</i>
	<i>preventive safety actions</i>
<i>Document control</i>	<i>integrity of material handling &amp; storage</i>
	<i>...resource packaging and delivery</i>
<i>Contract review</i>	<i>control on non-compliance</i>
C. Supply chain management	
<i>Deliveries</i>	<i>health and safety records of purchases</i>
<i>Safety integrity of suppliers</i>	<i>health and safety audit of suppliers</i>
<i>Safety integrity of manufacturers</i>	<i>product identification and traceability</i>
	<i>training and servicing</i>

Rather than being prescriptive, these variables are measurable on a Likert scale. For example, like in other prequalification models, some assessment variables could be assessed as “Not Applicable”. This means there is no basis for their measurement relative to the specific project situation. Alternatively, a candidate contractor could be assessed in line with the variables as to whether they have “Demonstrated” or “Not Demonstrated” satisfactory compliance on the bases of the documentation they have supplied for assessment. This could be in the form of “Not evident”, “Evident only in trace”, “Developing” and “Established. Users of the model are also able to apply weightings to the variables in relation to their safety objectives.

## **Conclusion**

The Nigerian construction industry has had a poor safety record. Construction clients often do not demonstrate appropriate commitment to project safety. They have often mistaken contractors' performance as though performance encapsulates self-regulation regarding safety by default. This study has argued that the rife issue of low quality project that is evident in

media report regarding the Nigeria construction industry could be attributed to poor commitment to safety. Both clients and contractors have a role in this. Clients often do not assess contractors' safety credentials before they are appointed. Where safety has been reported in literature as a selection criterion, studies have only shown client's application of safety knowledge is ignorable. Similarly, the efficacy of contractors' safety records during construction is not often put to use. One key constraint in this is that there is growing concern in recent literature regarding the relationship between ad-hoc and post-hoc considerations of selection criteria. In essence, researchers have pointed out that extant studies on prequalification criteria are inconclusive, misleading and often do not reflect the objectives for which they were planned. The instrument proposed in this study bridges this gap. It adapts an established model by Australia's CIDA by integrating client's assessment of contractors' personnel as well as contractors' safety systems.

The model has not been validated. Further studies can be built around this. For example, an empirical study could be dedicated to understanding the relative importance of safety factors, the correlation between them and project outcomes. Alternatively, future studies can look into the relationship between policy impact and safety outcome in construction industries in developing countries. Apparently, there is a significant number of legislations and policies. However, their outturn effect, whether as combined or analysed individually, does not suggest a remarkable improvement in the industry.

### **Author Biography**

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