AN ASSESSMENT OF RISK IN CONSTRUCTION IN THE NIGERIAN CONSTRUCTION INDUSTRY

HENRY A. ODEYINKA
School of Property and Construction, Nottingham Trent University, Nottingham NG1 4BU, UK, E-mail: henry.odeyinka@ntu.ac.uk

ADE A. OLADAPO and JOSHUA O. DADA
Department of Quantity Surveying, Obafemi Awolowo University, Ile-Ife, Nigeria

ABSTRACT

Risk in construction is a variable in the process of construction whose occurrence results in uncertainty as to the final cost, duration and quality of the project. Some of the major causes of risk in construction include design error, estimating error, competitive tendering risk, financial risk and changes in political and economic climate among others. While these risk factors are not unknown to the Nigerian construction practitioners, the relative likelihood of occurrence and impacts in case of occurrence at pre and post contract stages is yet to be investigated. This then is the concern of this study. Data were collected using questionnaire survey self-administered on construction practitioners. Respondents were requested to score on a Likert-type scale, their perception of the likelihood and impacts of some identified risk factors at pre and post contract stages. Survey responses were analysed by computing the relative index of each factor and ranking the computed indices. Results showed that the major risk factor encountered at pre-contract stage is design risk while at post contract stage; they are financial and political risks. These findings have implications as regards the risk factors to focus attention on for risk management purposes at pre and post contract stages.

Keywords: construction, pre-contract, post contract, risk, Nigeria

INTRODUCTION

The environment within which decision-making takes place can be divided into three parts: certainty, risk and uncertainty [Flanagan and Norman, (1993)]. According to them, certainty exists only when one can specify exactly what will happen during the period of time covered by the decision. This, they concluded, of course does not happen very often in the construction industry. Bennett and Ormerod [1984] also concluded that an important source of bad decisions is illusions of certainty. They submitted that uncertainty is endemic in construction and needs to be explicitly recognised by construction managers.

According to [Flanagan and Norman (1993)], uncertainty, in contrast to risk, might be defined as a situation in which there are no historic data or previous history relating to the situation being considered by the decision-maker. In other words according to them, it is
‘one of a kind’. A company has to operate in an environment where there are many uncertainties. The aim is to identify, analyse, evaluate and operate on risks. Accordingly, the company is converting uncertainty to risk. The more one thinks about risk and uncertainty, the more one is inclined to the view that risk is the more relevant term in the building industry [Flanagan and Norman, (1993)]. [Perry and Hayes (1985)] submitted that while the distinction between risk and uncertainty is recognised, the distinction is unhelpful when it comes to construction projects.

[Fong (1987)] asserted that it is generally recognised that those within the construction industry are continually faced with a variety of situations involving many unknowns, unexpected, frequently undesirable and often unpredictable factors. These factors according to [Lockyer and Gordon (1996)] include timing schedule slippage of the project tasks, technological issues, people-oriented issues, finance, managerial and political issues. [Smith (1999)] and [Chapman and Ward 1997)] submitted that generally, risk is viewed within the context of the probability of different outcomes and that the general attitude towards risk is its identification, evaluation, control and management. Some of the major causes of risk in construction include design error, estimating error, competitive tendering risk, financial risk and changes in political and economic climate among others. Whilst these risk factors are not unknown to the Nigerian construction practitioners, the relative likelihood of occurrence and impacts in case of occurrence at pre and post contract stages is yet to be investigated. This then is the concern of this study.

**An overview of risk in construction**

Risk is inherent in all human endeavours, including construction activities, and the risk elements involved are diverse and varied [Odeyinka, (2000)]. Risk has been defined in many different ways by economists, insurance scholars and construction management researchers among others. In the business and insurance domain, [Knight (1921)] defines risk as measurable uncertainty or uncertainty of loss. Risk has also been defined as the uncertainty that exists as to the occurrence of some events [Greene, (1973)]. In the light of these definitions, risk can be viewed as a psychological phenomenon that is meaningful in terms of human reaction and experience. It can also be viewed as an objective phenomenon that may or may not be recognised in terms of human reaction and experience.

In construction management domain, [Perry and Hayes (1985)] and [Healey (1982)] defined risk as an exposure to economic loss or gain arising from involvement in the construction process. [Moavenzadeh and Rossow (1976)] however regarded risk as an exposure to loss only. Buftaied [1987] described risk in construction as a variable in the construction process whose variation results in uncertainty as to the final cost, duration and quality of the project. Moreover, [Fong (1987)]. According to [Akintoye and MacLeod (1997)], risk in construction has been the object of attention because of time and cost overrun associated with construction projects. Many time and cost overruns according to [Perry and Hayes (1985)] are attributable to either unforeseen or foreseen events for which uncertainty was not appropriately accommodated. [Thompson (1992)] also identified an effect of risk on construction project as failure to achieve the required quality and operational requirements. This is in addition to cost and time overruns which other authors also identified.
[Perry and Hayes (1985)], [Thompson (1992)] and [Akintoye and MacLeod (1996)] have identified risk sources in construction at pre contract stage to include design risk, competitive tendering risk, tender evaluation risk and estimating risk among others. In addition, they also identified risk factors at post contract stage to include physical risk, site condition, inclement weather, legal risk, environmental risk, logistic risk, political risk, financial risk and contractual risk among others.

**Data and methodology**

Data were collected from Lagos and Abuja, which are respectively the commercial as well as the political capital of Nigeria. The choice of these cities was made for data collection, as they are the hubs of construction activities in Nigeria. Data collection was done through a questionnaire survey self-administered on 40 randomly selected construction practitioners involved in a nearly completed or recently completed construction projects. Subjects include project quantity surveyors, architects, engineers and contract managers in the employment of construction companies, consulting firms, government establishment and institutions [see Tables 1 and 2]. The computed mean experience of the respondents is 14.5 years with a standard deviation of 5.2 years. About 49% of the respondents were educated up to HND level whilst the remaining 51% had at least first degree in construction related fields [Table 3]. This background information regarding the respondents indicates that responses provided by them could be relied upon for this study.

Many risk management researchers as stated earlier viewed risk as the probability that cost, schedule or technical performance of a system goes wrong combined with the consequences of these aspects going wrong. With this view, they argued that risk could be measured through the following formula:

\[
R = P \times I \quad \text{[Equation 1]}
\]

where:
- \( R \) = the degree of risk
- \( P \) = probability of occurrence of a risk
- \( I \) = the consequence or perceived impact on a project

Akintoye et. al. [2001] and Carter et. al. [1994] referred to this as the risk exposure or expected value [EV] while Tweeds [1996] referred to it as average risk estimate. This method of risk measurement has a well-established place in decision theory domain.

<table>
<thead>
<tr>
<th>Table 1: Types of organisation surveyed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of organisation</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>Construction company</td>
</tr>
<tr>
<td>Consulting firm</td>
</tr>
<tr>
<td>Government establishment</td>
</tr>
<tr>
<td>Institution</td>
</tr>
<tr>
<td>Others</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
Table 2: Respondents’ designation

<table>
<thead>
<tr>
<th>Respondent’s designation</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity surveyors</td>
<td>15</td>
<td>48.39</td>
<td>48.39</td>
</tr>
<tr>
<td>Architects</td>
<td>6</td>
<td>19.35</td>
<td>67.74</td>
</tr>
<tr>
<td>Engineers</td>
<td>5</td>
<td>16.13</td>
<td>83.87</td>
</tr>
<tr>
<td>Builders</td>
<td>3</td>
<td>9.68</td>
<td>93.55</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>6.45</td>
<td>100.00</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Educational qualification of respondents

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>HND</td>
<td>15</td>
<td>48.38</td>
<td>48.38</td>
</tr>
<tr>
<td>B.Sc.</td>
<td>8</td>
<td>25.81</td>
<td>74.19</td>
</tr>
<tr>
<td>B.Sc. + M.Sc/MBA</td>
<td>8</td>
<td>25.81</td>
<td>100.00</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

[William (1996)] however contended that rather than decreasing the two-dimensional nature of the risk measure, it should be extended. Charette [1989] uses 3-dimensional graphs [see Fig. 1] with independent axes he labels severity [i.e. impacts], frequency [i.e. likelihood] and 'predictability' (in technical terms, the extent to which the risk is aleatoric rather than epistemic). [William (1996)] demonstrated that calculating 'expected' risk as probability multiplied by impact has limitations and that ranking risks according to this figure is misleading. [William (1996)] concluded that both probability and impact must be considered at all times. Taking the cue from [Williams (1996)], and [Charette (1989)] underpins the approach adopted in this study in measuring respondents’ perception of risk. In this study, two-dimensional approach to measurement of risk have been adopted in which case the likelihood or probability of risk occurring and impact in case of occurrence have been considered.

Out of the 40 questionnaires administered, 31 responses fit for analysis were received, representing a response rate of 77.5%. The questionnaire identified from literature and based on discussion with industry practitioners, various risk factors encountered at the pre and post contract stages of construction. Using a two-dimensional scaling, respondents were requested to score on a Likert –type scale of 0-4, the likelihood of the identified risk factors occurring and their perceived impacts in case of occurrence. The measuring scale of 0 represents a situation where there was no likelihood of occurrence or impact while 4 represents a very high likelihood of occurrence. This then gives the measuring scale the property of an interval scale, which enables the collected data to be capable of being subject to various statistical analyses.
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Data analysis and results

Data analyses were carried out by evaluating the relative importance of the identified risk factors at pre and post contract stages of construction. The numerical scores assigned by respondents were transformed to relative importance index [RII] using the following formula:

\[
RII = \sum_{i=0}^{i=n} E_i P_i \]  

[Equation 2]

Where \( E_i \) is the \( i^{th} \) likelihood of occurrence of risk factor or impact and \( P_i \) is the percentage of respondents to the \( i^{th} \) likelihood of occurrence or impact.

Risk factors associated with construction contract at pre-contract stage

An analysis was carried out to evaluate the relative importance of risk factors at pre-contract stage. Table 4 summarises the result of the analysis. From the table, it is evident that the highest-ranking risk factor at the pre-contract stage is design risk. This is not surprising due to the fact that most projects in the Nigerian construction industry are procured using the traditional procurement option. As most design details are still unresolved at the pre-contract stage, there is a lot of uncertainties as to the final cost and completion duration. It is therefore not a surprise that this risk factor ranks highest. Following design risk on relative importance scale are tendering risk and estimating risk.
Competitive tendering has had the effect of preventing a realistic attitude towards risk [Thompson, 1992]. This is because the risk involved is often buried in the total bid. It is therefore not a surprise that this risk factor ranks next to design risk and should therefore engage the attention of the construction contractor.

Estimating risk ranks next to tendering risk on the relative index scale [Table 4]. During bidding, the contractor will usually base his estimate on similar past project. The contractor will attempt to assess the current market price for the proposed project, the design of which is subject to revision and with proposed labour force not yet recruited. In most cases, the contractor would have to bear any losses attributable to faulty estimating. As such, it is also not surprising that this risk factor ranks fairly high. Tender evaluation risk ranks lowest on the relative index scale [Table 4]. In public works, the usual thing is to go for the lowest tender. However, there are cases of many contracts in which the lowest tender did not result in the lowest final cost [Chapman and Ward, 1997]. As such, selection of contractors on their tender price alone is like buying trouble. It is however not surprising that this risk factor ranks lowest as the risk can be avoided by using risk analysis to decide what range of price is reasonable.

From Table 4, it is also evident that whilst the likelihood of design risk occurrence ranked 1st overall, its impact in case of occurrence also ranked 1st. This same pattern is repeated for estimating risk [rank of 2 in both cases], competitive tendering risk [rank of 3 in both cases] and tender evaluation risk [rank of 4 in both cases]. This indicates that the order of impact also follows the order of likelihood of occurrence.

### Table 4: Likelihood and impact of risk factors at pre-contract stage

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Likelihood of risk occurrence index</th>
<th>Rank</th>
<th>Risk impact index</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design risk</td>
<td>1.90</td>
<td>1</td>
<td>2.87</td>
<td>1</td>
</tr>
<tr>
<td>Estimating risk</td>
<td>1.75</td>
<td>2</td>
<td>2.81</td>
<td>2</td>
</tr>
<tr>
<td>Competitive tendering risk</td>
<td>1.60</td>
<td>3</td>
<td>2.03</td>
<td>3</td>
</tr>
<tr>
<td>Tender evaluation risk</td>
<td>1.40</td>
<td>4</td>
<td>1.50</td>
<td>4</td>
</tr>
</tbody>
</table>

Risk factors associated with construction contract at post-contract stage

Further analysis was carried out to evaluate the relative importance of the likelihood and impact of occurrence of risk factors at post-contract stage. Table 5 summarises the result of the analysis. From this table, it is evident that the risk factor ranking highest in likelihood of occurrence is financial risk. It also ranked 2nd in its impact in case of occurrence. Financial risk to contractor includes whether the building owner has enough money to complete the project, financial failure of the building owner or sub-contractors, availability of money to the contractor in a suitable manner and time to enable the contractor to progress with the work [Akintoye and MacLeod, (1997)]. Financial risk according to [Perry and Hayes (1985)] also include adequate provision of cash flow, fluctuations, inflation and taxation. In view of all these issues involved in financial risk, it
is therefore not surprising that it ranked highest in likelihood of occurrence and also
ranked 2nd in its impact in case of occurrence.

Political risk ranked 2nd in its likelihood of occurrence while it ranked 3rd in its impact in
case of occurrence. Political risk includes wars, revolution, and changes in laws or
decrees, which were not envisaged during the formation of a contract. The Nigerian
construction industry had in the recent past coped with frequent change of government
and as such exposed to political risk to a great extent. It is therefore not a surprise that the
likelihood of occurrence of the risk factor ranked 2nd while its impact in case of
occurrence ranked 3rd. Physical risk on the other hand ranked 3rd in its likelihood of
occurrence whilst it ranked 1st in its impact in case of occurrence. Physical risk according
to [Perry and Hayes (1985)] includes site difficulty, inclement weather, flood, earthquakes,

| Table 5: Likelihood and impact of risk factors at post-contract stage |
|--------------------------|--------------------|-------------------|----------|
| Risk factor             | Likelihood of risk occurrence index | Rank | Risk impact index | Rank |
| Financial risk          | 3.45               | 1    | 3.18              | 2     |
| Political risk          | 2.94               | 2    | 3.10              | 3     |
| Physical risk           | 2.32               | 3    | 3.19              | 1     |
| Contractual risk        | 1.87               | 4    | 1.90              | 5     |
| Logistic risk           | 1.55               | 5    | 2.68              | 4     |
| Legal risk              | 1.39               | 6    | 1.61              | 6     |
| Environmental risk      | 1.23               | 7    | 1.19              | 7     |

destruction of work by fire, etc. and accident on construction site. Since most of these
issues have great potential of occurrence on any construction site, it is therefore not a
surprise that physical risk ranked 3rd in its likelihood of occurrence. Moreover, since the
impact on occurrence of this risk factor could be devastating, it is also not a surprise that
it ranked 1st in its impact in case of occurrence.

Contractual risk ranked 4th in its likelihood of occurrence while it ranked 5th in its impact
in case of occurrence. Contractual risks are those associated with flaws in contract
document or improper contractual relationship [Akintoye and MacLeod, (1997)]. The risk
consequences or implication of these include claims and disputes, disruption of work,
stoppage of work, lack of coordination, delays and inflated cost. In spite of the grave
consequences of this risk factor, it is hardly surprising that it ranked mid way among the
identified risk factors. This is because balancing of risk allocation within construction
project by the two major parties to the contract can mitigate the risk factor.

Other risk factors which ranked low both in likelihood and impact of occurrence include
logistic risk [damage to material and equipment during transportation, availability of
suitable labour and materials], legal risk [liability for acts of others, direct liabilities,
complying with local law] and environmental risk [risk associated with the environment
where construction work is taking place e.g. reclaimed land, contaminated site,
ecologically damaged site, etc.]
CONCLUSION

This paper has attempted to investigate the likelihood of occurrence and impact in case of occurrence of some identified risk factors at pre and post contract stages of construction in the Nigerian construction industry. The paper concludes that at pre contract stage, the likelihood of occurrence of identified risk factors was found to be in the order of design risk, estimating risk, competitive tendering risk and tender evaluation risk. The perceived impact of the risk factors in case of occurrence was also found to be in the same order. Whilst this order is not a surprise in traditionally procured projects, which form the basis of the majority of the responses to the study survey, it provides an invaluable piece of information to the construction contractor as regards the risk factors to concentrate on in the risk management process.

Moreover, the paper concludes that at the post contract stage, the likelihood of occurrence of identified risk factors was found to be in the order of financial risk, political risk, contractual risk, logistic risk, legal risk and environmental risk. Unlike the case with the risk factors at pre-contract stage, the perceived impact in case of occurrence did not follow the same order of the likelihood of occurrence. For instance, whilst physical risk ranked 3rd in its likelihood of occurrence, it ranked 1st in its perceived impact in case of occurrence. Whilst this ordered list helps the construction contractor to target the significant risk factors to concentrate on for risk management purposes, it also reveals the need to consider the two-dimensional nature of risk in the risk management process.

REFERENCES

The assessment of risk in construction in Nigeria
