# DEVELOPING MODELS FOR PREDICTING THE IMPACT OF RISK FACTORS ON CONSTRUCTION CONTRACTORS' CASH FLOW FORECASTS IN NIGERIA

**By**

**Mustapha ABDULRAZAQ**
**BSc. QS (ABU 2002), MSc. Const Mgt (ABU 2008)**
**PhD/ENV-DESIGN/00084/2009-2010**

**A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY IN PARTIAL FULFULMENT FOR THE AWARD OF DOCTOR OF PHILOSOPHY IN QUANTITY SURVEYING**

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## DEDICATION

This thesis is dedicated to my late father Mallam Abdulrazaq Yusuf of blessed memory.

## DECLARATION

I declare that the work in the thesis entitled "**DEVELOPING MODELS FOR PREDICTING THE IMPACT OF RISK FACTORS ON CONSTRUCTION CONTRACTORS' CASH FLOW FORECASTS IN NIGERIA"** has been performed by me in the Department of Quantity Surveying under the supervision of Professor Ahmed D. Ibrahim, Dr. Yahaya M. Ibrahim and Dr. Abdullahi Ibrahim. No part of this thesis was previously presented for another degree or diploma at this or any other University. The information derived from the literature has been duly acknowledged in the text and a list of references provided.

| Mustapha Abdulrazaq | _____ | _____ |
|---|---|---|
| Name of Student | Signature | Date |

## CERTIFICATION

This thesis entitled "**DEVELOPING MODELS FOR PREDICTING THE IMPACT OF RISK FACTORS ON CONSTRUCTION CONTRACTORS' CASH FLOW FORECASTS IN NIGERIA"** by Mustapha ABDULRAZAQ, meets the regulations governing the award of the degree of Doctor of Philosophy of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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|---|---|
| Prof. A. D. Ibrahim<br>Chairman, Supervisory Committee | Date |
| Dr. Y. M. Ibrahim<br>Member, Supervisory Committee | Date |
| Dr. A. Ibrahim<br>Member, Supervisory Committee | Date |
| Dr. Y. M. Ibrahim<br>Head of Department | Date |
| Prof. K. Bala<br>Dean, School of Postgraduate Studies | Date |

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## ABSTRACT

Research has shown that construction contractors face challenges when attempting to manage their present and future financial requirements, via cash flow (CF) forecasting and/or the use of cash flow forecasting (CFF) models. Consideration for risk factors impacting on CF forecasts/CFF models has also been identified as a key issue affecting contractors' application of CFF models. The aim of the research is to develop models for predicting the impact of risk factors on CF forecasts predicted by contractors in Nigeria. A list of risk factors that impact on CF forecasts were identified through the review of existing literature on cash flow management, cash flow forecasting, risks in cash flow forecasts and factors contributing to project delays. The identified risk factors were then investigated in relation to the likelihood of occurrence and the impact on CF forecasts, if they occur. Data was collected via a questionnaire survey of contractors operating in the Nigerian construction industry. Two (2) sets of questionnaire surveys were conducted. The first questionnaire survey focused on determining the likelihood of occurrence/impact of forty (40) and thirty-one (31) risk factors impacting on cash-in and cash-out forecasts respectively. Contractors were asked to rank on a scale of 0 to 5 the likelihood of occurrence/impact of the risk factors. The responses obtained were subjected to analysis with the use of IBM SPSS (version 21) software. The mean, standard error and standard deviation were computed. The computed means were used to rank the likelihood of occurence/impact of the factors in decending order. Seventeen risk (17) factors were found to significantly impact on "cash-in" forecasts- "delay in receiving retention", "accuracy of estimates", "change in government officials", among others. While eighteen risk (18) factors were found to significantly impact on "cash-out" forecasts- "increased duration of the project", "change in currency exchange rates", "high cost of materials", among others. The second survey focussed on sixteen risk (16) factors whose likelihood of occurence and impact on cash-out forecasts were found to be significant. The survey sought respondents to estimate the percentage variations between actual and forecasted "cash-out" forecasts owing to the occurence of the significant risk factors. The responses of the second survey were fed as input to IBMSPSS neural network software and used to develop neural network models for predicting the impact of the significant risk factors on "cash-out" forecasts. The models developed showed that construction contractors' cash-out forecasts vary with the actual expenditure by +20%, +25% and +25% at the 30%, 50%, and 70% completion stages respectively. Validation of the models shows a 77%, 69%, and 67% accuracy at 30%, 50%, and 70% completion stages respectively. The findings from the research imply that several risk factors have different degree of occurrence on cash-in and cash-out forecasts in, and different degree of impacts on cash-out forecasts in the Nigerian construction industry. The impact on cash-in was not modelled as literature had suggested that modelling the impacts was not a true representation of reality. Construction contractors practicing in the Nigerian construction industry should expect positive variations to their "cash-out" flow forecasts during the execution of projects. Major recommendations include; contractors should carefully consider the seventeen (17) and Eighteen (18) highest occurring and high impact risk factors affecting "cash-in" respectively, before embarking on any construction project. The Eighteen (18) and Sixteen (16) highest occurring and high impact risk factors affecting cash-out respectively, should be considered before embarking on any construction project

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# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background to the Study

Managing cash flow forecasts is an essential component of financial management. Cash flow in construction contracts is concerned with the timing of payments, receipts of payments and the consequent balance of cash remaining due to these transactions. Construction Contractors know that there can be a significant lapse in time from the point at which they are granted a project, incur labour, material and other costs, to the time they are actually paid for completed work. Consequently, an inability to properly plan for the inflow and outflow of cash during the life span of a project may well result in the abandonment of the project. Cash flow in construction consists of the following important components (Kenley, 2003):

i. Gross cash flow- consisting of inward cash flow and outward cash flow. Founded on the relationship between time and cost, gross cash flow allies with models for the time-cost relationship.
ii. Net cash flow- consisting of the balance between inward and outward cash flow.
iii. Organisational cash flow- consisting of the overlaying of the organisation's individual project net cash flows.
iv. Strategic Management of cash flow- consisting of the policy and strategic framework for managing the cash flow for the entire organisation, including non-construction projects or investments.

Gross cash flow and net cash flow deal with cash flow on projects. Organisational cash flow and strategic management of cash flow deal with cash flow at the level of the organisation.

Several factors affect cash flow to a contractor working on a project. These factors include (i) duration of the project (ii) retention conditions (iii) times for receiving payments from employers (iv) credit arrangement with suppliers, equipment rentals etc and (v) times of payment to subcontractors (Park *et al*, 2005). Other factors affecting

cash flow forecasting include the type of client, size of the project, the procurement route, type of the project etc (Kaka and Khosrowshahi, 1996). Thus, the need for forecasting the cash requirement of a project at the right time, in order to determine when and where to borrow or redirect funds cannot be over emphasised.

In an attempt to assist, contractors and employers forecast their cash requirements, several researchers have made efforts to develop cash flow forecasting models. These attempts became popular over thirty years ago within the construction industry. The approach of early studies may be characterised as nomothetic- the studies attempted to discover general laws and principles across categorised or none categorised groups of construction projects (Kenley, 2003). Some of the techniques used for modelling cash flow forecasts include polynomial regression (Balkau, 1975; Bromilow and Henderson, 1978; Peer, 1982), Weibull-linear model (Tucker, 1986), Logit models (Kenley and Wilson, 1986, 1989), neural network (Boussabaine and Kaka, 1998) and fuzzy logic (Boussabaine and Elhag, 1999; Chen *et al.*, 2013). The nomothetic approach adopted by early researchers has gained fewer acceptances because of several shortcomings that resulted in the inability of the models to produce typical value curves. These short comings emanated as a result of the uniqueness of construction projects arising from difference in payment conditions (Chen *et al.*, 2005), time lag between billing and actual payment (Park *et al.*, 2005), type of project (Boussabaine and Elhag, 1999), procurement route (Kaka and Price, 1991; Kaka and Khosrowshahi, 1996), type of client and several other factors. This paved way for the introduction of the idiographic approach- the search for specific laws pertaining to individual projects. Researchers have shown that models developed using the idiographic approach, are more accurate than the nomothetic models (Kenley and Wilson, 1986; Kaka and Price, 1991; Boussabaine and Elhag, 1999). Despite these improvements, forecasts by existing

models continue to vary considerably with actual cash flow (Odeyinka *et al.*, 2002; Odeyinka *et al.*, 2008, Ross *et al.*, 2013, Zayed and Liu, 2014). According to recent researches (Ross *et al.*, 2013; Odeyinka *et al.*, 2013; Zayed and Liu, 2014) the variation between the forecasts and the actual is as a result of non consideration of risk factors inherent in construction by the models developed. Hence, more researchers are advocating for understanding and evaluating the impact of risk factors on cash flows. Zayed and Liu (2014) in a comparative test of risk factors impacting on cash flow forecasts in North America and China showed that the risk factors had regional dimensions. Results from their study showed that extent of impact of the risk factors are regionally endemic owing to geotechnical, cultural, attitudinal and other regional issues.

In Nigeria, authors have linked project abandonment to delays associated with payments (Ogunsemi, 2000; Ogunsemi and Jagboro, 2006; Aibinu and Jagboro, 2002; Olawale and Ming, 2009; Lawal and Onohaebi 2010). These delays, according to the authors, were caused by cash flow management problems and other factors like procurement route, availability of credit facilities, interest rates, retention rates, time lags between billing and actual payment, project type, type of client (public or private) etc. The cash flow management issues that have been linked to project abandonment in Nigeria are mostly risk issues impacting on cash flow forecasts-interest rates, availability of credit facilities, procurement route, project complexity and the likes.

## 1.2 Statement of the Problem

Previous studies on cash flow forecasting focused on developing models to forecast cash flow and risk factors impacting on cash flow forecasts. In developing the models, earlier researchers focused on the nomothetic approach, which aggregated groups of

projects in order to develop a single standard model. The nomothetic approach failed to clearly address issues concerning the uniqueness of construction projects in relation to factors affecting their cash flows- grouping of projects was done without consideration for differences in these factors. These models have been shown to be unreliable in predicting typical value curves for individual projects. Consequently, researchers changed their focus to the idiographic approach, which seeks to, as much as possible, address the problem of uniqueness of projects by studying individual projects having similar characteristics. The idiographic approach gained more popularity as more studies continued to adopt it for its ability to accommodate the uniqueness of projects. A major consideration of the idiographic approach is the choice of a single client/financier as a major factor to consider in developing a model. It is pertinent to note that the attitude of particular clients has enormous diffusing effect on other factors that affect cash flow to a contractor.

Further researches in cash flow forecasts revealed that the accuracy of cash flow forecasting models depends largely on several risk factors. Some of these factors include type of client, payment conditions, size of the project, procurement route, credit facilities available to the contractor, interest rates, subcontracting arrangement etc. It became apparent that most of the cash flow forecasting models developed did not take cognisance of the risk factors inherent in cash flow forecasts. This resulted in models whose forecasting accuracies were minimal (Odeyinka *et al.*, 2002; Odeyinka *et al.*, 2008). The realisation that the accuracy of models were affected by the non consideration for risk factors gave led researchers to focus on modelling risk assessment for cash flow forecasts.

However, most of the studies on risk assessment for cash flow forecasting were done in Europe and Asia. Thus, the risk factors identified in literature were drawn from studies carried out in Asia, Europe, and North America. Studies on cash flow forecasting carried out in Africa are limited in number (e.g. Buertey *et al.*, 2010; *Abdulrazaq et al.*, 2012). In a study carried out in the UK (Kaka, 1990) over fifty risk factors affecting cash flow forecasting models were identified. Similarly, Buertey *et al.* (2010) identified 18 significant factors affecting cash flow to contractors in Ghana, which include advance payment, limit of retention, withholding tax, interest rates, period of honouring certificates, bank overdrafts (availability of cash credit facilities) etc. Despite these attempts, existing models on risk factors impacting on cash flow forecasts still fail to capture some risk factors.

The effect and extent of impact of these and other factors on contractors' cash flow differ from one country/organisation to the other owing to differences in policies, culture and other regional attributes. More specifically, risk assessment models that are available in literature did not consider some risk factors like "charging of 'land dues' by locals (illegally)" (Dantata, 2007), "change in government officials" (Dusai, 2011), "bureaucracy in processing payments (giving bribes to "speed up" payment) (Aibinu and Jagboro, 2002; Dantata, 2007; Dusai, 2011), "change in activities' start time" (Ross *et al.*, 2013) among others.

### 1.3 Justification of the Study

Generating reliable cash flow predictions has long been understood as an essential component of construction practice (Chen *et al.*, 2005). A construction contractor who is able to adequately forecast future cash shortfall through an efficient cash flow model can make appropriate arrangements to ensure availability of funds when required (Park

*et al.*, 2005). A good strategic financial management policy (based on accurate cash flow forecasting) gives a contractor the opportunity to properly plan the best time to commence a new project, provided he has the flexibility to adjust the starting time of the project, should a cash surplus be available from other projects. It has become evident that cash flow forecasting is critical to the survival of any contractor at any point in time (Kaka and Khosrowshahi, 1996). One project may be a drainer of cash while another, a supplier of cash for daily transactions at any given time (Park *et al.*, 2005). The need to plan and balance the differences in cash requirements and provisions from individual projects by project-based organisations like construction companies is quite critical. Although several researches have been conducted using historical data obtained from construction sites in various parts of the world, the variation between forecasts and actual cash flows is still paramount. This variation has been traced to the inability of forecasting models to cater for risk factors affecting cash flows. Thus the need for understanding and assessing risks in cash flows cannot be overemphasised. This will inadvertently help contractors manage risks properly and consequently manage their operational cash, thereby reducing the problems of projects abandonment.

## 1.4 Aim and Objectives of the Research

### 1.4.1 Aim

The aim of this research is to develop models for predicting the impact of risk factors on construction contractors' cash flow forecasts in Nigeria.

### 1.4.2 Objectives

The objectives are:

i. To identify risk factors associated with cash flow forecasts in the construction industry.

ii. To evaluate the likelihood of occurrence of the risk factors and their impact on construction contractors' cash-in forecasts in Nigeria.

iii. To evaluate the likelihood of occurrence of risk factors and their impact on construction contractor's cash-out forecasts in Nigeria.

iv. To develop and validate models for predicting the impact of risk factors on construction contractors' cash flow forecasts.

v. To test the models.

### 1.4.3 Research Questions and Hypotheses

The statement of the research problem gave rise to the following research questions;

i. What are the perceptions of contractors in Nigeria as regards the likelihood of occurrence and impact of risk factors on cash in forecasts?

**ii.** What are the perceptions of contractors in Nigeria as regards the likelihood of occurrence and impact of risk factors on cash-out forecasts?

iii. Can the interactions between the risk factors and their impacts on cash flow forecast be modelled?

The research questions prompted the following hypotheses;

On cash-in;

- Null Hypothesis, $\mathbf{H_0}$; there is no significant difference in the perception of contractors on the impact of risk factors in cash-in forecasts along project characteristics.
- Alternative Hypothesis, $\mathbf{H_1}$; there is a significant difference in the perception of contractors on the impact of risk factors in cash-in forecasts along project characteristics.

On cash-out;

- Null Hypothesis, $\mathbf{H_0}$; there is no significant difference in the perception of contractors on the impact of risk factors in cash-out forecasts along project characteristics.
- Alternative Hypothesis, $H_1$; there is a significant difference in the perception of contractors on the impact of risk factors in cash-out forecasts along project characteristics.

## 1.5 Scope and Limitation

### 1.5.1 Scope of the Study

The general area of this study is modelling of cash flow forecasts for construction clients and contractors, at the project and organisational levels. A project level cash flow for contractors was considered, as this has been found to impact more on the contractor's operations. Risk factors that impact on contractors' cash-in and cash-out flow forecasts at the project execution level were considered. Only contractors who operate within the construction industry in Nigeria were approached for responses. Thus, this research developed models for predicting the impact of risk factors on construction contractor's cash flow forecasts. Data covering the overall experience of the respondents was obtained from experienced small and large scale building contractors. The study developed a project-level model useful for individual contracts and not company-level models that are useful for the overall prediction across all projects handled by the contracting organisation.

### 1.5.2 Limitations:

The model developed in this research can only be used to forecast risk impacts on cash flows for projects that are governed by payment conditions, retention agreement, procurement route, duration of contract, and other conditions applicable in Nigeria. The

data collected for the development of the model may have been affected by the experienced judgement of the respondents (i.e. construction contractors operating in Nigeria), as this differ from one individual to another.

The research was conducted through the administration of questionnaires to contractors in the Nigerian construction industry. The accuracy of the models developed depends largely on the accuracy of the information supplied by the contractors. The use of questionnaire survey became pertinent when it became apparent that the contractors were unwilling to part with archival data which would have been more accurate for developing the model. In order to reduce the effect of these shortcomings, respondents were requested to fill the questionnaire as conscientiously as possible and to make judgements based on an aggregate of their experience in totality.

The neural network used for prediction has its limitations as well- the primary limitation being that the process involved in the prediction of the outputs are not presented as mathematical formulas, but in a “black box” manner. The knowledge of how weights are attached to the predictors and subsequent generation of the predicted is not available to the user of the model.

# CHAPTER TWO

## 2.0 REVIEW OF LITERATURE

### 2.1 Construction Cash Flows

Financial management has long been recognised as an important management tool and proper cash flow management is crucial to the survival of a construction company, because cash is the most important corporate resource for its day-to-day activities (Peer, 1982; Singh and Lakanathan, 1992). Money lending institutions find it easier to give loans to companies that can generate a comprehensive cash flow forecasts (Navon, 1995). Construction industry generally, suffers the highest number of insolvencies than any sector of the economy with companies failing because of poor financial management, especially inadequate attention to cash flow forecasting (Boussabaine and Kaka, 1998; Calvert, 1986; Harris and McCaffer, 2001). Cash flow forecasting is done at two levels. One is at the project level which is done at the estimating and tendering stage, when the forecast is just for a single project being estimated. The other level is for the calculation of a cash flow forecast for the entire organisation, which involves aggregating cash flows for all on-going projects and is done periodically (Harris and McCaffer 2001).

Construction project cash flows are a sub-set of cash flow for an organisation. It is the inflow of cash to the contractor from a client, and also the outflow of cash to suppliers, subcontractors and to direct costs (Kenley, 2003). Cooke and Jepson (1986) defined cash flow as the actual movement of money in and out of a business, and this is the definition adopted in this study. Money flowing into the business is termed positive cash flow and credited as cash received. Monies paid out are termed negative cash flow and are debited to the business. The difference between the two is termed net cash flow (Fig. 2.1). Positive cash flow is derived mainly from monthly payment certificates.

Negative cash flows are the expenditure on wages, materials, plants, subcontractors and overheads (Cooke and Jepson, 1986). The net cash flow will require funding by a contractor when there is cash deficit and where there is cash surplus, the project is self-financing.

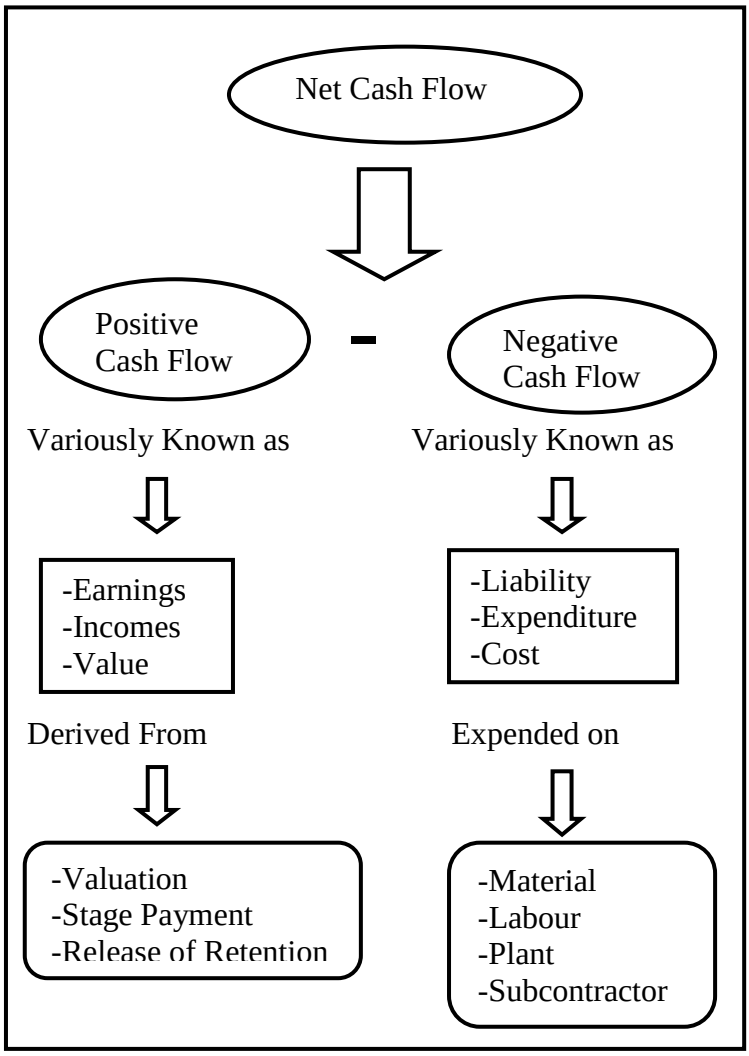


Figure 2.1 Construction Cash Flow Concept

Source: Odeyinka *et al.* (2008)

The positive cash flow is therefore referred to herein as earnings (cash-in) or income (receipts). The negative cash flow is referred to as liability or expenditure (cost, cost committed or cash-out). In a similar terminology, inward cash flow is the client-oriented flow of cash from the client to the contractor. This normally comes in periodic payments called 'interim or progressive payments'. Building contracts generally provide for such payments for two reasons:

i. To provide a mechanism whereby the contractor may recover money for work in progress, so that the contractor is not funding the project; and

ii. To restrict the payments to set periods (usually of one month) in order to reduce the amount of administration required by all parties.

Cash flowing in from the client may therefore be seen as being a series of lump sums, usually at intervals of one month, with no payments received in between (Kenley, 2003).

The flow of cash out to suppliers, subcontractors and direct costs is very different from the inward flow from the client. These payments follow the contract and agreement that exists between the main contractor on one hand and subcontractors and subcontracted suppliers on the other, and occur as labour and materials are called up and used during the construction of the project. Payments may be made daily such as purchase from local stores; weekly as wages or payment for goods on seven-day terms such as aggregate or steel; or monthly for subcontracts. At the end of the month many of the subcontractors and suppliers will be eligible for payment. Outward cash flow may be seen as an almost continuous (but variable) series of small lump sums, with concentration about the end of the month.

Cash flows to the contractor can take several forms depending on the nature of the contract. Cash flows generally occur in lump sums. The amounts of each payment are the periodic cash flows.

i. Progress payments- for capital works where the construction or assembly is undertaken at the supplier's premises, the supplier maintains ownership of the item until delivery. In this situation, highly structured forms of progress payment are required as the system of progress payment may be considered a loan.

> *In their simplest forms, progress payments may be viewed as a 'loan', a temporary interest free loan from a buyer (the prime contractor) to a seller (the subcontractor). They are based on cost incurred by the supplier in the performance of a specific order and are paid directly to the supplier as a stipulated and agreed to percentage of the total costs incurred (Fleming and Fleming, 1991:2)*

ii. Monthly cash flow- for most projects, the inward periodic cash flows are monthly. The monthly payment is determined by the contract agreement and the amount of work done at the end of each month (Table 2.1: column 3).

iii. Staged cash flow- it is useful to compare commercial/industrial building with domestic building. Generally for commercial/industrial contracts, a contractor is entitled to claim for payments at the end of every month, whereas a house builder may be entitled only to payments at the completion of stages in the progress of works (Table 2.1: Column 4).

iv. Turnkey cash flow- there are other methods for payments by the client to the contractor, particularly in modern contracts. One method that is becoming more common may be described as turnkey. Under such contracts, a single payment only is provided at the conclusion of the projects. This requires the builder to finance the project during construction, and involves a significant shift of risk to the contractor (Table 2.1: column 5).

Table 2.1: Comparative Table of Periodic Cash flows

| **Stage** | **Period** | **Monthly** | **Staged** | **Turnkey** |
|---|---|---|---|---|
| | Jan. | ₦0 | | |
| | Feb. | ₦382,603 | | |
| | Mar. | ₦1,350,726 | | |
| Stage 1 | Apr. | ₦2,557,667 | ₦4,920,996 | |
| | May | ₦2,543,151 | | |
| | Jun. | ₦1,794,395 | | |
| Stage 2 | Jul. | ₦894,551 | ₦5,232,096 | |
| | Aug. | ₦377,534 | | |
| | Sep. | ₦97,330 | | |
| Completion | Oct. | ₦2,044 | ₦476,908 | ₦10,000,000 |

Source: Kenley (2003)

Cash flows may be represented cumulatively rather than as periodic payments. The cumulative representation is most common in the building industry, and is often confused with the periodic representation.

Table 2.2: Periodic and cumulative cash flow

| Period | Periodic | Cumulative |
|---|---|---|
| Jan. | ₦0 | ₦0 |
| Feb. | ₦382,603 | ₦382,603 |
| Mar. | ₦1,350,726 | ₦1,773,330 |
| Apr. | ₦2,557,667 | ₦2,290,996 |
| May | ₦2,543,151 | ₦6,834,147 |
| Jun. | ₦1,794,395 | ₦8,628,542 |
| Jul. | ₦894,551 | ₦9,523,092 |
| Aug. | ₦377,534 | ₦9,900,627 |
| Sep. | ₦97,330 | ₦9,997,956 |
| Oct. | ₦2,044 | ₦10,000,000 |

Source: Kenley (2003)

### 2.1.1 The Need for Cash Flow Forecasting

The construction industry usually experiences a proportionally greater number of bankruptcies than do other businesses (Kaka and Khosrowshahi, 1996). Inadequate cash resources have been identified as the most recurrent cause of insolvency and subsequent failure of construction businesses. Failure to convince creditors and possible lenders of money that this inadequacy is only temporary aggravates the issue. The need to forecast cash requirements is important to make provision for these difficult times before they arrive (Harris and McCaffer, 2001). Cash flow forecasting provides a good warning system to predict possible insolvency. Cash flow forecast

enables preventive measures to be considered and taken in good time. Preventive measures include (Harris and McCaffer, 2001):

i. A contractor should not take a new contract when it becomes evident that engaging in the contract will stretch the company's projected cash requirements beyond its overdraft limit
ii. Re-negotiate overdraft limits with the support of reliable forecasts
iii. Adjust work schedule of contracts
iv. Negotiate extended credits with some suppliers
v. Accept supplier's full credit facilities, even if it means temporarily losing discounts.

Upson (1987) identified "giving early indication of shortages and thus gives time to;

i. Make arrangement for borrowing requirements
ii. Adjust programme of work to equalise borrowing and avoid peak demand
iii. Ensure credit control and monitoring of monies that are outstanding
iv. Control expenditure
v. Move surplus funds to an interest-bearing account
vi. Plan payments for money-demanding items like plants
vii. Repay loans as soon as possible.

As a follow up of a comprehensive cash flow forecast. One other common justification is the frequency of contractor failure.

Removal of the risk of bankruptcy is concerned with net cash flows. However, it is certainly true that a company, which manages net cash flow, is likely to begin by managing gross cash flows of projects. Other reasons for cash flow forecasting include (Kaka, 1990);

i. It ensures that sufficient cash is available to meet demands
ii. It provides a reliable indicator to lending institutions about the ability of a borrowing company to repay loans.
iii. It ensures that resources are fully utilised to the benefit of the owner and investor in the company.

Many otherwise profitable businesses have been forced into liquidation because calls for wages or bills for materials could not be met at the critical time, although substantial assets were frozen in long-term investments (Evans and Kaka, 1998). It is possible for the profit and loss account of a company to show apparent profit, when in

fact the firm is struggling to maintain a sufficient cash flow to allow it to continue trading.

Since project income will always lag behind project expenditure, the difference must be provided for in cash from company assets or borrowed funds for this purpose (Nunnaly, 1998). The finance charges associated with the use of such funds, as well as the maximum amount of fund available, are important considerations in the financial planning for a construction project. Nunnaly (1998) also observed that cash flow forecasting is important in determining the capacity of a firm to undertake additional projects. Most construction contracts require a minimum of 10% of the contract value as working capital (Nunnaly, 1998). This working capital is required to cover the difference between project income and project expenditure. The availability of working capital also affects the type of construction contract that might be appropriate for any additional work to be undertaken. When working capital is marginal, any additional work should be limited to low risk projects (Nunnaly, 1998).

The construction client also needs to forecast cash flow (Lowe and Lowe, 1998; Kenley, 2003). This was found to be important for the following reasons:

i. To identify the interest payments on short-term borrowing during the conception and construction phase of the project when undertaking the feasibility study on financial viability.
ii. To ensure that there is working capital in sufficiently liquid form to meet all contractual obligations (e.g. professional fees and interim payments) during the phases of the project.
iii. To enable the client to plan his financial position by borrowing short-term finance at the most advantageous rates.
iv. To enable the client select a suitable programme of projects that avoids overspending or injurious under spending. These problems are predominant in public sector agencies. Overspending, if not properly defended, could lead to imposing of sanctions. Under spending could imply that the cash not spent might not be carried forward to the following year's budget or even that the budgets for subsequent years might be cut as a consequence.

Thus, an approximate forecast at the conception phase of a project will assist the client to properly manage finances.

### 2.1.2 Cash Flow and Financial Plans

Mawdesley *et al.* (1997) emphasised the need for financial plan in cash flow management. This would normally represent the planned position throughout a project and as such would be concerned with the income, expenditure and net cash flow. The three categories were demonstrated by Mawdesley *et al.* (1997) as follows;

> *'Consider a person doing some work for an employer at a particular time. In doing the work, the worker earns a reward but in most circumstances work is being done, the employer is incurring a liability to pay the worker but it becomes expenditure only when payment is made. In general, a liability becomes expenditure and earnings become income'*

This simple model is complicated by various realities that make financial management a complex topic. For example; where some work does not directly earn anything but must be carried out; where inflation and interest rates are considered; where taxation and other dues are involved (Mawdesley *et al.*, 1997).

According to Boussabaine and Kaka (1998), in order to plan finances of a project properly, there is a need to update cash flow forecast in the course of a project. The suggested frequency of updating includes weekly, monthly and quarterly. For every minute that work is being done, revenue is being earned, liabilities (costs) are being incurred, and the associated adjustments need to be undertaken. However, updates should be done when the deviations from the existing plan are such that the existing plan is meaningless or when the client requests for an update. Ordinarily, there are only two times during the construction of a project when the contract earnings and income are equal; prior to the start of construction and when the construction effort is completed, payments have been received from the owner and all expenses have been

paid (Kaka, 1990). The components of model are discussed below *(Mawdesley et al., 1997)*;

i. Expenditure- When a project is carried out, various payments are made. The owner's expenditure includes payment to the main contractor(s) for the work. The main contractor's expenditure include payment to various suppliers for their materials, subcontractors for their inputs, the plant hire company (or the contractor's plant department) for the use of plant and equipment and the labour force for their work. The main contractor may also possibly differentiate between the expenditure given to suppliers of materials, subcontractors, labour and plant. It is reasonable to consider these as classifications for the expenditure- referred to as cost heads. Typical cost heads in a contractor's organisation are: labour, plant, permanent materials, temporary materials, subcontractors and overheads.
ii. Income and earnings- during the life of projects money flows into the projects as well as out. Main contractors receive payment from owners. Suppliers and subcontractors receive money from main contractors. The money flowing into a company is called income or revenue. It is obviously very closely related to expenditure (Mawdesley *et. al.*, 1997).

### 2.1.3 Time Lag and Projection of Cash Requirements

The timing of a cash flow is important to a construction contractor (Harris and McCaffer, 2001). There is generally a time lag between being committed to making a payment and actually paying for it. These time lags are the credit arrangements that contractors have with their creditors and debtors. The availability of cash and profit to a contractor is heavily dependent on this time lag. Kaka (1990) observed that normally, the earnings will be received on some monthly basis plus a time lag factor and the liabilities that have been incurred will be disbursed in some different sequence. Harris and McCaffer (2001) demonstrated that a cost versus time curve can be derived from a value versus time curve if the margin for profit and head office overheads added to the estimated direct costs is spread uniformly throughout the project.

According to Kaka (1990), the projection of cash requirements is to assist management in ensuring that there will be adequate funds available to pursue the construction programme, while at the same time not tying up the full cost of the project for the entire construction period. Management has the responsibility of looking for an optimum utilisation of funds in order to minimise the amount of time that any funds must be tied up in unproductive use. The forecast of expenditures for the project becomes management's blueprint for liquidating investments or borrowing in order to supply the necessary cash to fund the project. More aptly, this forecast is known as a cash flow forecast (Evans and Kaka, 1998). The contractor undertakes a relatively small number of discrete but complex operations and is required to finance at any time the difference between the cumulative contractual value of work done less retention monies and the cumulative cost of doing the work. The aggregate of a contract's cash flow will then depend on the scale of work and its phasing in with the rest of the firm's work. It follows that there will be periods of deficit and periods of surplus. It is the job of financial managers to raise funds to meet the former and apply the latter in the best interest of the firm (Cooke and Jepson, 1986).

## 2.2 Forecasting Cash Flow

### 2.2.1 Estimating Movement of Cash

The movement of cash during a contract may be roughly estimated from an earlier estimate derived from an empirical S-curve (Cooke and Jepson, 1986) as illustrated in Fig. 2.2. From the figure, a quarter of the cumulative value occupies a build-up period of one third of the contract duration and another quarter occupies the tail-end period of one third. Half of the accumulated value is gained over a centre third of steady progress. As the figure shows, a parabolic curve links the centre section to the origin

and end. Alternatively, a forecast of income may be derived from a contract programme prepared at the pre-contract planning stage. The cash-in (positive flow) can be accessed from the forecast monthly valuations (less retention). The cash-out (expenditure or negative flow) is calculated by reducing the cash-in by the anticipated profit margin spread across the entire project. The expenditure (cash-out) can then be plotted against time (Cooke and Jepson, 1986).

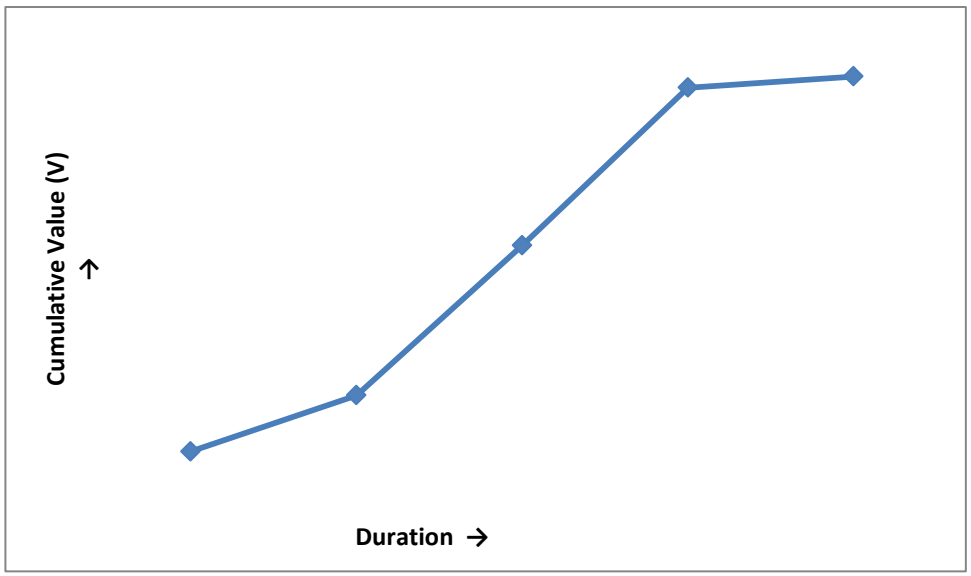


Figure 2.2 An Empirical S-Curve
Source: Cooke and Jepson (1986)

There are many approaches to forecasting cash flows that construction companies can adopt. The most appropriate approach being to calculate the cash flows on a project basis and aggregate the cash flows from all projects and head office to form the overall company cash flow (Harris and McCaffer, 2001). Harris and McCaffer also identified the data required for the detailed cash flow forecast as comprising of:

i. a graph of value vs. time, value being the monies a contractor will eventually receive for doing the work (i.e. cash-in);
ii. The measurement and certification interval;
iii. the payment delay between certification and the contractor receiving the cash;
iv. the retention conditions and retention repayment arrangements;
v. A graph of cost vs. time, the contractor's cost liability arising from labour,

plant, materials, subcontractors and other cost headings as necessary;
vi. the project cost broken down into items (i) to (v);
vii. the delay between incurring a cost liability under the above headings and meeting that liability.

The graph of value vs. time is needed in order to derive cash in. Calculations are usually done on a cumulative basis and so the cumulative value vs. time is produced over each time period (Harris and McCaffer, 2001). The graph of cost vs. time is needed to derive cash out or expenditure. Each bill item can be attributed the same percentage for profit and overheads in order to ease the quick transformation from value (cash-in) and cost (cash-out). This approach gives the contractor a base for easy pre-tender analysis of his forecasts. The approach allows the contractor to derive cumulative cost vs. time figures as a simple proportion of the cumulative value vs. time figures. Alternatively, where front-end loading (early activities carrying a greater margin than later activities) had been employed, the cumulative cost could be produced in the same way as the value vs. time from the project plan by costing each activity accordingly (Harris and McCaffer, 2001).

The net cash flow is the difference between the cumulative contract cash-out and the cash-in received from periodic valuations (Cooke and Jepson, 1986). The cash flow requirements of a project are thus obtained from plotting the graphs of forecasted cash-in, cash-out and subsequent net cash flows at any point in time.

Harris and McCaffer (2001) noted that at the beginning of a project, a negative cash flow is experienced by a contractor. This represents locked up capital that is supplied from the company's cash reserves or borrowed. Accordingly, if the company borrows the cash it will have to pay interest charged to the project. If it uses its own cash reserves however, it is being deprived of the interest earning capacity of the cash and should therefore charge the project for this interest lost.

The production of cumulative value vs. time and cost vs. time figures based on project plans is time-consuming because it requires every project in the forecast, i. e. every active or new project in the company's workload, to be represented by a network or bar chart. However, it is possible to bypass the 'plan' stage and use 'standard' cumulative value vs. time curves that adequately represent each project type. These cumulative values vs. time curves, presented in percentage terms, can be obtained from certification records of past projects. To make a standard curve from a library unique to a specific project, the time scale has to be multiplied by the project's estimated duration and the value scale by the project's estimated value (Harris and McCaffer, 2001). Several research efforts have been made to model standard curves to forecast cash flow. However, there have been considerable variations between the modelled cash flow profiles and the actual ones in many instances. These variations have been attributed to the uniqueness of individual construction projects (Kenley and Wilson, 1986).

### 2.2.2 Cash Flow Models

Two basic approaches were adopted by researchers in the development of cash flow forecasting models; the nomothetic and idiographic approaches. Early researchers in the field of study employed the nomothetic approach, which aggregated groups of projects in order to develop a single standard model. Projects were not grouped under any sort of criteria or characteristic. The nomothetic approach failed to clearly address issues concerning the uniqueness of construction projects in relation to factors affecting their cash flows. The idiographic approach on the other sought to, as much as possible, address the problem of uniqueness of projects by studying individual projects having similar characteristics. The idiographic approach gained more popularity as more studies continued to adopt it for its ability to accommodate the uniqueness of projects.

### 2.2.3 Nomothetic Models

The unpublished work of Bromilow (1969), reported in Kenley (2003) reported one of the earliest works on cash flow forecasting. Bromilow examined four medium sized commercial and industrial projects. He used polynomial regression to find the equation of best fit for the curve. Of importance is his finding that the cumulative relationship between payments and time is S-shaped rather than linear. This finding was consistent with the work of other researchers in cash flow and related works. Prior to 1969, it was often held that the relationship could be approximated as linear, implying that progress payments were of equal value and at equal intervals. Bromilow's finding was an important contribution and is generally accepted by later researchers as having been proven. However, the Bromilow model is a client model which was developed to satisfy the need of the client organisations that needed to forecast their cash commitments during the life of a project. The model was developed at a time of relatively stable economic conditions, before contractors became interested in modelling and models.

Another major study in the area of construction project gross cash flows was initiated at the British Department of Health and Social Security (DHSS). It was started by Hudson in 1967. The findings of the study were published by Hudson (1978). The Hudson model of project cash flows is an analytical model that has the ability to achieve standard curves for categories of project and adapting to each individual project using real data points and simultaneous equations.

Berdicevsky (1978) analysed the data from four projects constructed within a University to derive a third-degree polynomial. The four projects were all different in size, function, design, construction time and intended use. This gave the regression a

low validity. Berdicevsky was more concerned with gross inward cash flows for the contractor.

Peer (1982) supported the use of standard curves because, in his opinion, cash flow forecast is often required before any detailed time schedule can be given. He performed a polynomial regression on the data points of four major housing projects. The fourth degree polynomial regression equation proved to be more accurate than the Tanh and error functions because the standard deviation was found to be minimal for the regression.

Tucker (1986), using reliability theory, adopted a probability approach to forecasting cash flows. Tucker assumed that "…the characteristics of the payment units are all similar and that they are treated under similar conditions, the payment unit completion time T may be considered as having a probability distribution". The cumulative S-curve represents the cumulative probability of expenditure. Tucker's work was instrumental to the formation of a computer software package called FINCASH developed by the Common Wealth Scientific and Industrial research Organisation (CSIRO).

Khosrowshahi (1991) developed a mathematical model which was tied to the periodic expenditure rather than the cumulative expenditure. The derivation of Khosrowshahi's formula was found to be complex by subsequent researchers.

Kaka and Khosrowshahi (1996) attempted to compare standard cost commitment curves with the types of contracts and procurement routes. These they did by analysing 150 contracts under different types, procurement and sizes. The analysis showed that one typical standard curve cannot be used for cash flow forecasting and thus they proposed the development of standard curves for contracts based on similar characteristics (i.e. size, procurement etc) as this has an impact on the cash flow

forecast. The classification used for the contracts can be expanded to include other criteria like location, type of client etc.

Kaka (1999) collected the actual monthly cost commitment curves for 118 building projects from four contractors in order to develop a method that will stochastically generate s-curve envelops. The method was adopted in order to monitor progress of projects.

Odeyinka and Ojo (2007) developed a conceptual framework for assessing risk impacts on clients' cash flow. The framework proposed a step-by-step approach for developing a model to predict clients' risks in relation to cash flow. The framework suggested identifying risk factors affecting cash flow forecasting from existing literature and discussion with construction clients. This will be followed by identification of significant risk factors impacting on clients' cash flow. Cash flow data from various projects will then be obtained and grouped according to type, client, procurement and duration. The significant risk factors will then be used to determine the extent of occurrence of the identified factors in projects. The extent of risk occurrence responsible for variations between actual and forecasted cash flow will then be determined at different completion stages of the projects. The pair of data obtained will then inform the researchers to develop the model for determining impact of risks on client's cash flow. The model development will focus on clients' negative cash flow only as this appears to be the cash position of the client during construction. However the research can be viewed from the perspective that a client can also obtain positive cash flow during construction.

Park *et al.* (2005) proposed a model for forecasting cash flow which considered time lag between cost incurred and value earned by the contractor during the construction

stage. The model took cognisance of monthly actual costs incurred against planned costs during the construction stage. Moving weights were obtained via a series of ratios comparing cost categories and budgets (initial and final). These moving weights were used to forecast subsequent costs on monthly bases. The model developed was tested against existing fixed weight model (F.W.M). The tests show that Moving weight model (M.W.M) is more accurate than F.W.M. This research restricted itself to activities during construction and did not take into consideration cost activities before and after the construction stage- these also have a bearing on total cash flow for projects.

Kaka and Khosrowshahi (2008) developed a mathematical based model which sought to address the difficulties encountered by large companies when collecting data for use in computer based models. The research assumed that future works start at the middle of each year and by using a standard value build-up curve, average duration and total value of work needed, models for forecasting turn over and working capital required by Contractors at company level were proposed. The hypothetical models were tested using a previously developed and tested computer based model. However, the research did not capture how on-going works can be incorporated into the model. Neither was it able to address forecasting at individual project level.

Motawa and Kaka (2009) proposed a model that uses a series of integral equations to enhance cash flow through analysing alternative payment mechanisms (e.g. cost reimbursement, lump sum, cost-plus a percentage, target cost etc). The model also incorporates a system for paying off-site materials based on whether off-site materials are not to be considered, to be considered fully before provided on site and before

construction starts or to be partially considered before provided on site, then fully considered once construction starts.

Cui *et al.* (2010) developed a model for the system analysis of cash flow management strategies. The strategies studied included front-end loading, back-end loading, overbilling, under billing and trade credits. The study concluded that by using an overbilling and under billing strategy a project management team could reduce project overdraft balance by as much as 11.4%. A properly implemented trade credit strategy would result in another 19% reduction in overdraft going by the developed model. The use of the model was limited by the fact that it can be used only when system parameters for specific projects are customised.

Chao (2010) opined that rates for project overheads (i.e. preliminaries) estimation is mostly based on subjective decision without any sound bases. This method, he argued, is prone to inaccuracy. As a result he proposed a Decision Support System (DSS) based on a construction firm's cost data and using a neural network. The model was developed by collecting historical data on 173 projects from a single construction firm that operates in Taiwan. Four factors consistent to all the projects were used as an input to the model (project size, duration, type of work and location). The result from the studies showed that the higher the direct cost of a project the lower the estimated overhead rate. The study also showed that for each project an optimal duration with the lowest rate exists below and above which the estimated rate increases. Perhaps collecting the same sets of data in a different country and/or expanding the factors beyond the four considered will yield different results.

Jiang *et al.* (2011) developed a multi-objective cash flow planning model, known as the Pareto Optimality efficiency network model, which considers typical banking

instruments, the constraints of financial market, budget constraints and retention. A good view of cash flow management is provided by the model. However, other factors like client's progress payment, delayed payment and penalties for delays were not captured.

Chen and Roy (2011) used the Evolutionary Fuzzy Support Vector Machine Inference Model for Time Series Data ($EFSIM_T$), an artificial intelligence hybrid system focusing on the management of time series data characteristics which fuses fuzzy logic (FL), weighted support vector machines (weighted SVMs) and a fast messy genetic algorithm (fmGA), to predict cash flow. Simulations performed on historic data showed $EFSIM_T$ to be an effective tool for the prediction of cash flow.

Lucko (2011) used singularity functions to model cash flow profiles. Singularity functions define ranges of behaviour between cut-offs and are yet to flexibly and accurately model profiles. The various payment terms and cash flow profiles of the data collected were modelled using the function. The study introduced new capabilities of singularity functions for financial modelling and optimisation by integrating different cost behaviours and payment terms.

### 2.2.4 Idiographic Models

Mishkawi (1989) developed a mathematical model based on practices in the petrochemical industry. The model appeared to have been developed without reference to models in existence as at the time. The curves derived from Miskawi's formular were found to be unlikely to be of much use in the construction industry.

Betts and Gunner (1993) carried out an analysis of 73 projects. Their work adopted a polynomial regression approach. They performed a polynomial regression on sets of data for projects from different categories. They introduced and rejected previous

models either because they were not “favourable to the data gathered in the region under study” or “were evaluated and found to be inappropriate”.

According to Kaka (1990), previous models did not incorporate enough variables to predict cash flows with enough flexibility. Thus he developed a model which incorporated over fifty variables including risk factors associated with cash flow forecasting. The model was based on individual contracts considering their separate cost categories and payment history (i.e. valuations). The method adopted by the researcher proved that the inclusion of more variables in the development of cash flow models improves their accuracy and flexibility.

In an attempt to obtain more accuracy in cash flow modelling, Evans and Kaka (1998) collected historical data on 20 food retail stores to analyse the accuracy of standard/average value curves. The samples were chosen for their consistency in Architectural design and specification. Data collected were associated with costs and contract durations. The data were analysed using Logit transformation and standard deviation. The result of the analysis showed that value curves are not good enough to generate accurate s-curves. The Authors suggested the use of cost commitment curves instead.

Boussabaine and Elhag (1999) developed a model targeted at the idiographic (project-specific) nature of construction project cash-flow curves, by introducing the fuzzy theory and applying it to cash flow profiles. In order to do this they needed an originating profile, which they derived from 30 projects. The fuzzy logic was adopted to manage uncertainty and ambiguity in cash flow forecasts.

Boussabaine *et al*. (1998) developed a cost flow forecasting model based on Artificial Neural Network (ANN). ANN uses trained artificial intelligence to predict cash flows. The researchers collected data from 50 projects with 100% completion, with duration ranging between 1 and 2 years and carried out under the Institution of Civil Engineers Standard Conditions of contract. Forty cases were used to train the ANN while the remaining 10 were used to test and validate the model developed. The model was developed using projects of very similar characteristics.

Kirkham *et al*. (2002) collected data on the consumption of electricity in a National Health Services (NHS) acute care hospital building in the UK. Their aim was to demonstrate a methodology for forecasting the cost of electricity in an NHS building. They found that by using expert judgement alongside statistical tests, an increase in accuracy of projection was achieved. The researchers also found that the underlying distribution of electricity costs were mostly that of the Weibull distribution. The Authors concluded that the result could be used in whole life cycle cost model for forecasting electricity cost.

Blyth and Kaka (2006) developed a multiple linear regression model for forecasting S-curves at the pre-tender stage of a project. They collected and standardised activities for 50 construction projects. The projects were classified into various criteria based upon project function. Logit transformation and linear regression was then used to develop the proposed model. The research was able to define its idiographic approach (emphasis on individual rather than grouped projects), the classification of the projects using 20 criteria emphasised the need for more specific classification of projects for the purpose of obtaining more accurate forecasts.

Chen (2009) developed a cost response (CR) model for company level cost flow forecasting of project-based corporations (i.e. construction companies). The author argued that although many researchers had developed s-curves for predicting individual projects, the reliability of generating company-based forecasts based on the individual project models was questionable. Thus the author developed a company-level model using a combined method of transformed time series data, multivariate regression analysis and incomplete principal component regression analysis of economic activities and balance sheets of the companies.

### 2.2.5 Risks in Cash Flow Forecasts

Researchers in the construction industry have attempted to define risk and suggest management strategies for containing risks. Healey (1982) defined risk as "an exposure to economic loss or gain arising from involvement in the construction process". However, Moavanzadeh and Rossow (1976) regarded risk as "an exposure to loss" only. Perry and Hayes (1985) defined risk as "the chance of exposure to the adverse consequences of future events". It is generally recognised that participants within the construction industry are continually faced with a variety of situations involving many unknown, unexpected, frequently undesirable, and often unpredictable factors (Fong, 1987). Flanagan and Norman (1993) asserted that risks are associated with uncertainties but uncertainties, in contrast to risks, might be defined as situations in which there are no historic data or previous history relating to the situation being considered by the person making a decision. The more the thought that is given to risks and uncertainties, the more the inclination to accept risk as the more important term in the building industry (Flanagan and Norman ,1993). The aim of a construction firm should be to identify, analyse, evaluate, and operate on risks. Risk, if contained properly in businesses, can be used as an instrument for gaining advantages (Khosrowshahi, 2000).

In forecasting cash flows, the major problem that construction managers face involves both the risk and ambiguity surrounding cash flows expected on projects. Factors that are responsible for variation in project cash flows can be grouped under five main headings- contractual, programming, pricing, valuation and economic factors (Lowe, 1987). Several models have been developed by construction researchers to assist project managers forecasts their cash requirements. In spite of these various attempts at modelling construction cash flow curves, accurate forecasts have been a difficult thing to achieve due to risks inherent in construction projects (Odeyinka, 2008). Flanagan and Norman (1993) concluded that certainty, as opposed to risk, does not happen frequently in the construction business. Bennett and Ormedo (1984) also concluded that uncertainty is a major characteristic of construction and needs to be explicitly recognised by construction managers.

Researchers' interest in risks associated with cash flow forecasts was triggered when it became obvious that ignoring the risks associated with forecasting cash flows was a fundamental reason why inaccuracies were continuously obtained from cash flow forecasting models (Odeyinka, 2003). In the last two decades efforts have been made to investigate and report risk and associated factors that are responsible for variations between forecast and actual cash flow forecasts.

Kaka and Price (1991) attempted to develop a model capable of forecasting net cash flows at the tendering stage. They argued that generating cash flow forecasting models based on value curves was not ideal due to different "loadings" and "estimating" approaches. The contractor, they posited, rarely loads the cost of items in a contract with the same rate. The possibility of building an ideal cost curve was examined by building an average curve from seventeen project data. The average curve obtained was

used to forecast net cash flows for five projects. It was discovered that the model performed well on the five projects used for testing its validity. In developing the model the researchers took into account “all the effective variables”. Theses effective variables as pointed out by Kaka and Price (1991) include- front end loading, error in measurement, inflation, retention rate and payment delay by clients, which effectively, can be considered as risk factors affecting cash flow forecasts.

Kaka and Khosrowshahi (1996) also studied the effect of different procurement routes on contractor’s cash flows. Historical data obtained from 150 construction projects were collected under four criteria - type of project, size of the project, company type and procurement route. The effect of these criteria on the S-curve was then examined. Several tests carried out on the curves generated revealed that different procured projects with different sizes produced different patterns. Company type and type of project did not significantly affect the shape of the S-curve. Results also revealed that, in some cases, the variation in procurement routes had a significant effect on contract cash flows. Three factors were particularly identified as the cause of the variation in cash flows-cash delays, retention condition and the procurement route.

Kaka (1996) made the argument that results from traditional cash flow forecasting models have not exhibited significant variation in actual cash flow profiles which had been demonstrated by previous researches. Thus, further variables were needed to enhance the flexibility of cash flow profiles. The study then presented a model designed to use more than fifty variables to calculate the cash flow of individual contracts. Majority of the variables identified by the study were risk related - estimated duration of the project, front –end loading, retention percentage, under measurement, over measurements, payment delay from client, variation orders, duration variance and

associated penalties, cost variances across all cost items, etc. The study further reiterated the need to study risks associated with cash flow forecasts. Kaka *et al.* (2007) also claimed that measurement accuracy, client's retention, delay in payment by client, front end loading and delay in payment to subcontractors also affect the financial performance (invariably, cash flows) of a contractor. Tang and Leung (2005) also identified front end loading and claim loading as risk strategies employed by contractors in the construction industry.

The study of risks in construction was given a different outlook when Khosrowshahi (2000) suggested that rather than continuing to see risk as a "disease" or "hazard" as described by researchers before him, risk can be properly managed in the modern day highly complex business environment to yield financial advantages for the company. By developing a forecasting model which was used to demonstrate that risk management can be advantageous, Khosrowshahi was able to show that a proactive approach to risk management can produce favourable result in terms of cash flows to an organisation.

Barbosa and Pimentel (2001) studied the cash flow management practice in Brazil. They developed a linear programming model for cash flow management in the Brazilian construction industry. The issues identified by the researchers and incorporated into the model include possible delays on payments, use of available credit lines, effect of changing interest rates, and budget constraints which they claim often occur in the Brazilian construction industry. The research was restricted to the Brazilian experience and also emphasised geographical restriction of risks factors affecting cash flow forecasts.

Odeyinka, Lowe and Kaka (2002) argued that despite several attempts by researchers to develop cash flow forecasting models for contractors and clients in the construction industry, many of the models failed to consider and analyse the risk factors responsible for the considerable variations in the modelled cash flow profiles. Consequently the researchers set out to identify and assessed the risk factors responsible for variations in the construction cash flow profiles. The study was conducted via a questionnaire survey of contracting organisations. The result of the analysis conducted revealed the major risk factors affecting cash flow forecasting relates to "changes in design or specifications", "contract conditions pertaining to cash flow", "interim valuations" and "certificates and construction programming" issues such as "inclement weather". However, the study was conducted in the UK where the researchers identified as having "a stable economy". The research further emphasised the geographic dimension of risk factors impacting on cash flows and cash flow forecasts.

Hwee and Tiong (2002) also attempted to assist construction contractors to understand the trend of cash flows prior to engagement. A computer based model that had a cash flow forecasting ability that incorporated impact of five risk factors on project cash flows was developed. The risk factors identified and studied are duration of the project, over measurements, under measurements, variation, and material cost variances.

Park, Han and Russell (2005) argued that previous researchers had concentrated too much on forecasting cash flows in the early stage of pre - tendering stage, while neglecting the forecasts during construction stage. They therefore proposed a model for forecasting cash-in and cash-out during the construction process. In developing the model several factors affecting cash flows were considered. Majority of the factors are risk related - time delays, change orders, duration of projects, retention condition, time

of receiving payment from client, availability of credit facilities, availability of equipment and time of payment to subcontractors.

Tang and Leung (2005) also developed a model to assist contractors in the process of financial decision making. The Impartial Decision Model developed in three dimensional vectors had financial risks attached. The risks identified and incorporated in the model included heavy rainfall, shortage of labour, time constraints and delay in payment. The identification of heavy rainfall and shortage of labour as a risk factor affecting financial capabilities further emphasised the geographical dimension of risks associated with construction financing.

Dantata (2007) in a study of the general overview of the Nigerian construction industry identified key factors affecting the growth of contractors in the Nigerian construction industry. The researcher identified skilled manpower shortage, high cost of materials, unstable prices of materials, delay in payment by clients, frequent social tensions and Bureaucracy in processing payments as key factors inhibiting contractors from growing. Dusai (2011) also identified bureaucracy in processing payments, change in government leadership and informal charging of land dues by locals as important factors affecting contractors' progress in the Nigerian construction industry. Although neither of the two researchers tagged the factors as "risk factors to cash flow forecasts", previous and subsequent researches tagged them as such.

Odeyinka, Lowe and Kaka (2008) identified and assessed the extent of occurrence and impact of risk factors responsible for the variation between forecast and actual construction cash flow. The researchers administered structured questionnaires to UK based contracting organisations. A project-by-project approach was adopted and respondents were asked to respond to questions based on a project they were recently

involved with. 26 risk factors identified were used as basis for formulating the questionnaire. The study revealed 11 significant risk factors that impacted on cash flow forecasts in the UK construction industry. The 11 risk factors were grouped under 3 generic factors – “changes in design or specification”, “project complexity” and “natural inhibition”.

Enshassi, Al-najjar and Kumaraswamy (2009) carried out a study of Gaza strip (Palestinian Authority) to determine delays and cost overruns in the construction projects. The study was prompted by the special conditions available in the region (Gaza strip frequently undergoes civil unrest as a result of dispute between Israel and Palestine). A combination of contractors, consultants and owners in the construction industry were randomly selected for the study. The findings from the research are that strikes and border closures, material related factors, lack of materials in markets, and delay in material delivery to site contribute majorly to time delays. While cost overruns are caused majorly by price fluctuations of construction materials, contractor delays in material and equipment delivery, and inflation. The factors identified by the study are direct risk factors impacting on cash flows.

Most of the researches in cash flow forecasting and other related construction financing were carried out in Asia and Europe. A few related studies were carried out in Africa though. Aibinu and Jagboro (2002) studied the effects of construction delays on project delivery in the Nigerian construction industry. The study revealed that shortage of material/manpower, variation orders, strikes, civil unrests and inclement weather were inimical to smooth project delivery in the country. Subsequent researchers identified the same as risk factors affecting cash flow forecasts.

Buertey *et al.* (2010) developed a model for predicting construction cash flow in Ghana through a case study of a group of flats under construction by the government. Analysis of data gathered through a questionnaire survey of consultants, contractors and client's representatives 18 factors were identified as significantly affecting cash flow forecasts for contractors in Ghana. The factors include contractual specification for maximum amount valuation, availability of credit facility, advance payments, interval between two certificates, period of honouring certificates by client, rate of retention, interest rates, front/back end loading, accuracy of measurements etc.

Mbachu (2011) investigated the sources of contractors' payment risks and cash flow problems in the New Zealand construction industry. Data was collected from project teams as to their perception of the risks contributing to payments in New Zealand. The result identified payment delays, high interest rates, inflation, government regulations, complexity of projects and claims as significantly impacting on cash flows.

An analysis of the impact of negative cash flow on construction performance in Dubai carried out by Al-Jabouri *et al.* (2012) showed that there were negative cash flows for up to 70% of project duration. The study also revealed that adjustment of activities' start time and relationship between contractor and owner were major risks in forecasting cash flows.

Muhamid (2013) assessed common risks affecting time overruns in road construction projects in Palestine. By assessing contractors' perspective of the factors inhibiting cost overruns of road projects, seven crucial risk factors were found to result in the overruns- delay of payment by employer, poor communication between construction project parties, exchange rate fluctuation, availability of bank loans, inflation,

inclement weather and lack of equipment, which had also been identified as risk factors impacting on cash flow forecasts.

Jarkas (2013) studied primary factors influencing bid mark-up size decisions of general contractors in Kuwait. The effects of 40 factors on contractors' decision to raise or drop mark-up size were investigated. "Relationship with owner" topped the list of factors responsible for decision to adjust mark up. Bid mark up had earlier been discovered as a crucial risk factor influencing cash flow forecast (Kaka, 1990). This consequently suggests that "relationship with owner" is an important risk factor affecting cash flow forecasts. The finding further buttressed qualitative factors influencing profits to contractors.

Odeyinka *et al.* (2013) identified eleven significant risk factors impacting on cash forecasts for contractors in the UK. By studying 26 risk factors via a questionnaire survey of contractors, the researchers were able to conclude that the eleven factors impacted cash flow forecast more in UK's "stable" economy. The study revealed a regional dimension to risks in cash flow forecast.

Ross *et al.* (2013) also revealed "activities' start time", "estimating errors", "dates of interim payment", and "retention percentage" as being crucial to expenditure forecasting practice by construction contractors.

Cheng (2013) explored cost influencing factors on construction projects. 42 factors identified from literature and interviews with construction experts were used for the survey. An analysis of the data collected revealed 16 key cost-influencing factors as being topmost. Seven of the 16 factors are associated with cash flow forecasts- dispute

between contract parties, high cost of commodity, shortage of material, incompetent consulting team, under-valuation, geotechnical issues, and inclement weather.

Chang *et al.* (2013) made a case for developing a two-stage model for project profit prediction. They argued that an accurate project-profit prediction is crucial to a construction company because it can provide an early feasibility estimate and completion for a project. The two stage model developed proved to be credible in providing the desired results. In developing the model risk variables impacting on cash flows were incorporated. The factors incorporated are cost of materials, available manpower, payment delays, and cost variations.

Han *et al.* (2013) identified diverse risk factors influencing project cash flows particularly in the domain of international projects, laying further emphasis on impact of location on risk factors affecting cash flow forecasts. The study classified risk factors impacting cash flows into two- financial risks and project-specific risks. Financial risks include external economic conditions like exchange rates, cost escalation, and interest rate. While project-specific risks include host country's geotechnical condition, weather and climate differences and resource delivery conditions. The study emphasised on the need for a construction firm to decide on a decent level of cash contingency to accommodate risks in carrying out overseas construction jobs.

McClain *et al.* (2014) discovered that poor communication, geotechnical issues and problems with foundation were prominent risk issues associated with cash flow forecasts. Delay in payment by employer, delay in honouring certificates, change orders and nominated subcontractors fault were identified as significant contributors to decisions to delay claims in construction contracts executed in India (Chaphalkar and Iyer, 2014).

Zayed and Liu (2014) emphasised on the impact of location on factors affecting cash flow forecasts. Data for the study was collected from North America and China. A total of 43 factors affecting cash flow forecasts were used for the study. 33 and 67 questionnaires were collected from North America and china respectively seeking respondents to rate the impact of each identified factor on cash flow forecasts. Result from the survey showed a significant difference in the impact of the following risk factors in the two locations- "contractor's personal relation with the consultant team", "contractor's personal relation with the owner", "lack of skilled labour", "change of progress payment duration", "change of labour and staff wages", "delay of making payments to suppliers", and "number of claims".

Several risk factors affect cash flow forecasts as shown in the various studies above. Recent researches have also insinuated that geographical location may have influence on the risks factors that affect cash flow forecasts (Cheng, 2013; Chang *et al.*, 2013; Hang *et al.*, 2013; Zayed and Liu, 2014; etc). These facts seem to suggest that there is a need to develop a model that will capture and evaluate all the risk factors identified in order to forecast the variation between actual and forecasted cash-out/cash-in in a particular region.

## 2.3 Cash Flow in the Nigerian Construction Industry

In the area of cash flow forecasts in the Nigerian construction industry, studies carried out by Aibinu and Jagboro (2002), Dantata (2007), and Dusai (2011) focused on delays to projects in the Nigerian construction industry. A close look at the factors identified by the studies as having bearings on delays to project duration, however, revealed a direct connection to cash flows and cash flow forecasts. A more recent study, Abdulrazaq *et al* (2012) reported that contractors in Nigeria practice cash flow

forecasting formally or informally, suggesting that contractors in Nigeria are carrying out some form of forecasting.

Most of the problems identified as being paramount in the Nigerian construction industry by Dantata (2007) were not directly ascribed to cash flow forecasts but are inadvertently crucial to cash flow forecasts. The following problems were identified (Dantata, 2007);

i. Unethical Practices- several unethical practices have been reported by researchers. The problem of corruption is a major detriment to the development of the industry as it prevents competition amongst players in the industry. The most common of these practices in the Nigerian construction industry are; vital information leaked to contractors after paying bribes, inclusion of "kickbacks" in tender, ignoring of excessive prices by officials due to vested interests, forwarding bids having officials interest built in, allowing multiple subcontracting of a project, and assurance of winning bids given to contractors well in advance of the bidding process. While these problems are common in other countries, there prevalence in Nigeria is very alarming.
ii. Lack of skilled manpower- lack of adequate and skilled manpower has been continually responsible for Nigeria's poor showing economically, and that it also contributes in no small measure to the high rate of unemployment and other related problems in the country. Many of the large companies seek manpower from elsewhere in order to fill the gap. This immensely adds to their operating cost and shrinks their profit margins.
iii. Unavailability and High cost of materials- the unavailability of some basic materials in Nigeria increases the cost of construction since many of the materials have to be imported. In most cases the locally fabricated materials have relatively higher costs compared to other countries. Also, for most of the materials the local supply is almost always less than the demand, hence requiring costlier importation.
iv. Unstable prices of materials- prices of basic construction materials such as cement and steel often fluctuates significantly in Nigeria. For example, whenever there is a problem with one of the cement plants in the country, which further widens the gap between supply and demand of the product, the price of cement rises significantly. Since some contracts are contracted on a fixed price basis, this causes significant problems to companies as costs will turn out to be higher than earlier anticipated.
v. Financial problems- a major problem for companies in the Nigerian construction industry is that of finance. Unless companies are large enough and have sufficient money at hand, or

are given a large percentage of the contract sum up front, often companies need to borrow money from the banks, before receiving payments from clients. In Nigeria, however, it is very difficult to borrow money from the banks. Even when the loans are secured, the interest rates on them are very high, often as high as 20% if not higher. This prevents many companies, especially smaller ones, from being able to borrow money in order to execute projects.

vi. Incompetent professionals- many practicing professionals are not licensed by the appropriate licensing agencies. As a result many buildings are not built in accordance with the required standards. Whenever there is a mishap, during or after construction, like the collapse or failure of some buildings or structure, no professional builder or engineer is found who is responsible. This problem is more apparent in the informal sector of the construction industry, where people build based on their gut feeling.

vii. Frequent social tensions- often companies win bids for jobs, receive part of the payment, but face unplanned delays due to tensions in the vicinity of their works. This is particularly a big problem in the Niger-Delta, where foreign workers are often kidnapped and released only upon payment of ransom. This causes significant delay in construction activities and adds to the cost of construction in those regions since companies have to budget for security in case of an eruption of violence around their work sites.

viii. Delay in payment by clients- this is one of the major reasons why construction companies go out of business in Nigeria. Payments to contractors are rarely done on time and as stipulated in the contract conditions. Whenever there is a change in government, the new government often defaults in payment of jobs given by the previous government. Large companies are usually able to write-off some of these monies owed. However, small companies are unable to survive.

## 2.4 Impact of Risk Factors on Cash Flow Forecasts

Studies have shown that risk factors impacting cash-in and those impacting cash-out differ. Some of the factors impact both cash-in and cash-out to a contractor while other factors impact only the cash-in or cash-out. The list below summaries the risk factors identified from literature (and their effect on cash flow), for investigation in this study (see appendix ‘c’ for details). The effects of the identified factors on cash-in, cash-out or both, differ in severity and impact. The discussion below strives to highlight these impacts.

1. Accuracy of estimates; the responsibility of estimating quantities of materials, labour and equipment required for carrying out the works lies primarily with the contractor. Poor risk identification and response especially in respect of site challenges and high rate of on-site material wastage is a recipe for negative cash-in/out flows (Mbachu, 2011). The contractor's Quantity Surveyor must use lessons learnt from past experiences as well as knowledge to arrive at accurate estimates.
2. Archaeological remains; these have a negative effect on the cash-out to a contractor. If archaeological remains are found on a site, the contractor is usually expected to excavate and remove the remains and claim for variations.
3. Availability of credit facilities; credit facilities like bank loans, loan organisations, hire purchase and several other forms of short and long term loan outlets can be a good source of cash-in for a contractor. If not properly managed, this can adversely affect the contractor's profit margin and indeed the progress of the works.
4. Back/front end loading; this could have a positive or negative effect on cash flows depending on the strategy adopted by the contractor. Front-end loading gives the contractor surplus cash at the beginning of the project. If properly utilised the surplus cash at the early stage of a project ensures timely completion as a result of availability of cash. Back-end loading., if properly employed, also provides cash at the latter stage of a project. This strategy is more effective when the capital intensive works to be executed are at the tail end of a project. However, any omission of items on which loading was effected can result in serious shortfall of cash for the contractor (Kaka, 1990).

5. Bureaucracy in processing payments; according to Dantata (2007), bureaucracy in payment does not only stop at the paper works involved in the processing of contractors' payments, especially in government financed works. Bribery and other forms of corruption contribute to unnecessary elongation of the process before a contractor is paid what is due to it (Dusai, 2011).
6. Changes in currency exchange rate; this could adversely affects cash-out and cash-in. If local currency becomes devalued, value of the payments coming as cash-in to the contractor becomes lowered. Consequently, loss in profit in profit becomes inevitable.
7. Charging of "land dues" by locals (illegally); construction activities in some communities are viewed as opportunities to extort money from contractors. This action is mostly perpetrated by local "hoodlums" who demand to be paid "fees" for venturing into their "territory" (Dantata, 2007).
8. Change in government officials; according to Dusai (2009), change of government officials within ministries and parastatals sometimes results in malicious delays in payment to contractors who are not seen as "friendly" by the new persons-in-charge. This results in reduced cash-in.
9. Change in interest rates; interest rates affects the cost of materials in the market. When there is a hike in interest rates, the likelihood is of cash-out rising as a result of inflation.
10. Change to initial design; changes to initial design results in several multiple effects (Odeyinka, 2003). Indefinite and uncontrolled changes to initial design generally gives rise to unexpected expenditure which could be a source of draining the contractors profit.

11. Change in activities' start time; it is notable that when the contractor schedules activities that cost more than the advance payment, the chances of project failure increases (Al-Jabouri *et al.*, 2012). A good contractor would schedule activities in such a way as to avoid doing costly items at the initial stage of works.
12. Change orders; these are also important to contractor's cash-in and cash-out flow because when they are large in value their impact on internal rate of return (IRR) is significant (Zayed and Liu, 2014). This has the impact of affecting expectations on cash-in and hiking cash out.
13. Civil disturbances; this has been shown to cause unnecessary delays to construction works. The delays caused give rise to tension which inadvertently results in demand for higher wages by operatives and even instantaneous inflation. This results in a net increase in cash-out.
14. Client's insolvency; when the client becomes unable to uphold his/her financial responsibilities, insolvency sets in. This translates into zero cash-in to the contractor and invariably, abandonment of the project.
15. Compliance with new regulations; in complying with statutory requirements, contractors may incur extra-budgetary expenditure resulting in an increase in cash-out.
16. Contractual specification of minimum amount valuation; if the condition of contract insists on a minimum amount for interim valuation, then the contractor is obliged to put in extra efforts in order to qualify for payments. By this requirement cash-out may increase in order to achieve accelerated work and thus claim the minimum interim valuation.

17. Delay in paying creditors- generally, this boosts contractor's cash-in. If the creditors' agree to hold off for a certain period, the interim valuations coming as cash-in for the contractor becomes available in totality for execution of the works.
18. Delay of payment from client; several reasons could lead to delay in payment from the client; disagreement over payment claims, disagreement over what constitutes variation, late or partial/non-payment for works duly completed etc (Mbachu, 2011). Delay in payment may force the contractor to resort to taking bank overdrafts and short term loans that will affect profit negatively. Cash-out is also affected as delay in paying suppliers may result in having to purchase materials at inflated rates.
19. Delay in receiving retention; when retention is not released as and when due, monies meant as cash-in are delayed. This suppresses cash-in and thus curtails the expenditure capacity of the contractor.
20. Delay in receiving advance payment; if advance payment becomes delayed, then the contractor's cash-in is obstructed. This becomes especially critical as advance payments are requested at the initial part of the works. The delay could well result in an overall undesirable extension of the works.
21. Delay in agreeing variation/day works; sometimes the contractor's Quantity Surveyor and the consultant Quantity surveyor may not resolve differences regarding variations and/or day work values. This affects cash-in as forecasted by the contractor, negatively.
22. Delay in settling claims; claims are monies due to the contractor as a result of variations instructed or encountered on sites. Delaying settlement to claims is an automatic reduction of cash-in to the contractor.

23. Discount on materials purchased; when there are discounts on materials purchased, the contractor is provided an opportunity to boost cash-in. If this is properly utilised, work s accelerated and profit increased.
24. Dispute between contractor and owner; dispute between the two principal parties to a construction contract, if not handled skilfully could escalate and degenerate into legal squabbles. This means additional cost and loss of profit to the contractor.
25. Duration of the project; this affects both cash-in and cash-out. Small projects might not be affected by duration changes but medium and large projects are more sensitive to duration changes (Hwee and Tiong, 2002). The longer the duration the more the danger of loss of value for money.
26. Geotechnical issues; depending on the location of the works, this can lead to unprecedented variation to expected cash flows. The result being an increase in cash-out to the contractor.
27. High cost of materials; this affects projects in several ways. One of the most crucial being that the contractors expenditure is increased over and above that forecasted.
28. Inflation; inflation adversely affects cash-out. A rise in cost of living means a change to anticipated expenditure. This means that the cash-out forecasts become negated and more cash-out incurred against plan.
29. Inclement weather; this causes discomfort to workers and suppliers. The result of the discomfort is increase in wages and hike in prices. These two consequences result in more cash-out to the contractor.
30. Interval between two certificates; the time taken between two certificates can have serious implications on the availability of cash to the contractor. If the

interval between the certificates is unduly high, cash-in is negatively impacted and vice versa.

31. Incompetent consulting team; consulting team's inefficiency could lead to high losses for the contractor. Consultants' lack of clear understanding of employer's needs and inability to learn from past experiences could translate to avoidable errors that will affect contractor's smooth progress and thus financial losses (Mbachu, 2011). This risk leads mostly to a negative cash-in for the contractor and high cash-out.
32. Labour strikes; labour strikes generally paralyse the economy. When this happens, economic activities become strangled. This gives rise to additions to cash-out and unnecessary delays to cash-in.
33. Large retention percentage; cash retention has been recognised as an important factor that affects cash-in flow to the contractor (Kaka, 1990; Tang and Leung, 2005). This means that whenever an employer makes a payment to the contractor, a small portion is kept back (Kaka, 1990). The portion is commonly in the region of 3-5%. The primary purpose of retention is to provide fund for the employer in the event of contractor's insolvency. A secondary purpose is to motivate the contractor to complete any minor outstanding items and repair defects after work is completed. The higher the percentage retained the less cash-in the contractor receives for each payment.
34. Listed buildings; these are monumental buildings that must not be tampered with in a country. During a construction exercise, encountering this type of buildings invariably results in having to work round them in order to respect the law. This increases cash-out.

35. Overheads; if an organisations overheads are not properly handled, they could lead to excessive expenditure thus hiking cash-out.
36. Over measurements; this is a source of discomfort for contractors. Over measurements may avail the contractor with cash-in at some interval but in general creates avoidable disputes.
37. Poor communication amongst parties; this leads to estrangement amongst parties and misunderstandings regarding contract requirements (Muhamid, 2013). This has a negative effect on cash-in to a contractor. Estranged consultants will be quick to find faults and cause unnecessary delay in approving materials and / or works that ordinarily should result in cash-in for the contractor.
38. Poor design; the most critical issues associated with poor designs are design and detailing errors and buildability issues (Mbachu, 2011). Designer's reluctance to accept blame for critical errors arising from design and detailing mostly lead to rework which inadvertently impacts on both cash-in and cash-out. Buildability issues resulting in risks to cash flow include placing premium on aesthetics at the expense of economy, not taking on board contractor's input at the design stage and reluctance to approve alternative materials and design among others.
39. Period of honouring certificate by client; the longer it takes for the client to honour certificates, the more the contractor encounters cash-in problems and thus cash-out is negatively affected.
40. Problems with foundation of buildings; when this occurs. The contractor is forced to incur unplanned cash-out.

41. Production time slippage; this implies that the time planned for producing the works is not given due diligence. This results in unnecessary delays and several cash-out problems.
42. Receiving advance payments; this helps contractors to secure sufficient cash flow in the early stage of the project to reduce negative cash flow period (Al-Jabouri *et al.*, 2012). If properly managed, advance payments are a source of surplus cash for the contractor throughout the project duration.
43. Relationship between contractor and consulting team; in cases where the relationship the relationship between the contractor is healthy and friendly, both cash-in and cash-out problems becomes minimised (Al-Jabouri *et al.*, 2012). A good relationship is developed between the parties if instructions are followed accordingly and clarification sought properly from the consultants by the contractor. A contractor who has excellent public relations with the consultants finds it easy to receive assistance from the consulting team. This good relationship enhances positive cash flows and minimises cost flows.
44. Relationship between contractor and owner; relationship between employer and contractor is very important to the success of projects. In cases where the relationship is healthy, friendly, and above all built on professional trust (the confidence of past mutual experience is important here), cash-in problems becomes almost nonexistent enhancing project performance success (Al-Jabouri *et al.*, 2012). A good relationship enhances positive cash flows.
45. Relationship between main and subcontractor; relationship between the main and sub contractor is very important to the success of projects. A good relationship enhances positive cash flows, especially to the main contractor. The main contractor depends heavily on the subcontractor for early completion of

parts of the works. Early completion translates to early claim to cash-in for the main contractor. In cases where the relationship is built on professional trust (the confidence of past mutual experience is important here), sub contractors could carry out works without immediate pay and get paid as the main contractor is paid. This eliminates cash-in problems (Al-Jabouri *et al.*, 2012).

46. Replacement of defective work; this has a negative impact on cash in/out-flow. Constructing the work appropriately the first time saves time and money, which enhances project cash flow (Zayed and Liu, 2014).
47. Subcontractor's insolvency; According to Mbachu (2011) the subcontractor's financial/cost management issues are key to the survival of a project. Taking too many jobs at the same time may result in over stretching the capacity of the subcontractor thereby resulting in insolvency and consequently, abandonment of the subcontract work. This has the tendency to generate negative in flow of cash and hike cash out.
48. Shortage of key plant items; in construction, more than 50% of project expenses are spent on materials and key plant items (Zayed and Liu, 2014). This makes project cash out flow very sensitive to material cost fluctuation. The effect is more devastating when materials and key plants are in short supply resulting in a hike in prices.
49. Shortage of skilled labour; this is crucial to cash flow forecasts. Any shortage in the workforce expected by a contractor results in an unprecedented disruption of the cash-out plans of the contractor.
50. Strikes and internal military action; this generates tension and consequently, hike in prices. It negatively affects cash-out forecasts. More monies are spent by the contractor on both materials and labour when this occurs.

51. Under measurements; when the quantities in the bills of quantities are not a good representation of the actual quantities, the cash-in to the contractor becomes highly inadequate and thus causing complications on the works
52. Under-estimating project complexity; when contractors do not take the preliminary analysis of a project seriously, they face the problem of being ill - prepared for the cash requirements of the project.
53. Undervaluation; this results from negligence of the consultant Quantity Surveyor and gives rise to poor cash-in to the contractor.
54. Variations; variations to the original works are acceptable in construction works. But where variations are not properly checked, they become a source of dispute and/or cash drainers in a project.
55. Withholding tax; this becomes a problem if the rates keep changing or if the rates are high. A high rate indicates reduction in cash-in for the contractor.

# CHAPTER THREE

## 3.0 RESEARCH METHODOLOGY

### 3.1 Philosophy adopted in this research

The ontological position this thesis holds is the realist perspective, which views the external world as consisting of pre-existing hard, tangible structures, which exist independently of an individual's cognition. On one hand, one can be a relativist and hold a belief that multiple realities exist as subjective constructions of the mind and on the other hand one can hold a realist view, which holds the belief that the external world consists of pre-existing hard, tangible structures which exist independently of an individual's cognition. The realist perspective adopted for this study stems from the fact that cash flow forecasting issues consist of pre-existing tangible facts that are free from contractors' cognition. The ontological question and applied to this research is: 'what is the nature of risks factors to cash flow forecasts and do they impact on the forecasts made by contractors?'

The epistemological position adopted by the research is the positivist view. Epistemological considerations may either be positivist or Interpretivist. The *positivist's* position involves the application of natural science methods to the study of social reality while holding the view that the world conforms to the laws of causation and complex issues can be reduced through reductionism. On the other hand, *interpretivists* hold the position of the absence of universal truth and lay emphasis on realism of context and they also hold that the understanding and interpretation come from researcher's own frame of reference.

### 3.2 Research approach

The quantitative research method has been adopted for this research. Quantitative approach (sometimes referred to as scientific approach) was originally developed in the

natural sciences to study natural phenomena. The approach uses empirical approaches including survey methods, laboratory experiments, formal methods (e.g. econometrics) and numerical methods such as mathematical and computer modelling. Quantitative research is 'objective' in nature, it is an inquiry into a social or human problem, based on testing a hypothesis or a theory composed of variables, measured with numbers and analysed with statistical procedures, in order to determine whether the hypothesis or theory holds true. The approach relies on the objectivists' view of the social world and generally involves the collection and analysis of data using statistical procedures and analysis.

This research was conducted by examination of relevant literature followed by a field survey. The first stage consisted of planning to develop a list of cash flow forecasts risk factors which was done by extensive and intensive literature review in cash flow management, cash flow forecasting, risks in cash flow forecasts and factors contributing to project delays.

The identified risk factors were later investigated in relation to the likelihood of their occurrence and the impact, if they occur. The overall research frame work is shown in fig. 3.1 below

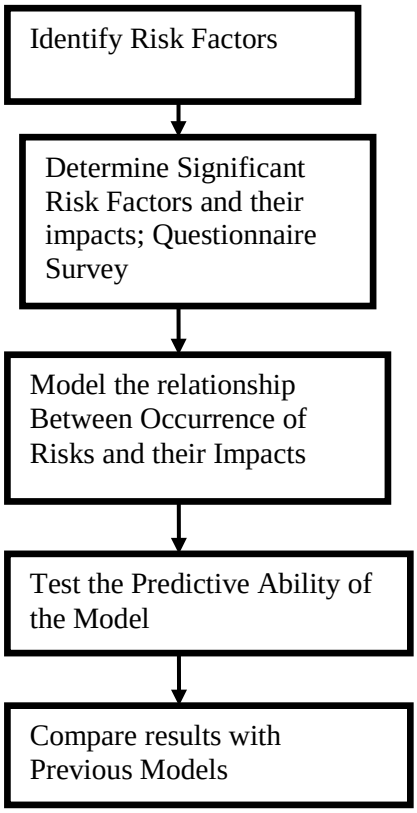


Fig. 3.1: Conceptual model for assessing risk impacts on construction cash flow forecasts in Nigeria.

### 3.2.2 Identification of the Population

In order to ensure applicability of the findings from this study across the country, it became necessary to have a population that represented the contactors operating across the country. A list of registered contractors was obtained from the government establishment saddled with the responsibility of registering and ensuring continuity of construction and other contractors in Nigeria. The Corporate Affairs Commission (CAC) is the sole organisation responsible for this. A comprehensive list consisting 61,893 construction contractors was obtained. This number represented both extant and extinct contractors as at April 2015. In order to obtain a list of contractors actively involved in the industry, the current list of contractors who had paid all taxes prescribed by the government was obtained from the Federal Inland Revenue (FIRS). This reduced the list of contractors to 10,213. This constituted the target population.

### 3.2.3 Sampling Technique and Sample Size

Determining sample size and dealing with no response bias is one of the most essential steps in a quantitative survey design. “One of the real advantages of quantitative methods is their ability to use smaller groups to make inferences about larger groups that would be prohibitively expensive to study (Holton and Burnett, 1997). The question then arises; how large of a sample is required to infer research findings back to a population?

Researchers are learning experimental statistics from highly competent statisticians and then doing their best to apply the formulas and approaches to their research design. Several researchers have found Cochran’s (1977) sample size formular for both continuous and categorical data useful in coming up with an appropriate sample size (Bartlett *et al.*, 2001). Cochran’s (1977) formular uses two key factors- (1) the risk the researcher is willing to accept in the study, commonly called the margin of error, and (2) the alpha level, the level of acceptable risk the researcher is willing to accept that the true margin of error exceeds the acceptable margin of error, also known as type 1 error.

For the purpose of identifying the appropriate sample size of this study, probability sampling technique was adopted owing to the fact that the size of the population was already known. Cochran’s (1977) table for determining minimum returned sample size for a given population size for continuous and categorical data was used for determining the appropriate sample size for this study (margin of error = 0.05, alpha level = 0.5) (see appendix D). A total sample size of 370 was identified to be sufficient for the study. Contractors whose annual turnover ranged between “less than

₦100million” (small contractors) to “above ₦500million” (Large contractors) (see table 4.6) were considered.

## 3.3 Data Collection

Literature has suggested several means by which data for research can be collected. According to Bartlett *et al.* (2001), these include opinion research, empirical research, archival research and analytical research. Data for this research were collected via an opinion- based survey of contractors operating in the Nigerian construction industry.

### 3.3.1 The Questionnaire Survey

In order to obtain a reasonably high response for a questionnaire survey, self-administration of the questionnaires or postal survey is recommended (Fellows and Liu, 1997). Both methods for the administration of questionnaires are effective provided the addresses of the respondents are available and accessible to the researcher. The self-administered survey was adopted for this study. This approach, despite been more expensive and more tedious than the postal approach, has been found to be useful because of the opportunity to interact with the respondents, if it becomes necessary (Naoum, 1998). Fellows and Liu (1979) suggested that questionnaires could be designed in two ways- open or closed. Open questions are easy to ask but difficult to answer and difficult to analyse. On the other hand closed questions have a set of as determined by the researcher's assessment of current literature. Fellows and Liu (1997) cautioned that the structured formation of available responses in a closed questionnaire may constrain the responses. Thus the opportunity was provided to the respondents to express other views they felt were important to the study but not covered by the questionnaire. This was done by inserting a response opportunity of "other (please specify)" where necessary within the questionnaire.

### 3.3.2 Questionnaire Design

In the first survey, the questionnaire was divided into two parts (sections A and B). This was done to make the questionnaire easy to understand and very clear to the respondents. Section "A" requested general information from the respondents. These include mainly information about the respondents such as name of organisation, type of projects commonly executed, position of the respondent in the organisation, the average duration of projects executed, average value of project executed, the procurement route commonly adopted in projects executed, the annual turnover of the organisation and the nature of the client served. The provision of the 'other (please specify)' option was included to each category of the questions to reduce rigidity which may artificially constrain the responses (Fellows and Liu, 1997). These pieces of information were to enable the grouping of the responses provided by the respondents.

In section B of the questionnaire, table 1 consisting of 40 risk factors derived from literature as potentially affecting "cash-in" flow forecasts were listed. Respondents were then requested to provide opinions regarding the likelihood (i.e. probability) of each factor occurring and the likely impact should the factor occur. Respondents were asked to score their opinion on a 0-5 Likert type scale, zero being included so as to accommodate the instances where the risk factor was not applicable (Holton and Burnett, 1997). The highest likelihood of a risk factor occurring and maximum impact was each assigned a score of 5. Table 2 consisting of 31 risk factors derived from literature as potentially affecting cash-out flow forecasts were listed. Respondents were then requested to provide opinions regarding the likelihood (i.e. probability) of each factor occurring and the likely impact should the factor occur. Respondents were asked to score their opinion on a 0-5 Likert type scale, zero being included so as to accommodate the instances where the risk factor was not applicable. The highest

likelihood of a risk factor occurring and maximum impact was each assigned a score of 5. Fellows and Liu (1997) contended that by using an odd number of response points, respondents may be tempted to 'opt out' of answering by selecting the mid- point. They therefore suggested that it might be helpful not only to keep the number of response points small but also to use an even number of response points, thereby having no central point. They therefore advocated a 4 or 6-point scale of responses as being preferable to the more usual 5 or 7 points. As suggested by Fellows and Liu (1997), a 6-point scale was adopted in measuring the probability of occurrence/degree of impact of risk factors in this study.

For each of tables 1 and 2, a third category was included seeking for respondents' opinion of the variation between the forecasts and actual cash-in/cash-out at 30%, 50% and 70% completion of the projects. Respondents were requested to indicate whether the variation between the forecasts and actual were negative or positive.

In the second survey, the questionnaire was also divided into two parts (sections A and B). Section "A" requested general information from the respondents. These include mainly information about the respondents such as name of organisation, type of projects commonly executed, position of the respondent in the organisation, the average duration of projects executed, average value of project executed, the procurement route commonly adopted in projects executed, the annual turnover of the organisation and the nature of the client served. The provision of the 'other (please specify)' option was included to in each category of the questions to reduce rigidity which may artificially constrain the responses (Fellows and Liu, 1997).

In section "B" of the questionnaire, two tables were presented. The first table consisted of 16 significant risk factors derived from analysis of the responses from the first

survey as potentially affecting cash-out flow forecasts were listed. Respondents were then requested to provide opinions regarding the likelihood (i.e. probability) of each factor occurring. On the second table, respondents were asked to approximate percentage difference between actual and forecasted expenditure in percentages, at 30%, 50% and 70% completions of executed projects as a result of the risks occurrence.

### 3.3.3 Questionnaire Pre-testing

Prior to administering the questionnaire, it is recommended practice to pre-test the data collection instrument (Naoum, 1998). Wilkinson and Birmingham (2003) rightly observed that it is easy to overlook mistakes in the questionnaire and ambiguities may exist. A would-be respondent is given the opportunity to take a clear look at the questionnaire and point out areas that need to be adjusted. The questionnaire for this research was checked by people of similar characteristics to the actual targeted respondents (i.e. contractors operating in Nigeria). Before then an assessment of the questionnaire was made by the supervisors of the thesis and observations were made and discussed. The available options, layout of the questionnaire, ambiguous words and technical terms were checked and simplified. The pre-test allowed the researcher to estimate how much time it will take an average respondent to fill out the questionnaire. An average filling time of 15 minutes was found to be the rate for the filling. This was deemed appropriate for the purpose of research and for the intended respondents. The steps taken for the questionnaire survey are summarised below:

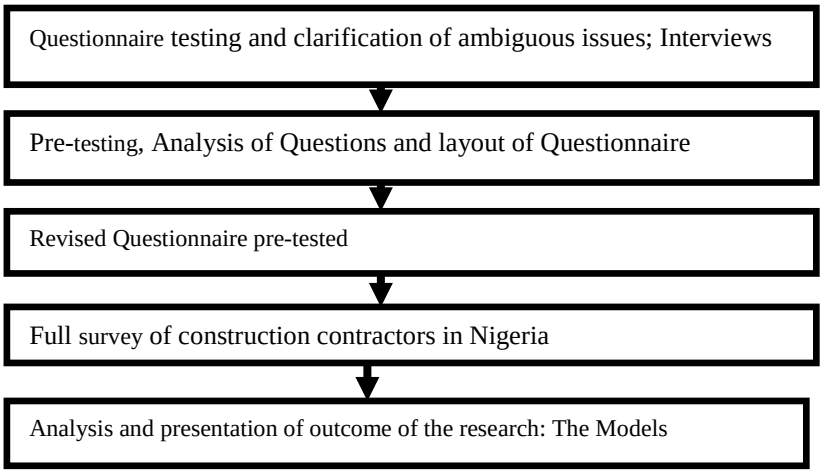


Fig 3.2 Steps in the questionnaire survey

### 3.3.4 Administration and Retrieval of the Questionnaires

In order to cover as many respondents as possible, fifteen number research assistants were engaged to hand-deliver the questionnaires to the intended respondents as identified from the FIRS record. At this point the research assistants were advised to use the list for the purpose of identifying and distributing the questionnaires to as many of the respondents as possible bearing in mind the total number of 370. The research assistants were familiar with the territories in which the addresses were found and could easily access the identified contractors. The table below shows the retrieval rate per regions in the country:

Table 3.1: Rate of Retrieval of Completed Questionnaires

| | Region | No. of Contractors Registered with CAC | % OF TOTAL | No. of Questionnaires Retrieved | % Retrieved |
|---|---|---|---|---|---|
| 1 | North East | 2,756 | 4.45 | 18 | 100.00 |
| 2 | North Central | 10,841 | 17.52 | 34 | 50.75 |
| 3 | North West | 9,940 | 16.06 | 46 | 74.19 |
| 4 | South West | 22,086 | 35.68 | 37 | 27.21 |
| 5 | South East | 6,328 | 10.22 | 18 | 47.37 |
| 6 | South- South | 9,942 | 16.07 | 16 | 26.23 |
| | **TOTAL (POPULATION)** | **61,893** | **100.00** | **169** | **44.24** |
| | **SAMPLE SIZE** | **370** | | | |

Source: field survey, 2014

Three hundred and seventy (370) copies of the questionnaires were printed and distributed. The research assistants were given several copies of the questionnaires with an additional soft copy in case the need arises to print more copies. Each questionnaire had a covering letter, which contained the objective of the study, the benefits of the study and confidentiality of the respondents and their organisations.

The research assistants ensured that the respondents (comprising of Administrative Managers, Architects, Directors, Managing Directors, Project Directors, Project Engineers, Project Managers, project Supervisors, and Quantity Surveyors) were properly guided where necessary. A date for possible retrieval of each of the questionnaires was agreed by the respondents and research assistants. Some of the respondents offered their telephone numbers for possible reminders and appointment for the collection of the filled questionnaires. Others only gave convenient dates for retrieval. In order to speed up the response rate, the research assistants were made to pay the responding contractors a reminding visit and /or call. At the end of the exercise, 169 questionnaires, representing a response rate 45.67% were returned. This, according to Akintoye and Fitzgerald (2000) and Fellows and Liu (1997) is above the average response rate of 20-30% in construction-related researches. Most of the respondents whose questionnaires were not retrieved were either “unavoidably out of town” or “beyond reach” during the period of retrieval. Eleven (11) questionnaires, out of the one hundred and sixty-nine retrieved, were found to be inappropriate for analysis as they were wrongly filled. Thus, a total of one hundred and fifty-seven (157) questionnaires were used for the analysis.

## 3.4 Analytical techniques and strategies

### 3.4.1 Data analysis techniques

There are several reasons why researchers analyse data. These include but are not restricted to (Walliman, 2001):

i. For Measurements
ii. To make comparison between entities
iii. To examine relationships
iv. To make forecasts
v. To test hypotheses
vi. To construct concepts and theories
vii. To explore
viii. To control and
ix. To explain facts

The nature of analysis that data could be subjected to are many and the determinant of which method would be appropriate include the nature of the data itself, the nature of relationship being sought from the data and the research questions/hypothesis being investigated.

Two broad classifications of analytical methods are quantitative and qualitative analysis. Qualitative data analyses involve building of typologies and taxonomies and the generation of concepts and theory. Quantitative data analysis seeks to relate variables, build causal networks and relate findings to general theoretical frameworks (Walliman, 2001).

### 3.4.2 Questionnaire data analysis

The data obtained from the questionnaire survey were of numerical nature owing to the closed ended and open ended nature of the questions. The numerical data were compiled and entered into the Statistical Package for Socials (IBMSPSS version 21) Software. The analysis of the data involved both descriptive and inferential statistical

operations available in the SPSS software. The quantitative data were analysed and results of descriptive statistics obtained include frequency distributions (represented in tables and charts), measures of central tendency (means) and standard deviation. The 169 contractors were asked to rank on a scale of 0 to 5 the likelihood of occurence of the 40 risk factors identified from literature. Where 0= not applicable, 1= very low, 2= low, 3= medium, 4= high and 5= very high. The responses obtained were subjected to analysis with the use of IBM SPSS (version 21) software. The mean, standard error and standard deviation were computed. The computed means were used to rank the likelihood of occurence of the factors in decending order with the use of micrsoft excel(R). The survey undertaken entailed a comparison of results for probability of risk factors occurring, the degree of impact if they occur and the actual impact on the forecast cash flows with the use of ANOVA. Majority of the data solicited during the survey are either nominal or ordinal. Ordinal data are more appropriate for calculation of central tendencies like mean of a sample, while nominal data are more apt for capturing data of general nature for which names are assigned.

### 3.4.3 Choosing the Machine-learning Technique

Machine learning is a type of artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed. Machine learning focuses on the development of computer programmes that can teach themselves to grow and change when exposed to new data (http://www.predictivemodelingresources.com/). The process of machine learning enables systems to search through data to look for patterns. The data is then used to improve the programme's own understanding in order to detect patterns in data and adjust programme actions accordingly. Machine learning is similar to data mining. However, instead of extracting data for human comprehension- as is the

case in data mining applications- it uses the data to improve the programme's own understanding.

There are several machine-learning concepts that have been developed by researchers in information and communication technology (ICT). These include (http://visualstudiomagazine.com/articles/2013/05/01/neural-network-feed-forward.aspx);

i. Supervised Learning
ii. Unsupervised Learning
iii. Reinforcement Learning
iv. Deep Learning
v. Others

Accuracy in predictions has been found to be high when using the supervised and unsupervised learning techniques. These learning techniques include the following (McCaffrey, 2013);

i. Artificial Neural Networks
ii. Associated Rule Learning
iii. Hierarchical Clustering
iv. Cluster Analysis
v. Outlier Detection

When prediction is intended, Artificial Neural Network (ANN), also called Neural Networks, is the appropriate tool (Odeyinka, 2003; Odeyinka *et al.*, 2013; McCaffrey, 2013). Neural networks are the preferred tool for many predictive applications because of their power, flexibility, and ease of use (IBM, 2012). Predictive neural networks are particularly useful in applications where the underlying process is complex, such as:

i. Forecasting consumer demand to streamline production and delivery costs.
ii. Predicting the probability of response to direct mail marketing to determine which households on a mailing list should be sent an offer.
iii. Scoring an applicant to determine the risk of extending credit to the applicant.
iv. Detecting fraudulent transactions in an insurance claims database.

ANNs are processing devices (algorithms or actual hardware) that are loosely modelled after the neuronal structure of the mammalian central nervous system but on much

smaller scales. A large ANN might have hundreds or thousands of processor units, whereas a mammalian brain has billions of neurons with a corresponding increase in magnitude of its overall interaction and emergent behaviour. An artificial neural network models biological synapses and neurons. The feed-forward mechanism, also known as the multilayer perceptron (MLP), the most fundamental aspect of neural networks, is a function of predictors (also called inputs or independent variables) that minimise the prediction error of target variables (also called outputs). Neural networks are typically organized in layers called the network's architecture. Layers are made up of a number of interconnected 'nodes', which contain an 'activation function'. Patterns are presented to the network via the 'input layer', which communicates to one or more 'hidden layers' where the actual processing is done via a system of weighted 'connections'.

The hidden layers then link to an 'output layer' where the answer is output as shown in Fig. 5.1 below.

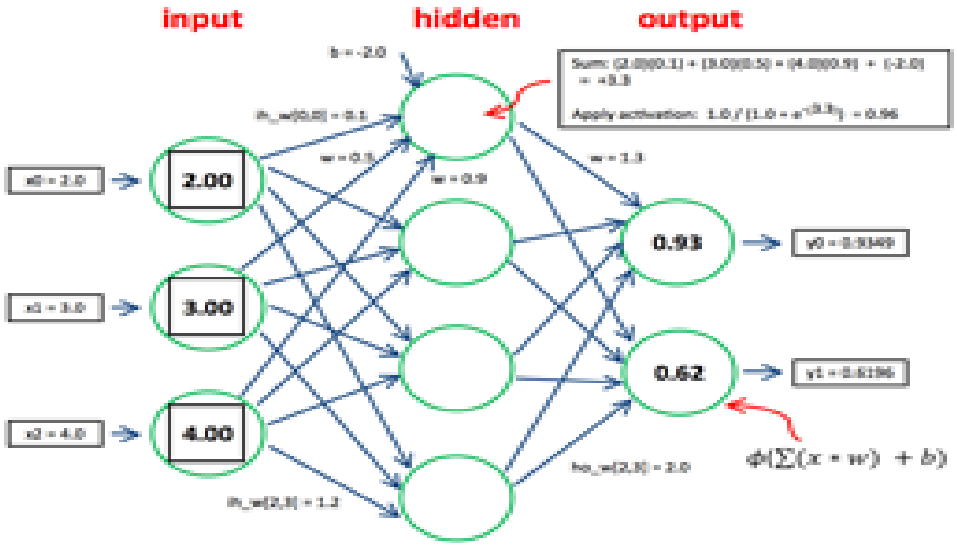

Fig. 3.3: ANN Architecture (Adapted from McCaffrey, 2013)

This input-process-output mechanism is called neural network feed-forward. The architecture in fig. 5.1 can be characterised as a fully connected three-input, four-hidden, two-output neural network. The neural network shown in the figure is most often called a two-layer network because the input layer does not really do any processing. Each node-to-node arrow in Figure 5.1 represents a numeric constant called a weight. For example, assuming nodes are zero-indexed starting from the top of the diagram, the weight from input node 2 to hidden node 3 has value 1.2. Each hidden and output node, but not any input node, has an additional arrow that represents a numeric constant called a bias. For example, the bias for hidden node 0 has value -2.0. Because of space limitations, figure 5.1 shows only one of the six bias arrows (McCaffrey, 2013).

# CHAPTER FOUR

## 4.0 DATA PRESENTATION, ANALYSIS AND DISCUSSIONS

### 4.1 Data Collection:

A combination of mean response analysis and Analysis of Variance (ANOVA) were employed in analysing the collected data. The research hypotheses considered were tested at 95% level of confidence. The findings are reported in two main sections; analysis of the contractors' response on the Likelihood of risk occurrence and degree of impact on cash-in/cash-out flow forecasts.

### 4.2 Results of the Questionnaire Survey

The questionnaire sought for the respondents to provide information concerning their position in the organisation on behalf of which they are responding. Several categories of respondents filled the question as indicated in the Table below.

Table 4.1: Position of respondents in the construction firms surveyed

| Position | Frequency | Percent |
|---|---|---|
| Administrative Manager | 18 | 11.5 |
| Architect | 9 | 5.7 |
| Director | 25 | 15.9 |
| Managing Director | 9 | 5.7 |
| Project Director | 1 | .6 |
| Project Engineer | 14 | 8.9 |
| Project Manager | 56 | 35.7 |
| Project Supervisor | 9 | 5.7 |
| Quantity Surveyor | 16 | 10.2 |
| **Total** | **157** | **100.0** |

Source: field survey, 2014

Majority of the respondents (35.7%) were Project Managers who were deeply involved in the firm's projects. Twenty-five of the respondents, representing 15.9% were Directors in the firms. This was followed by 18 Administrative Managers (11.5%), 16 Quantity Surveyors (10.2%), 14 Project Engineers (8.9%), 9 Managing Directors (5.7%), 9 Architects (5.7%), 9 Project Suoervisors (5.7%) and 1 Project Director (0.6%).

### 4.2.1 Types of projects Executed by the Respondents

Table 4.2 represents the types of buildings commonly Executed by the respondents. 64 number buildings, representing 40.8%, were commercial. 23 number werer hospital buildings, 7 (4.5%) were residential buildings while 63 nmber (40.1%) were public and community buildings. Only four types of buildings were executed by the respondents.

Table 4.2: Type of Projects Executed by Respondents

| Types of Project | Frequency | Percent |
|---|---|---|
| Commercial Buildings | 64 | 40.8 |
| Hospital Buildings | 23 | 14.6 |
| Residential Buildings | 7 | 4.5 |
| Public and Community Buildings | 63 | 40.1 |
| **Total** | **157** | **100.0** |

Source: field survey, 2014

In spite of the provision for "others (please specify)" in the questionnaire, no other type of buildings were captured. The prevalence of commercial and public/community buildings can be explained by the fact that government pays more attention to these building types than any other. As government is the major client in the Nigerian construction industry, it is not surprising that residential buildings, mostly owned by individuals, had the least response.

### 4.2.2 Duration of the Projects Executed by the Respondents

Most of the projects executed by the respondents had an average duration of 13-24 months (54.78% of the respondents). This was followed by projects with durations of more than 24 months with 42.04%. projects with les than 12 months duration had the least resoponse rate of 3.18% as indicated on Table 4.3.

Table 4.3: Duration of Projects Executed

| Duration | Frequency | Percent |
|---|---|---|
| less than 12 months | 5.00 | 3.18 |
| 13-24 months | 86.00 | 54.78 |
| more than 24 months | 66.00 | 42.04 |
| **Total** | **157.00** | **100.00** |

Source: field survey, 2014

The fact that government is the major client in the industry is a major explanation for the majority of projects having durations greater than 12 months. Government owned projects in Nigeria are generally characterised by delays.

### 4.2.3 Value of the Projects Executed by the Respondents

A look at the value of projects in Naira as indicated on Table 4.4 shows that majority of the respondents carried out works of less than 50 milllion naira (32.5%).

Table 4.4: Value of Projects Executed

| Value of Projects | Frequency | Percent |
|---|---|---|
| Below N50 million | 51 | 32.5 |
| N51-N100million | 46 | 29.3 |
| N101-200million | 37 | 23.6 |
| Above N200 million | 23 | 14.6 |
| **Total** | **157** | **100.0** |

Source: field survey, 2014

The number of firms that carried out works of 51 to 100 million naira were 46 while those that carried out works of 101 to 200 million naira were 37 in number. 23 number firms, representing 14.6% 0f the respondents carried out projects which worth were above 200 million naira. The somewhat even distribution across the four cadres of project types in terms of cost is not surprising. Most building projects fall within the price range and are genrally distributed along those values.

### 4.2.4 Procurement Method of the Projects Executed by the Respondents

Table 4.5 below shows that majority of the respondents where engaged to carry out projects work under the traditonal arrangement.

Table 4.5: Procurement Option Adopted for the Executed Projects

| Procurement Options | Frequency | Percent |
|---|---|---|
| Traditional Procurement | 155 | 98.7 |
| Project Management | 2 | 1.3 |
| **Total** | **157** | **100.0** |

Source: field survey, 2014

The prevalence of the traditional method of procurement is a confirmation of the assertions by most researchers in Nigeria that the procurement method is still the most consitently used in the country. Other options like “design and build” and “others (please specify)” offerred in the questionnaire did not influence the choice of other procurement methods available.

### 4.2.5 Annual Turnover of the Responding Organisations

Table 4.6 shows the distribution of the responses across the six geo-political zones of the country. 18 responses (11.5%) were obtained from the north eastern part of the country. The north central was represented by 31 responses, showing a 19.7% participation from that region of the country. The participation from nort-west was the highest- 27.4% amounting to 43 number firms. The southwest had the second largest number of participants in the survey, 35 number of firms representing 22.3%. The south eastern part of the country had 16 firms responding to the questionnaires, this indicates a 10.2% response. The least response was obtained from the sout south geo-political zones; 14 number responses indicating 8.9% participation.

Table 4.6: Annual Tunover of the Responding Organisations

| Annual Turnover | Frequency | Percent |
|---|---|---|
| Less than100m Naira | 18 | 11.5 |
| 101m-200m Naira | 31 | 19.7 |
| 201m-300m Naira | 43 | 27.4 |
| 301-400m Naira | 35 | 22.3 |
| 401-500m naira | 16 | 10.2 |
| Above 500m Naira | 14 | 8.9 |
| **Total** | **157** | **100.0** |

Source: field survey, 2014

The low response from "401m-500m Naira" and "above 500m Naira" categories may have been influenced by the low number of construction firms in those categories``.

### 4.2.6 Nature of the Clients for the Projects Executed by the Respondents

The Table below shows that the Federal governement is the major client to the respondents with 52.9% . Followed by State government with a rate of 45.9% and 1.3% for the Local Government.

Table 4.7: Nature of the Project Client

| Nature of Client | Frequency | Percent |
|---|---|---|
| Federal Government | 83 | 52.9 |
| State Government | 72 | 45.9 |
| Local government | 2 | 1.3 |
| **Total** | **157** | **100.0** |

Source: field survey, 2014

## 4.3 Analysis of Likelihood of Occurence of Risk Factors affecing cash-in Forecasts

The contractors' perception of the Likelihood of factors affecting risk occurrence in cash flow forecasts is examined in this section. A questionnaire survey (see Appendix A) of 40 risk factors derived from literature as potentially impacting construction cash flow was carried out. The contractors were asked to respond to the likelihood of occurence of the factors and the impact, on the same questionnaire.

### 4.3.1 Occurence of Risk Factors Affecting cash-in Forecasts

Table 4.8 shows the result of the analysis of the likelihood of occurrence of the risk factors.

Table 4.8: Occurence of Risk Factors Affecting cash-in Forecasts

| Risk Factors | Mean | Std. Deviation | Rank |
|---|---|---|---|
| Delay in Receiving Retention | 4.72 | 0.60 | 1 |
| Accuracy of Estimates | 4.61 | 0.62 | 2 |
| Change in Government Officials | 4.57 | 0.70 | 3 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.36 | 0.72 | 4 |
| Increase in duration of the Project | 4.27 | 1.14 | 5 |
| Delay in Payment from Client | 4.25 | 0.99 | 6 |
| Delay in Releasing Advance Payment | 4.20 | 0.54 | 7 |
| Withholding Tax | 4.13 | 1.25 | 8 |
| Discount on Materials Purchased | 4.06 | 0.46 | 9 |
| Delay in Paying Creditors | 3.97 | 1.17 | 10 |
| Dispute Between Contractor and Owner | 3.84 | 0.84 | 11 |
| Variations | 3.68 | 0.66 | 12 |
| Under Valuation | 3.68 | 0.85 | 13 |
| Changes in Activities' Start Time | 3.50 | 1.21 | 14 |
| Change in Interest Rates | 3.38 | 0.96 | 15 |
| Production Time Slippage | 3.32 | 0.91 | 16 |
| Changes to Initial Design | 3.25 | 0.75 | 17 |
| Geotechnical Issues | 2.97 | 0.97 | 18 |
| Inclement Weather | 2.95 | 1.54 | 19 |
| Long Interval Between Two Certificates | 2.76 | 0.96 | 20 |
| Overheads | 2.66 | 1.33 | 21 |
| Problems with Foundation | 2.64 | 1.59 | 22 |
| Replacement of Defective Work | 2.48 | 1.37 | 23 |
| Bad Relationship Between Contractor and Consulting Team | 2.16 | 0.51 | 24 |
| Compliance With New Regulations | 1.99 | 1.20 | 25 |
| Unavailability of credit facilities | 1.75 | 1.05 | 26 |
| Incompetent Consulting Team | 1.72 | 1.19 | 27 |
| Back/Front end Loading | 1.54 | 0.66 | 28 |
| Bad Relationship Between Main and Sub Contractor | 1.52 | 0.83 | 29 |
| Bad Relationship Between Contractor and Owner | 1.50 | 0.66 | 30 |
| Change Orders | 1.43 | 1.71 | 31 |
| Period of Honouring Certificates | 1.23 | 1.23 | 32 |
| Listed Buildings | 1.23 | 1.28 | 33 |
| Contractual Specification of Minimum Amount Valuation | 1.16 | 1.75 | 34 |
| Receiving Advance Payment | 1.13 | 1.19 | 35 |
| Client's Insolvency | 1.10 | 0.98 | 36 |
| Civil Disturbance | 0.99 | 0.83 | 37 |
| Large Retention Percentage | 0.87 | 1.23 | 38 |
| Labour Strikes | 0.82 | 1.17 | 39 |
| Subcontractor's Insolvency | 0.46 | 1.04 | 40 |

Source: field survey, 2014.

From the Table (4.8), the risk factor whith the highest occurence is “Delay in Receiving Retention”. This is followed by “Accuracy of Estimates”, “Change in government Officials”, “Bureaucracy in Processing Payments (giving bribe to "speed up" payment

files movement)", and "Increased Duration of the Project". These represent the top 5 risk factors that occur in construction projects in Nigeria. "Client's Insolvency", "Civil Disturbance", "Large RetentionPercentage", "Labour Strikes" and "Subcontractor's Insolvency" were the last five amongst the 40 risk factors. The positions of the first five does not come as a surprise as corruption have become common-place in Nigerian Government coffers. "Change in government Officials" and "Bureaucracy in Processing Payments (giving bribe to "speed up" payment files movement)" are manifestations of corrupt practices in Government parastatals saddled with the responsibility of paying contractors at the required time. Changes in officials handling government issues results mostly in the abandonment of an existing policy to give way for the selfish interest of the new officials. In most cases the focus is not on the progress of the parastatl but on the progress of the newly appointed individuals and their personal desires. "Accuracy of Estimates" ranking among the top 5 may also be a result of the last minute preparation attitude of Nigerians and Nigerian Government. For estimates to be accurate, appropriate time must be given for preliminary estimates, checking and re-checking of quantities and other related features in estimating project values. This is rarely done. The least five risk factors do not necesarily pose a surprise. Retension percentages in Nigerian projects rarely exceed 5%, which is good for any contractor whose profit margin has been reasonably computed. Client's insolvency has long been taking cared of by Government's insistence that no project shall be embarked on except the amount required are ascertained to be adequate and available at prescribed accounts accessible to the custodians of the projects.

The ressults obtained have variations with those obtained from previous studies. Zayed and Liu (2014) identified "change of progress payment", "payment duration", "financial position of the contractor" and "project delays" and "poor planning" as the

most significant factors affecting congtractors' forecasts in North America and China. The similarities with that and those observed in this study appear only in "project delays" juxtaposing with "increased duration of the project", while "payment duration" juxtaposes with "Bureaucracy in Processing Payments (giving bribe to "speed up" payment files movement)"/ "Delay in Receiving Retention", although the reason for that in America and china was not related with corruption. Other factors like "Accuracy of estimates" and "Change in government Officials" do not seem to be as important in China and North America.

In a study of risk factors affecting construction cash flow forecasting in the UK, Odeyinka *et al.* (2013) identified "changes to initial design", "inclement weather", "variation to works", "labour shortage" and "production time slippage" as the 5 top-most risk factors occurring. The same factors ranked 17$^{th}$, 19$^{th}$, 12$^{th}$, 39$^{th}$ and 16$^{th}$ in the present study. Incidentally, "Client's insolvency", "Labour Strikes", and "Civil Disturbance" ranked very low in both studies. This implies that the civil unrests and labour strikes rarely pose a great danger to construction contractors in both the UK and Nigeria. More importantly though is the fact that the most significant factors occuring in Nigeria are either rating low or totally absent in the UK construction industry (e.g. "changein government officials"). Another related study by Chaphalkar and Iyer (2014) in india indicated "delay in payment from employer", "delay in honouring claims", ""change order" and "nominated subcontractor's insolvency" as being more critical. In comparison, the present study rated all but "delay in payment by employer" low.

In order to determine the variation between forecasted cash-in and actual Cash-in, the respondents were asked to estimate, from their experience, the impact of each of the

risk factors on the variability between the forecasted amount and the actual amount received.

### 4.3.2 Impact of Risk Factors Affecting cash-in Forecasts

The 169 contractors were asked to rank on a scale of 0 to 5 the degree of impact of the 40 risk factors identified from literature. Where 0= no impact, 1= little impact, 2= fairly critical impact, 3=critical impact, 4= very critical impact, 5= extreme critical impact. The responses obtained were subjected to analysis with the use of IBM SPSS (version 21) software. The mean, standard error and standard deviation were computed. The computed means were used to rank the degree of impact of the factors in decending order with the use of micrsoft excel(R). Table 4.9 shows the result of the analysis. 157 questionnaires were found useful for the analysis.

Table 4.9: Impact of Risk Factors on cash-in Forecasts.

| Risk Factor | Mean | Rank |
|---|---|---|
| Delay in Receiving Retention | 4.60 | 1 |
| Accuracy of Estimates | 4.60 | 1 |
| Change in Government Officials | 4.59 | 3 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.33 | 4 |
| Increase in duration of the Project | 4.27 | 5 |
| Delay in Payment from Client | 4.26 | 6 |
| Withholding Tax | 4.11 | 7 |
| Discount on Materials Purchased | 4.08 | 8 |
| —— —— ——— ——— | ——— | —— |
| Subcontractor's Insolvency | 0.41 | 40 |

Source: field survey, 2014.

From Table 4.9 the risk factor with the highest impact is “Delay in Receiving Retention”. This is followed by “Accuracy of Estimates”, “Change in government Officials”, “Bureaucracy in Processing Payments (giving bribe to "speed up"

payment)", and "Increased Duration of the Project". These represent the top 5 risk factors that have impact in construction projects in Nigeria. "Client's Insolvency", "Civil Disturbance", "Large RetentionPercentage", "Labour Strikes" and "Subcontractor's Insolvency" were the last five amongst the 40 risk factors. "Change in government Officials" and "Bureaucracy in Processing Payments (giving bribe to "speed up" payment files movement)" are manifestations of corrupt practices in Government parastatals who, for selfish reasons request for enticements before carrying out their civic responsibilities. The the impacting factors rank exactly the same as the ranks in the likelihood of occurence. This may have been influenced by the manner in which the questionnaire was designed. However, the coincidence in ranks makes sense because the higher the likelihood of occurence of a factor, the more it is likely to impact on the the forecasts made by contractors. A typical instance is when there is a change in government officials (i.e. change in a paying director of a ministry, cash offficer, governor of a state etc) and the new government does not, for selfish reasons, deem it fit to pay contractors waiting to be paid because they are considered to be "friends" of the previous regime. Payments due to these contractors become frustrated without particular explanations. This is especially true where the new regime happens not to be in good tidings with the former regime. "Accuracy of Estimates" ranking among the top 5 is a result of the last minute preparation attitude of Nigerians and Nigerian Government. A typical project documentation in Nigeria is generally marred by unplanned changes and dire minute manipulations. Another reason for the manisfestation of the factor is the lack of tests and site investigation procedures that have become common place in the Nigerian construction industry. Soil tests, topography tests and the likes are hardly ever considered until the project is awarded. Even the location for projects are not determined until after award of the contract.

These reasons and several others are enough to make accuracy of estimates extremely difficult. The least five risk factors do not necesarily pose a surprise. Retention percentages in Nigerian projects rarely exceed 5%, which is good for any contractor whose profit margin has been reasonably computed. Client's insolvency has long been taking cared of by Government's insistence that no project shall be embarked on except the amount required are ascertained to be adequate and available at prescribed accounts accessible to the custodians of the projects. Labour strikes and civil unrests are phenomena not too rampant in Nigeria, except during elections which take place every four years.

The ressults obtained have variations with those obtained from previous studies. Zayed and Liu (2014) identified "change of progress payment", "payment duration", "financial position of the contractor" and "project delays" and "poor planning" as the most significant factors impacting on contractors' forecasts in North America and China. The similarities with that and those observed in this study appear only in "project delays" juxtaposing with "increased duration of the project", while "payment duration" juxtaposes with "Bureaucracy in Processing Payments (giving bribe to "speed up" payment files movement)"/ "Delay in Receiving Retention", although the reason for that in America and china was not related with corruption. Other factors like "Accuracy of estimates" and "Change in government Officials" do not seem to be as important in China and North America.

In a study of risk factors affecting construction cash flow forecasting in the UK, Odeyinka *et al.* (2013) identified "changes to initial design", "inclement weather", "variation to works", "labour shortage" and "production time slippage" as the 5 top-most risk factors occurring. The same factors ranked $17^{th}$, $19^{th}$, $12^{th}$, $39^{th}$ and $16^{th}$ in the present study. Incidentally, "Client's insolvency", "Labour Strikes", and "Civil

Disturbance" ranked very low in both studies. This implies that the civil unrests and labour strikes rarely pose a great danger to construction contractors in both the UK and Nigeria. More importantly though is the fact that the most significant factors impacting in Nigeria are either rating low or totally absent in the UK construction industry (e.g. "changein government officials"). Another related study by Chaphalkar and Iyer (2014) in India indicated "delay in payment from employer", "delay in honouring claims", ""change order" and "nominated subcontractor's insolvency" as being more critical. In comparison, the present study rated all but "delay in payment by employer" low.

### 4.4 Occurence of Risk Factors affecting cash-out Forecasts

The contractors' perception of the Likelihood of factors affecting risk occurrence in cash out forecasts is examined in this section. A questionnaire survey (see Appendix A and B) of 31 risk factors derived from literature as potentially impacting construction cash-out was carried out. The contractors were asked to respond to the likelihood of occurence of the factors and the impact, on the same questionnaire. The research hypotheses are also detailed hereunder.

Table 4.10 below shows the result of the analysis. 157 questionnaires were used for the analysis."Increased Duration of the Project" ranked highest. This is not surprising because the longer a project lasts the more a contractor spends as a result of increased overheads and several other avoidable expenses like security for the works, protection, lighting etc. The second in rank is "Change in currency exchange rate". The Nigerian foreign exchange market is mostly controlled by the 'black market' and changes to exchange rates are determined by the forces of demand and supply. This makes the market very volatile, resulting in small but frequent 'glitches' in the market value of

foreign currencies (especially the US dollar). The frequency of these fluctuations have an unfavourable impact on the expenditure of the contractor. Any sudden and sharp rise in currency excahsnge rates affects the contractor negatively as he is forced to spend more than forecasted. “High cost of materials” is ranked 3rd by the respondents. This phenomenon is a common feature of the Nigerian markets where almost every quality material is imported or obtained locally with high production cost. The high production cost of materials and a combination of other economic factors makes the cost of construction materails very high.

Table 4.10: Occurence of Risk Factors on cash-out Forecasts

| Risk Factor | Mean | Std. Error | Std. Deviation | Rank |
|---|---|---|---|---|
| Increased Duration of the Project | 4.51 | .05081 | .63668 | 1 |
| Change in Currency Exchange Rates | 4.31 | .06106 | .76512 | 2 |
| High Cost of Materials | 3.98 | .04649 | .58256 | 3 |
| Variations | 3.87 | .06332 | .79337 | 4 |
| Shortage of Key Plant Items | 3.77 | .05336 | .66864 | 5 |
| Replacement of Defective Works | 3.73 | .06088 | .76277 | 6 |
| Delay in Payment from Client | 3.68 | .05272 | .66060 | 7 |
| Delay in Settling Claims | 3.60 | .04225 | .52939 | 8 |
| Poor communication Amongst Parties | 3.24 | .08592 | 1.07656 | 9 |
| Inclement Weather | 3.21 | .08763 | 1.09797 | 10 |
| Inflation | 3.17 | .03021 | .37857 | 11 |
| Changes to Initial Design | 3.15 | .09767 | 1.22378 | 12 |
| Under-estimating Project complexity | 3.13 | .07235 | .90650 | 13 |
| Charging of "Land Dues" by Locals (illegally) | 3.10 | .13829 | 1.73273 | 14 |
| Over Measurements | 3.10 | .05252 | .65812 | 14 |
| _____ | | | | |
| Failure of Subcontractors | 0.91 | .07472 | .93628 | 29 |
| Geotechnical Issues | 0.82 | .06548 | .82044 | 30 |
| Archaeological Remains | 0.17 | .05435 | .68105 | 31 |

Source: field survey, 2014.

The 4th ranking risk factor is “variation”. This may not be unconnected to the incessant taste for novelty of the Nigerian client. Between the commencement and completion of a construction project, it is not surprising for clients to insist on several changes arising from appreciation of some new materials available or from a realisation that specifications which had been rushed are no longer feasible. The 5th highest ranking risk factor is “shortage of key plant items”. This revelation is expected because most plant items required in the Nigerian construction industry are imported, expensive and require specialised imported skills for maintenance. The combination of these and other attributes makes the availability and maintainability of plant items in the country a difficult issue. Contractors end up spending more than anticipated if plant items required develop problems as work progresses or even from the very beginning. The

risk factors that have the lowest likelihood of occurence are “Client’s Insolvency”, “Compliance with new regulations”, “failure of subcontractors”, “geotechnical issues” and “achaeological remains”. Except for the occurence of “achaeological remains”, these factors occuring least on construction sites is not surprising. Nigeria is a country with rich history, thus it would have been expected for archaeological remains to rank high in occurence. The low rank of the factor may be connected to the respect the country has for ancestry and superstitution. Archaeologically rich sites are carefully observed and particularly avoided for fear of not committing offence to the “world beyond”.

The ressults obtained have variations with those obtained from previous studies. In a study of risk factors affecting construction cash flow forecasting in the UK, Odeyinka *et al.* (2013) identified “changes to initial design”, “inclement weather”, “variation to works”, “labour shortage” and “production time slippage” as the 5 top-most risk factors occurring. The same factors ranked 17th, 19th, 12th, 39th and 16th in the present study. Incidentally, “Client’s insolvency”, “Labour Strikes”, and “Civil Disturbance” ranked very low in both studies. This implies that the civil unrests and labour strikes rarely impacts on the cash-out forecasts by contractors in both the UK and Nigeria. Most significant factors impacting on the forecasts in Nigeria are either rating low or totally absent in the UK construction industry (e.g. “increase in duration of the project”, “change in currency exchange rates”, “shortage of key plant items” etc). This may have stemmed from the fact that the two economies differ considerably. A similar survey carried out by Shehu *et al.* (2014) revealed that in Malaysia “late payment from contractor to subcontractors and suppliers”, “dispute between contractor and subcontractor’, “late payment from client to contractor” and “bureaucracy in government agencies” are crucial factors affecting contractor’s forecasts. The present

study has some similarities with that carried out in Malaysia. “Delay in payment from client” and “increase in the duration of the project” also ranked very high as in the study in Malaysia.

### 4.5 Analysis of Impact of Risk Factors affecting cash-out Forecasts

This section examines the contractors' perception of the degree of impact of the risk factors when they occur. The same data set was used to perform the analysis. The survey of the 31 risk factors derived from literature as potentially impacting construction cash flow was carried out using structured questionnaires. The contractors were asked to weight the degree of impact each factor had on the forecasts should it occur (see appendix A).

Table 4.11 below shows the ranking of the degree of impact of the risk factor on cash-out forecasts

Table 4.11: Impact of Risk Factors on Cash-out Forecasts.

| Risk Factors | Mean | | Std. Deviation | Rank |
|---|---|---|---|---|
| | Statistic | Std. Error | Statistic | |
| Increased Duration of the Project | 4.46 | 0.0575 | 0.7208 | 1 |
| Change in Currency Exchange Rates | 4.32 | 0.0613 | 0.7682 | 2 |
| High Cost of Materials | 4.06 | 0.0334 | 0.4188 | 3 |
| ——— | ——— | ——— | ——— | ——— |
| Geotechnical Issues | 0.84 | 0.0685 | 0.8587 | 30 |
| Archaeological Remains | 0.12 | 0.0446 | 0.5587 | 31 |

Source: field survey, 2014.

From Table 4.11 the risk factor with the highest impact is “Increase in duration of the project”. This is followed by “change in currency exchange rates”, “high cost of materials”, “delay in payment from client”, and “shortage of key plant items”. These represent the top 5 risk factors that have impact in construction projects in Nigeria. “Increas in duration of the project” impacts hihest on the forecasts possibly because a

change in timing for a contractor has several multiple effects. Once the duration of a project is increased, all attendant cost features involved in running a project multiply by some increased factor. “Change in currency exchange” affects cost of materials in the market steming from the fact that most construction materials are not made in the country and thus are very sensitive to change in currency exchange rates. Another manifestations of dependency on imported materials is the high cost of construction materials. As the industry is filled with properties emanating from outside the country, the tendency that material cost will be high is ineviTablet. “Delay in payment from client” ranked 4$^{th}$ in impact on cash-out forecasts. This risk factor impacting on cash-out is rather surprising but a closer look will justify its hihg impact. Delays of payment from the client ay result in the short term bankrupcy of the contractor, a result of which may be the postponment of anticipated payments for labour provided. This postponement results in probable intersts or defered payments that increases cost to the contractor. The 5$^{th}$ ranking factor impacting on cash-out forecasts is “shortage of key plant items” , the high rank of the impacting factor is also expected. For shortage of key plant items results in unanticipated spendings to the contractor.

The results obtained when compared with thise in existing literature, vary to some extent. Zayed and Liu (2014) identified “contractor’s personal relation with owner”, “contractor’s personal relation with consulting team”, “lacked of skilled labour” and “change of progress payment duration”, “change of labour and staff wages”, “delay of making payment to suppliers” and “number of claims” as the most significant factors impacting on contractors’ forecasts in North America. These do not align with the findings of the present study. The dissimilarities observed could be as a result of differences emenating from cultural and attitudinal changes in the regions of study. In a study of risk factors affecting construction cost flow (i.e. cash-out) forecasting in the

UK, Odeyinka *et al.* (2013) identified "changes to initial design", "inclement weather", "variation to works", "labour shortage" and "production time slippage" as the 5 top-most risk factors occurring. The same factors ranked 13th, 11th, 8th, 18th, and "not applicable" in the present study. Incidentally, "Client's insolvency", "Labour Strikes", and "Civil Disturbance" ranked very low in both studies. This implies that the civil unrests and labour strikes rarely pose a great danger to construction contractors in both the UK and Nigeria.

Another related study by Chaphalkar and Iyer (2014) in india indicated "delay in payment from employer", "delay in honouring claims", ""change order" and "nominated subcontractor's insolvency" as being more critical. In comparison, the present study rated all but "delay in payment by employer" low.

## 4.6 Occurence of Risk Factors Affecting cash-in and cash-out Forecasts and Grouping by Project Characteristics

Analyses of the risks factors were carried out based on some categories identified from literature. The categories identified are; project types, duration of projects, value of the projects, region of the country where the projects were executed, nature of the client for whom the project is being executed and the procurement route via which the projects were obtained. Test of hypotheses were conducted along these divisions. Data analyses were carried out using the Statistical Package for Social Sciences (SPSS). The first analysis deals mainly with the ranking of the risk variables based on their mean values. This was followed by the Analysis of Variance (ANOVA) to test the hypotheses. Appendix C contains full details of tables derived from the analyses while summaries of the tables are presented and discussed in the main text.

The research hypotheses are as follows;

For cash-in;

(i) Null Hypothesis ($H_0$); There is no significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-in Forecasts along project characteristics

(ii) Alternative Hypothesis ($H_l$): There is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-in Forecasts along project characteristics.

For cash-out;

(i) Null Hypothesis ($H_0$); There is no significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-out Forecasts along project characteristics

(ii) Alternative Hypothesis ($H_l$): There is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-out Forecasts along project characteristics.

Table 4.12 shows the ranking of the Likelihood of risk factor occurrence in cash-in Forecasts along project type grouping. The most prevalent project types executed by the respondents are commercial buildings, hospital buildings, residential buildings and public/community buildings.

Table 4.12: Occurence of Risk Factors in cash-in Forecasts across Project Types

| | Commercial | | Hospital | | Residential | | Public/Community | | F | Sig. |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Bad Relationship Between Contractor and Consulting Team | 2.14 | 24 | 2.04 | 25 | 1.71 | 28 | 4.57 | 3 | 3.292 | .022* |
| Changes in Activities' Start Time | 3.64 | 11 | 3.30 | 16 | 1.86 | 24 | 4.05 | 10 | 5.386 | .001* |
| Changes to Initial Design | 3.34 | 15 | 3.00 | 18 | 2.57 | 20 | 3.98 | 11 | 3.435 | .019* |
| Delay in Paying Creditors | 4.03 | 10 | 3.78 | 13 | 2.57 | 21 | 3.32 | 16 | 4.296 | .006* |
| Dispute Between Contractor and Owner | 3.58 | 12 | 4.00 | 9 | 4.43 | 5 | 2.68 | 21 | 4.429 | .005* |
| Geotechnical Issues | 3.20 | 18 | 2.96 | 19 | 3.57 | 13 | 2.48 | 22 | 4.248 | .006* |
| Inclement Weather | 3.13 | 19 | 2.52 | 22 | 1.29 | 29 | 2.44 | 23 | 4.076 | .008* |
| Incompetent Consulting Team | 1.58 | 27 | 1.74 | 27 | 3.57 | 11 | 2.27 | 24 | 6.725 | .000* |
| Labour Strikes | 0.66 | 38 | 1.00 | 39 | 2.57 | 19 | 1.84 | 26 | 6.611 | .000* |
| Large Retention Percentage | 0.64 | 39 | 1.13 | 35 | 2.43 | 22 | 1.65 | 27 | 5.253 | .002* |
| Period of Honouring Certificates | 1.11 | 34 | 1.39 | 29 | 0.14 | 40 | 1.51 | 31 | 2.713 | .047* |
| Problems with Foundation | 2.86 | 21 | 2.52 | 21 | 0.57 | 38 | 1.41 | 32 | 4.757 | .003* |
| Replacement of Defective Work | 2.89 | 20 | 1.87 | 26 | 0.86 | 35 | 1.27 | 35 | 7.606 | .000* |
| Withholding Tax | 4.28 | 7 | 4.04 | 7 | 2.86 | 17 | 0.43 | 40 | 2.849 | .039* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

From the Table it is clear that the opinions regarding thirteen risk factors were significantly different (P < 0.050) among project types groupings. These are: “bad relationship between contractor and consulting team”, “changes in activities' start time”, “changes to initial design”, “delay in paying creditors”, “dispute between contractor and owner”, “geotechnical issues”, “inclement weather”, “incompetent consulting team”, “labour strikes”, “large retntion percentage”, “period of honouring certificates”, “problems with foundation”, “replacement of defective work” and “withholding tax”. “Accuracy of estimates” ranked highest for both hospital and

public/commununity buildings. Even as the same factor ranked 2nd in the overall assessment, it still means that the factor is crucial to forecast of cash-in irrespective of the type of project. “Delay in receiving retention” ranked 1st in overall but the factor ranked rather low for hospital buildings (19th). This is an indication that hospital buildings are given a high priority by clients in the Nigerian construction industry and thus retentions are not delayed as and when due. “Bureaucracy in proceesing payment files” ranked 4th overall but ranked 6th for hospital, residential, and public/community buildings. It ranked 5th for commercial buildings too. This is an indication that the risk factor has a near-equal level of occurence for all types of buildings and that its level of occurence is high. “Change in government officials” ranked 2nd overall but ranked 7th for public/community buildings, 3rd for both commercial and residential buildings, and 2nd for hospital buildings. This also indicates the high level of occurence for the factor in all building types investigated. However, the occurence is less prevalent in public/community buildings. “Accuracy of estimates” which ranked 2nd overall, ranked 2nd for commercial and residential buildings. The factor ranked 1st for both hospital and public/community buildings. This is an indication of very high level of occurence of the factor in all the building types. Perhaps the reason for its high occurence is not far from the ever dire minute preparation approach to contract documentations that characterises construction projects executed in Nigeria. Despite its 5th rank in the overall, “increase in the duration of the project” ranked low for public/community buildings. This may be connected to the fact that community buildings receive more rigorous attention than the other types, most probably for political reasons.

The opinion of the respondents was significantly different on the following factors-

"bad relationship between contractor and consulting team", "geotechnical issues", "inclement weather", "incompetent consulting team", "labour strikes", "large retntion percentage", "period of honouring certificates", "problems with foundation", and "replacement of defective work". However, the factors ranked low in the overall and under the groupings. Thus it can not be concluded that the factors need to be considered for modelling.

As a result of the fore-going observations the null hypothesis for the types of projects is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-in Forecasts along project types.

### 4.6.1 Occurence of Risk Factors Affecting cash-in Forecasts and Grouping by Duration of Projects

Table 4.13 shows the ranking of the Likelihood of risk factor occurrence in cash-in Forecasts along project duration grouping. The durations of the project executed by the respondents fell within 'less than 12 months', '13-24 months', and 'above 24months'.

Table 4.13: Occurence of Risk Factors in cash-in Forecasts across Project Durations

| | **Less than 12 months** | | **13-24 Months** | | **Above 24 Months** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Accuracy of Estimates | 4.80 | 1 | 4.72 | 2 | 4.45 | 4 | 4.312 | 0.015* |
| Back/Front end Loading | 2.00 | 25 | 1.62 | 27 | 1.43 | 31 | 3.221 | 0.043* |
| Civil Disturbance | 1.80 | 29 | 1.06 | 37 | 0.82 | 39 | 3.974 | 0.021* |
| Unavailability of credit facilities | 2.40 | 22 | 1.88 | 26 | 1.54 | 29 | 3.410 | 0.036* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Ten of the forty variables were considered to be significantly differnt by the responents. among project duration groupings. These are: “accuracy of estimates”, “back/front end loading”, “civil disturbance”, “client’s insolvency”, “delay in releasing advance payment”, “labour strikes”, “overheads”, “problem with foundation”, “production time slippage”, and “unavailability of credit facilities”. “Delay in receiving retention” ranked 1st overalland also ranked 4th for durations less than 12 months, and 12-34 months. The factor ranked low relatively for the duration “above 24 months” (8th position). Thus the factor is also one to be reckoned with when forecasting cash-in. “Accuracy of estimates” ranked 2nd overalland also ranked 2nd for durations less than 12 months, and 12-34 months. It ranked 4th for ‘above 24 months’ duration- not as high as for the other two. This means that the factor is crucial to forecast of cash-in irrespective of the duration of the project. “Change in government officials” ranked 3rd overall and also third for all the three categories of the duration examined. This means that the factor has the tendency to occur with high consistency and should be taken seriously. “Bureaucracy in proceesing payment files(giving bribes to ‘speed up’ payments)” ranked 4th overall but didn’t quite rank very high for the durations ‘less than 12 months’, and ‘12-34 months’ (6th position for both). On the other hand the factor ranked quite high for the duration ‘above 24 months’. The explanation may lie in the fact that the longer a project takes the higher the tendency for corrupt practices to perpetrate. “Increase in duration of the project” also maintained a high rank in the overall and in individual durations of the project (5th overall and and average of 5 across the grouping). This indicates that increase in duration of projects have high occurence in projects executed in Nigeria.

“Back/front end loading”, “civil disturbance”, “client’s insolvency”, “labour strikes”, “overheads”, “problem with foundation”, “production time slippage”, and

"unavailability of credit facilities" elicited significantly different opinions from the respondents. However, the factors ranked low in the overall and under the groupings. Thus it can be concluded that the factors need not to be considered for modelling.

Based on the analysis the null hypothesis for the duration of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-in Forecasts along project duration.

### 4.6.2 Occurence of Risk Factors Affecting cash-in Forecasts and Grouping by Value of Projects

Table 4.14 shows the ranking of the Likelihood of risk factor occurrence in cash-in Forecasts along project Value grouping. The values of the project executed by the respondents fell within 'less than 50 million naira', '51-100 million naira', '101-200 million naira' and 'above 200 million naira'.

Table 4.14: Occurence of Risk Factors in cash-in Forecasts across Project Values

| | **Less than 50 million Naira** | | **50-100 million Naira** | | **101-200 million Naira** | | **Above 200 million Naira** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Back/Front end Loading | 1.61 | 27 | 1.63 | 28 | 1.64 | 27 | 1.08 | 38 | 4.633 | 0.004* |
| Bad Relationship Between Contractor and Owner | 1.45 | 29 | 1.50 | 29 | 1.33 | 34 | 1.88 | 28 | 3.294 | 0.022* |
| Changes in Activities' Start Time | 3.84 | 11 | 3.63 | 14 | 2.78 | 19 | 3.58 | .97431 | 13 | 0.001* |
| Delay in Paying Creditors | 4.35 | 7 | 4.13 | 9 | 3.42 | 13 | 4.17 | 5 | 5.443 | 0.001* |
| Delay in Payment from Client | 4.55 | 5 | 4.26 | 6 | 3.86 | 9 | 4.42 | 1 | 3.422 | 0.019* |
| Dispute Between Contractor and Owner | 3.76 | 12 | 3.78 | 11 | 4.14 | 6 | 3.04 | 18 | 2.715 | 0.047* |
| Inclement Weather | 3.12 | 18 | 3.15 | 18 | 2.25 | 22 | 1.58 | 32 | 3.047 | 0.031* |
| Incompetent Consulting Team | 1.29 | 32 | 1.67 | 27 | 2.47 | 21 | 4.08 | 7 | 8.107 | 0.000* |
| Labour Strikes | 0.39 | 40 | 0.65 | 38 | 1.53 | 29 | 1.17 | 36 | 7.787 | 0.000* |
| Withholding Tax | 4.59 | 4 | 4.33 | 4 | 3.33 | 14 | 3.95 | 9 | 8.330 | 0.000* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

“Back/front end loading”, “bad relationship between contractor and owner”, “change in activities’ start time”, “delay in paying creditors”, “delay in payment from client”, “dispute between contractor and owner”, “inclement weather”, “incompetent consulting team”, “labour strikes”, “large retention percentage”, “listed buildings”, “period of honouring certificates”, “problem with foundation”, “production time slippage”, “replacement of defective work”, “subcontractor’s insolvency”, “unavailability of credit facilities” and “withholding tax” were considered to be sdtatistically significantly differnt by the responents. “Delay in receiving retention” which ranked 1st overallalso ranked very high for all the categories of project values. “Accuracy of estimates” ranked 2nd overalland also ranked within 1st and 3rd for the three categories. “Change in government officials” also ranked high for all the three categories of project values. The factor is the second highest ranking overall, implying a strong probility of occurence in projects irrespective of value. “Bureaucracy in processing payments (giving bribes to “speed up” payments)” ranked 6th for projects of value less than 50 milllion naira. This a little below the 4th overall rank, this could be explained by the fact that 50 million naira worth projects do not necessarily attract much interest from bribe seekers, given the relative paucity of the amount involved. The overall fifth most occuring factor, “increase in the duration of the project”, did not seem to occur hghly across the different values identified. Its occurence was only hgh in of value 101-200 million naira. Interestingly, the factor ranked very low (39th) for projects of value above 200 million naira. This may be explained the fact that such ‘large projects command several interests and are completed in good time in order to satisfy all stake holders involved.

The following factors statistically and significantly differed in the opinion of the contractors-“Back/front end loading”, “bad relationship between contractor and

owner", "change in activities' start time", "delay in paying creditors", "delay in payment from client", "dispute between contractor and owner", "inclement weather", "incompetent consulting team", "labour strikes", "large retention percentage", "listed buildings", "period of honouring certificates", "problem with foundation", "replacement of defective work", "subcontractor's insolvency", and "unavailability of credit facilities". However, the factors ranked low in the overall and under the groupings. Thus it can be concluded that the factors need not to be considered for modelling.

Based on the analysis the null hypothesis for the duration of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-in Forecasts along project values.

### 4.6.3 Occurence of Risk Factors Affecting cash-in Forecasts and Organisations' Annual Turnover

Table 4.15 shows the ranking of the Likelihood of risk factor occurrence in cash-in Forecasts along projects executed by organisatins based on their annual turnover.

Table 4.15: Occurence of Risk Factors in cash-in Forecasts across organisations' annual turn over.

| Risk Factors | Below 100m Mean | Rank | 101-200m Mean | Rank | 201-300m Mean | Rank | 301-400m Mean | Rank | 401-500m Mean | Rank | Above 500m Mean | Rank | F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Accuracy of Estimates | 5.00 | 1 | 5.00 | 1 | 4.86 | 1 | 4.00 | 9 | 3.69 | 12 | 5.00 | 1 | 57.050 | 0.000* |
| Back/Front end Loading | 1.72 | 27 | 2.00 | 24 | 1.86 | 28 | 0.97 | 34 | 1.31 | 29 | 1.00 | 27 | 21.425 | 0.000* |
| | — | – | — | — | — | — | — | – | — | — | — | – | — | ——— |
| Withholding Tax | 5.00 | 3 | 2.48 | 21 | 4.53 | 6 | 4.20 | 5 | 4.31 | 6 | 5.00 | 9 | 27.051 | 0.000* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

A look at Table 4.12 shows that the contractors' response were statistically significant for all the forty risk factors identified in this study. This suggests that modelling along the various grouping according to annual turnover is necessary. However, not all the factors proved to be of high occurence for all the groups. "Accuracy of estimates", "bureaucracy in processing payments (giving bribes to speecd up payments), "change in government officials", "delay in paying creditors", "delay in payment from clients", "delay in receiving retention", "delay in releasing advance payment", "discount on materials purchased", "increase in duration of project", and "withholding tax" are the variables to be inputed in the model as their mean scores are high and they ranked for all the categories of contractors. The other factors cannot be in-puted in the model because of their low ranking in the list.

As a result of the fore-going the null hypothesis for the organisations grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-in Forecasts along organisations' annual turnover.

### 4.6.4 Occurence of Risk Factors Affecting cash-in Forecasts and Grouping by Nature of Client

Table 4.16 shows the ranking of the Likelihood of risk factor occurrence in cash-in Forecasts along projects executed for the two major category of clients in the country- the Federal and State Governments. Local government Authorities were discarded from the study because only two of the 169 respondents indicated them as clients.

Table 4.16: Occurence of Risk Factors in cash-in Forecasts across Projects' Client.

| | **Federal Government** | | **State Government** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | STAT | (P.Values) |
| Change in Government Officials | 4.43 | 3 | 4.71 | 2 | 3.46 | 0.03* |
| Change Orders | 1.76 | 27 | 1.07 | 34 | 3.53 | 0.03* |
| Client's Insolvency | 0.87 | 37 | 1.35 | 33 | 5.75 | 0.00* |
| Contractual Specification of Minimum Amount Valuation | 1.49 | 31 | 0.79 | 39 | 3.35 | 0.04* |
| Delay in Payment from Client | 4.05 | 7 | 4.46 | 4 | 4.03 | 0.02* |
| Listed Buildings | 1.46 | 33 | 1.00 | 35 | 3.54 | 0.03* |
| Receiving Advance Payment | 0.86 | 39 | 1.46 | 31 | 5.20 | 0.01* |
| Unavailability of credit facilities | 1.54 | 30 | 1.94 | 25 | 4.47 | 0.01* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.16 shows that the contractors' response were statistically significant for eight risk factors. Two of the eight factors actually ranked high in the overall and for the categories. These are "change in government officials", and "delay in payment from clients". "Delay in receiving retention" ranked 1$^{st}$ in both categories of clients, as it did

in the overall. But there was no signicant difference in the opinion of the respondents on the factor. “Accuracy of estimates” which ranked 2nd overall also rankedvery high for the two types of client (2nd and 3rd respectively for Federal and State governments), but it was not found to be significant too. “change in government officials”, which was found to be significant statistically ranked 3rd overall also anked very high under both categories. “Bureaucracy in processing payments (giving bribes to “speecd up” payments), which did not have any statistical difference also ranked high in the categories as in the overall. “Increase in duration of project” did not proved to be significantly different in the opinion of the contractors. But the factor also ranked high in the overall and in the categories.

As a result of the fore-going the null hypothesis for the client of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-in Forecasts along nature of client.

## 4.7. Impact of Risk Factors Affecting cash-in Forecasts and Grouping by Project Characteristics

Analyses of the risks factors were carried out based on some categories identified from literature. The categories identified are; project types, duration of projects, value of the projects, region of the country where the projects were executed, nature of the client for whom the project is being executed and the procurement route via which the projects were obtained. Test of hypotheses were conducted along these divisions. Data analyses were carried out using the Statistical Package for Social Sciences (SPSS).

Table 4.17 shows the ranking of the degree of impact of risk factors on cash-in Forecasts along project type grouping. The most prevalent project types executed by

the respondents are commercial buildings, hospital buildings, residential buildings and public/community buildings.

Table 4.17: Impact of Risk Factors on cash-in Forecasts across Project Types

| | Commercial | | Hospital | | Residential | | Public/Community | | F | Sig. |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Bad Relationship Between Contractor and Consulting Team | 4.50 | 3 | 4.65 | 3 | 4.71 | 3 | 4.56 | 3 | 5.750 | 0.001* |
| Changes in Activities' Start Time | 3.83 | 10 | 3.87 | 10 | 3.71 | 9 | 4.05 | 10 | 4.703 | 0.004* |
| Delay in Paying Creditors | 3.30 | 16 | 3.26 | 16 | 2.86 | 16 | 3.32 | 16 | 5.568 | 0.001* |
| Dispute Between Contractor and Owner | 2.86 | 21 | 2.48 | 21 | 2.57 | 21 | 2.54 | 21 | 4.627 | 0.004* |
| Geotechnical Issues | 2.78 | 22 | 2.26 | 22 | 2.29 | 22 | 2.49 | 22 | 3.837 | 0.011* |
| Inclement Weather | 2.59 | 23 | 2.13 | 23 | 1.86 | 23 | 2.44 | 23 | 5.215 | 0.002* |
| Incompetent Consulting Team | 2.31 | 24 | 2.13 | 24 | 1.71 | 24 | 2.33 | 24 | 4.879 | 0.003* |
| Labour Strikes | 1.95 | 26 | 1.96 | 26 | 1.71 | 26 | 1.86 | 26 | 5.222 | 0.002* |
| Problems with Foundation | 1.28 | 32 | 1.30 | 32 | 1.14 | 32 | 1.46 | 32 | 5.548 | 0.001* |
| Replacement of Defective Work | 0.97 | 35 | 1.17 | 35 | 0.86 | 35 | 1.25 | 35 | 9.077 | 0.000* |
| Under Valuation | 0.89 | 38 | 1.00 | 38 | 0.57 | 38 | 0.83 | 38 | 3.596 | 0.015* |
| Withholding Tax | 0.36 | 40 | 0.35 | 40 | 0.14 | 40 | 0.40 | 40 | 4.301 | 0.006* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

From the Table it is clear that the opinions regarding twelve risk factors were statistically ignificantly different ($P < 0.050$) among project types groupings. These are: “bad relationship between contractor and consulting team”, “changes in activities' start time”, “delay in paying creditors”, “dispute between contractor and owner”, “geotechnical issues”, “inclement weather”, “incompetent consulting team”, “labour strikes”, “problems with foundation”, “replacement of defective work”, “under

valuation" and "withholding tax". "Accuracy of estimates" ranked highest for the building types identified in the study. Meaning it has the highest impact on forecasts where it occurs on a project. Even as the same factor ranked 2nd in the overall assessment, it still means that the factor is crucial to forecast of cash-in irrespective of the type of project. "Back/front end loading" ranked 28th overall but 2nd for all the building types. "Bad relationship between contractor and consulting team", "bad relationship between contractor and owner", and "bad relationship between main and sub contractor" ranked 3rd, 4th and 5th respectively in all the categories. These are qualitative rather than quantitaive issues. This is an indication that qualitative factors have higher impacts on cash-in Forecasts than quantitative factors. The qualitative factors ranked low overall but obviously have high impact on the building types. These may be conneted to the fact that the relationship between parties to a contract is highly influenced by building type.

The opinion of the respondents was significantly different on the following factors- "change in activities' start time", "delay in paying creditors", "dispute between contractor and owner", "inclement weather", "incompetent consulting team", "bad relationship between contractor and consulting team", "labour strikes", "geotechnical issues", "problems with foundation", "replacement of defective work", and "under valuation". However, the factors ranked low in the overall and under the groupings. Thus it can not be concluded that the factors need to be considered for modelling.

As a result of the fore-going observations the null hypothesis for the types of projects is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the impact of risk factors in cash-in Forecasts along project types.

### 4.7.1 Impact of Risk Factors Affecting cash-in Forecasts and Grouping by Project Durations

Table 4.18 shows the ranking of the degree of impact of risk factors on cash-in Forecasts along project duration grouping. The most prevalent project durations executed by the respondents are “less than 12 months”, “13-24 months” and “above 24 months”.

Table 4.18: Impact of Risk Factors on cash-in Forecasts across Project Durations

| Risk Factors | Less than 12 months Mean | Rank | 13-24 Months Mean | Rank | Above 24 Months Mean | Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|---|---|
| Accuracy of Estimates | 4.80 | 1 | 4.72 | 1 | 4.43 | 4 | 3.125 | 0.028* |
| Back/Front end Loading | 2.00 | 25 | 1.65 | 3 | 1.46 | 31 | 3.901 | 0.010* |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.20 | 6 | 4.23 | 4 | 4.51 | 3 | 6.073 | 0.001* |
| Civil Disturbance | 1.40 | 33 | 1.03 | 9 | 0.74 | 39 | 4.270 | 0.006* |
| Compliance With New Regulations | 2.00 | 26 | 2.15 | 11 | 1.83 | 27 | 3.133 | 0.027* |
| Delay in Paying Creditors | 4.00 | 7 | 4.16 | 14 | 3.77 | 10 | 3.501 | 0.017* |
| Discount on Materials | 3.80 | 9 | 4.01 | 18 | 4.22 | 6 | 6.002 | 0.001* |
| Purchased Variations | 4.00 | 8 | 3.88 | 39 | 3.63 | 12 | 3.345 | 0.021* |
| Withholding Tax | 3.80 | 11 | 4.30 | 40 | 3.91 | 9 | 2.449 | 0.066 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Eleven risk factors were found to be statistically and significantly different along project duration grouping (Table From 4.16). “Accuracy of estimates”, “back/front end loading”, “bureaucracy in processing payments (giving bribe to “speed up” payments), “civil disturbance”, “compliance with new regulations”, “delay in paying creditors”, “discount on materials purchased”, “overheads”, “production time slippage”, “unavailability of credit facilities”, and “variations” accounted for the significant difference in opinion of the respondent contractors. “Accuracy of estimates” ranked highest for two of the duration groupings but ranked 4th for the “above 24 months” category which is lower than for the other two but stil high in rating. This indicates a very high impact on forecasts where the factor occurs. The same factor ranked 1st in the overall assessment. “Delay in receiving retention” ranked 1st overall, ranked 4th for less than 12 months category, 16th for 13-24 months and 1st for above 24 months. The high impact for the above 24 months category could be ascribed to the large contract sums associated with projects of long durations. Contracts with durations above 24 months are mostly complex or very large. Thus the retention on them would be relatively large amounts, delay of which will impact highly on forecasts. “Change in government officials” which ranked 3rd overall also ranked very high for all the three categories of duration. This is not surprising as any form of change in government officers normally results in a dramatic twist of events in the Nigerian polity. “Bureaucracy in processing payments (giving bribes to “speed up” payments) ranked 4th overall ranked 3rd, 4th and 6th for above 24 months, 13-24 months and below 12 months respectively. It is not surprising that less than 12 months is ranking lower than the other two categories. This is because issues relating to bribery will be more apparent in projects with longer periods. The 5th highest overall (i.e. “increase in the duration of the project”) ranked very low the 13-24 months category. This could be explained by the fact that projects

falling within that category rarely experience increase in durations. The factors that seem to be more prevalent in this category are more quantitative than qualitative.

The opinion of the respondents was significantly different on the following factors- "Accuracy of estimates", "back/front end loading", "civil disturbance", "compliance with new regulations", "delay in paying creditors", "discount on materials purchased", "overheads", "production time slippage", "unavailability of credit facilities", and "variations". However, the factors ranked low in the overall and under the groupings. Thus it can not be concluded that the factors need to be considered for modelling.

It can be drawn from the observations thus far that the null hypothesis for the duration of projects is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the impact of risk factors in cash-in Forecasts along project duration.

### 4.7.2 Degree of Impact of Risk Factors Affecting cash-in Forecasts and Grouping by Value of Project

Table 4.19 shows the ranking of the degree of impact of risk factors on cash-in Forecasts along project value grouping. The project values executed by the contractors in this study are – "less than 50 million naira", "51-100 million naira", "101-200 million naira" and "above 200 million naira".

Table 4.19: Impact of Risk Factors on cash-in Forecasts across Project Values

| | Less than 50 million Naira | | 50-100 million Naira | | 101-200 million Naira | | Above 200 million Naira | | F | Sig. |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Back/Front end Loading | 1.67 | 28 | 1.65 | 28 | 1.67 | 28 | 1.08 | 36 | 5.824 | 0.001* |
| Change in Government Officials | 4.75 | 1 | 4.52 | 2 | 4.69 | 3 | 4.25 | 3 | 3.206 | 0.025* |
| Changes in Activities' Start Time | 3.78 | 12 | 3.54 | 14 | 2.75 | 19 | 3.42 | 15 | 5.668 | 0.001* |
| Changes to Initial Design | 3.25 | 17 | 3.24 | 17 | 2.94 | 18 | 3.54 | 12 | 3.379 | 0.020* |
| Delay in Paying Creditors | 4.41 | 6 | 4.11 | 8 | 3.39 | 13 | 3.67 | 9 | 6.340 | 0.000* |
| Delay in Payment from Client | 4.57 | 5 | 4.28 | 5 | 3.89 | 8 | 4.13 | 4 | 3.639 | 0.014* |
| Delay in Receiving Retention | 4.65 | 3 | 4.76 | 1 | 4.75 | 1 | 3.96 | 7 | 7.306 | 0.000* |
| Inclement Weather | 3.06 | 18 | 3.09 | 18 | 2.19 | 22 | 3.21 | 16 | 3.524 | 0.017* |
| Incompetent Consulting Team | 1.27 | 32 | 1.70 | 27 | 2.42 | 21 | 1.58 | 32 | 7.669 | 0.000* |
| Labour Strikes | 0.34 | 40 | 0.72 | 38 | 1.58 | 30 | 1.05 | 37 | 6.917 | 0.000* |
| Large Retention Percentage | 0.73 | 38 | 0.72 | 39 | 1.64 | 29 | 1.67 | 30 | 5.840 | 0.001* |
| Problems with Foundation | 2.78 | 22 | 2.65 | 23 | 1.50 | 31 | 2.29 | 24 | 5.751 | 0.001* |
| Production Time Slippage | 3.67 | 14 | 3.43 | 16 | 3.14 | 16 | 2.88 | 21 | 5.694 | 0.001* |
| Replacement of Defective Work | 2.69 | 23 | 2.70 | 22 | 1.92 | 25 | 2.96 | 20 | 3.457 | 0.018* |
| Withholding Tax | 4.59 | 4 | 4.33 | 4 | 3.28 | 14 | 3.92 | 8 | 10.340 | 0.000* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Sixteen risk factors were found to be statistically and significantly different along project value grouping (Table 4.17). “Back/front end loading”, “change in goernment officials”, “change in activities’ start time”, “changes to initial design”, “delay in paying creditors”, “delay in payment from client”, “delay in receiving retention”, “inclement weather”, “incompetent consulting team”, “labour strikes”, “large retention percentage”, “listed buildigs”, “period of honouring certificates”, “production time

slippage", "problem with foundation", "replacement of defective works" and "withholding tax" accounted for the significant difference in opinion of the respondent contractors. "Accuracy of estimates" ranked highest for all the four categories of value. Suggesting very high impact on forecasts where the factor occurs. The same factor ranked 1st in the overall assessment. "Delay in receiving retention" ranked 1st overall, ranked 3rd for less than 50 million naira category, 1st for 50-100 million naira category, 1st for 101-200 million naira category and 7th for the 'above 200 million naira' category. The high impact for all the categories corresponds with the overall impact. Perhaps the 7th position for the 'above 200 million naira' category is as a result of minimal extension of time for projects in that category.

The opinion of the respondents was significantly different on the following factors- "Back/front end loading", "inclement weather", "incompetent consulting team", "labour strikes", "large retention percentage", "listed buildings", "problems with foundation", "replacement of defective work" and "withholding tax". However, the factors ranked low in the overall and under the groupings. Thus it can not be concluded that the factors need to be considered for modelling.

It can be drawn from the observations thus far that the null hypothesis for the duration of projects is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the impact of risk factors in cash-in Forecasts along project Value.

### 4.7.3 Impact of Risk Factors Affecting cash-in Forecasts and Grouping by Organisation's Annual Turnover

Table 4.20 shows the ranking of the degree of impact of risk factors on cash-in Forecasts along organisations' annual turn over.

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Table 4.20: Impact of Risk Factors on cash-in Forecasts across Annual Turnover

| | Below 100m | | 101-200m | | 201-300m | | 301-400m | | 401-500m | | Above 500m | | F | Sig. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | | | | | F STAT | (P.Values) |
| Accuracy of Estimates | 5.00 | 1 | 5.00 | 1 | 4.86 | 1 | 4.00 | 9 | 3.63 | 11 | 5.00 | 1 | 53.785 | 0.000* |
| Back/Front end Loading | 2.00 | 25 | 2.00 | 24 | 1.86 | 28 | 0.97 | 34 | 1.31 | 31 | 1.00 | 27 | 26.179 | 0.000* |
| Bad Relationship Between Contractor and Consulting Team | 2.00 | 28 | 2.00 | 26 | 2.00 | 27 | 2.63 | 25 | 1.94 | 25 | 3.00 | 22 | 18.324 | 0.000* |
| Bad Relationship Between Contractor and Owner | 1.00 | 33 | 1.00 | 32 | 1.19 | 32 | 2.09 | 28 | 4.81 | 1 | 3.00 | 23 | 3.902 | 0.002* |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.00 | 8 | 4.00 | 6 | 3.81 | 11 | 5.00 | 1 | 4.69 | 3 | 5.00 | 2 | 32.491 | 0.000* |
| Withholding Tax | 5.00 | 7 | 2.48 | 21 | 4.58 | 6 | 4.20 | 5 | 4.00 | 7 | 5.00 | 9 | 30.083 | 0.000* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

The grouping along annual turnover of the responding organisation is presented on Table Table 4.20. All the forty factors considered in this research were found to be statistically and significantly different according to the opinions of the contractors. "Delay in receiving retention" ranked 1st overall, but ranked 5$^{th}$ in the north east, 3$^{rd}$ in north central and south west, 4$^{th}$ for organisations with 201-300m naira annual turnover, 12$^{th}$ for 401-500m and 13$^{th}$ for Above 500m naira. This is not surprising as organisations with high annual turnovers may not necessarily depend on retentions. On

the contrary, smaller organisations may depend highly early release of retention for cash flows. “Accuracy of estimates” ranked highest for four categories, agreeing with the overall rank of 1st. The factor ranked 11th the 401-500m category and 9th for 301-400m naira category. Not withstanding the difference with the other groups, the factor still hold a significant rank across the grouping. The 3rd overall- “change in government officials”, ranked high for most of the categories too. The exceptions were 301-400m and 401-500m where it ranked 6th and 13th respectively. These positions still fall within the ‘high’ ranks. “Bureaucracy in processing payments (giving bribes to “speed up” payment) ranked 1st for the 301-400m naira category, 2nd for the above 500m and 3rd for the 401-500m category. This suggest the highest level of corruption in the bigger firms. this may result from the fact that such firms engage more in projects with very high contract sums and thus very high tendency for corruption.

According to the perception of the responding contractors, all the risk factors are statistically, significantly different. Thus the the null hypothesis for the region of the execution of the projects is rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the impact of risk factors in cash-in Forecasts along regional divides.

### 4.7.4 Impact of Risk Factors Affecting cash-in Forecasts and Grouping by Nature of Client

Table 4.21 shows the ranking of the degree of impact of risk factors on cash-in Forecasts along differnt types of clients. Three types of clients were identified by the study- Federal government, state government and local government. Only two respondents identified local government authorities as their client and so the client was discarded from further analysis.

Table 4.21: Impact of Risk Factors on cash-in Forecasts across Nature of Client

| Risk Factors | Federal Government Mean | Rank | State Government Mean | Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|
| Client's Insolvency | 0.88 | 38 | 1.33 | 33 | 5.236 | 0.006* |
| Listed Buildings | 1.65 | 30 | 1.18 | 34 | 3.564 | 0.031* |
| Long Interval Between Two Certificates | 2.95 | 19 | 3.10 | 18 | 0.581 | 0.561 |
| Overheads | 2.63 | 22 | 2.82 | 21 | 0.820 | 0.442 |
| Period of Honouring Certificates | 0.94 | 36 | 1.35 | 32 | 2.341 | 0.100 |
| Problems with Foundation | 2.47 | 23 | 2.24 | 23 | 0.926 | 0.398 |
| Production Time Slippage | 3.37 | 14 | 3.32 | 16 | 0.595 | 0.553 |
| Receiving Advance Payment | 0.88 | 39 | 1.44 | 31 | 4.471 | 0.013* |
| Replacement of Defective Work | 2.70 | 21 | 2.40 | 22 | 0.972 | 0.380 |
| Subcontractor's Insolvency | 0.41 | 40 | 0.42 | 40 | 0.145 | 0.865 |
| Unavailability of credit facilities | 1.61 | 31 | 2.00 | 26 | 3.860 | 0.023* |
| Under Valuation | 3.59 | 13 | 3.68 | 13 | 0.299 | 0.742 |
| Variations | 3.78 | 11 | 3.75 | 12 | 0.122 | 0.885 |
| Withholding Tax | 4.01 | 8 | 4.19 | 7 | 0.959 | 0.385 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

The grouping along nature of client under which the projects were executed represented on Table 4.21. only four factors were considered to be statistically and significantly different according to the opinions of the contractors. These include “client’s insolvency”, “listed buildings”, “receiving advance payment” and “unavailability of credit facilities”. “Delay in receiving retention” ranked 1st overall, and also ranked high for both categories, suggesting a high rate of impact on the forecasts. “Accuracy of estimates” which also ranked 1st overall ranked 2nd for both categories suggesting a strong correlation with the overall impact. This also suggests that the factor is very critical to the impact on forecasts. The 3rd overall- “change in government officials”,

ranked high in both groups (3rd for the federal government and 1st for the state government), indicating yet another strong factor to consider along the client type divide. “Bureaucracy in processing payments (giving bribes to “speed up” payment) ranked 4th for federal government projects and 6th for state government projects, an indication that the factor has a high impact on forecasts too. Even though ranking 6th in state government projects suggests less cases of bribery in state government projects. “Increase in the duration of the project” ranked 5th for both categories. The same rank it has for the overall. This suggest a consistently high impact on cash-in forecasts irrespective of the client to a project.

“Client’s insolvency”, “listed buildings”, “receiving advance payment” and “unavailability of credit facilities”that have proven to be statistically and significantly different in the opinion of the contractors. However, the factors ranked low in the overall and under the groupings. Thus it can not be concluded that the factors need to be considered for modelling.

Thus the the null hypothesis for the “nature of client” grouping of the projects is rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the impact of risk factors in cash-in Forecasts along client type grouping.

## 4.8 Occurence of Risk Factors Affecting cash-out Forecasts and Grouping by Project Types

Table 4.22 shows the ranking of the Likelihood of risk factor occurrence in cash-out Forecasts along project type grouping. The most prevalent project types executed by the respondents are commercial buildings, hospital buildings, residential buildings and public/communitybuildings.

Table 4.22: Occurence of Risk Factors in cash-out Forecasts across Project Types

| Risk Factors | Commercial Mean | Commercial Rank | Hospital Mean | Hospital Rank | Residential Mean | Residential Rank | Public/Community Mean | Public/Community Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|---|---|---|---|
| Bad Relationship Between Main and Sub Contractor | 2.48 | 20 | 2.08 | 24 | 2.86 | 18 | 2.51 | 20 | 2.811 | 0.041* |
| Change in Currency Exchange Rates | 4.06 | 2 | 4.46 | 1 | 4.71 | 1 | 4.44 | 2 | 3.996 | 0.009* |
| Change Orders | 1.21 | 26 | 2.54 | 20 | 2.86 | 17 | 2.03 | 24 | 4.917 | 0.003* |
| Civil Disturbance | 1.43 | 24 | 3.13 | 10 | 3.57 | 8 | 2.48 | 21 | 5.494 | 0.001* |
| Client's Insolvency | 1.03 | 28 | 1.13 | 28 | 1.71 | 25 | 1.38 | 26 | 5.194 | 0.002* |
| Contractor/Owner Dispute | 2.81 | 17 | 2.75 | 17 | 3.00 | 13 | 3.32 | 10 | 6.298 | 0.000* |
| Delay in Agreeing Variation/Day Works | 3.11 | 13 | 2.83 | 15 | 2.29 | 22 | 3.16 | 14 | 5.320 | 0.002* |
| Replacement of Defective Works | 3.79 | 5 | 3.29 | 8 | 4.00 | 5 | 3.81 | 6 | 3.465 | 0.018* |
| Under Measurements | 2.60 | 19 | 2.38 | 23 | 2.29 | 23 | 2.13 | 23 | 7.464 | 0.000* |
| Variations | 3.83 | 3 | 3.71 | 6 | 4.71 | 2 | 3.87 | 5 | 3.167 | 0.026* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

From Table 4.21 it is evident that the opinions regarding seventeen risk factors were significantly different (P < 0.050) among project types groupings. These are: “bad relationship between main and sub contractor”, “changes in currency exchange rates”, “change orders”, “civil disturbance”, “client’s insolvency”, “contractor owner dispute”, “delay in agreeing variation/day works”, “delay in settling claims”, “high cost of materials”, “inclement weather”, “increased duration of the project”, “poor communication amongst parties”, “problem with foundation” “replacement of defective work”, “under measurements” and “variations”. “Increased duration of the project”

overall. The factor ranked 1st for both ranked highest for both public/commununity buildings and commercial buildings, while ranking 2nd and 3rd for hospital and residential buildings respectively. This is an indication that the factor has a very high likelihood to occur in all categories of building types. The second highest ranking factor, "changes in currency exchange rates", also ranked very high for all the four types of buildings. Reitrating its high frequency of occurence. "High cost of materials" is 3rd overall buth ranked 4th, 5th, 4th, and 3rd for commercial, hospital, rsidential and community/pyblic buildings respectively. The factor maintained its high position across the individual units of the group. "Variations" being the 4th overall also ranked relatively close to its overall across the group members, keeping it relevant as a factor requiring consideration when occurence is being sought. The 5th most occuring risk factor is "shortage of key plant items", did not quiet maintain the same rank across the groups but still exhibited a high level of likelihood of occurence.

The opinion of the respondents was significantly different on the following factors- "bad relationship between main and sub contractor", "change orders", "civil disturbance", "client's insolvency", "problem with foundation", and "under measurements". However, the factors ranked low in the overall and under the groupings. Thus it can not be concluded that the factors need to be considered for modelling.

As a result of the observations made the null hypothesis for the types of projects is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-in Forecasts along project types.

### 4.8.1 Occurence of Risk Factors Affecting cash-out Forecasts and Grouping by Duration of Projects

Table 4.23 shows the ranking of the Likelihood of risk factor occurrence in cash-out Forecasts along project duration grouping. The durations of the project executed by the respondents fell within 'less than 12 months', '13-24 months', and 'above 24months'.

Table 4.23: Occurence of Risk Factors in cash-out Forecasts across Project Durations

| | Less than 12 months | | 13-24 Months | | Above 24 Months | | F | Sig. |
|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Archaeological Remains | 0.60 | 31 | 0.17 | 1 | 0.09 | 31 | 7.547 | 0.000* |
| Bad Relationship Between Main and Sub Contractor | 2.00 | 24 | 2.35 | 24 | 2.63 | 19 | 3.773 | 0.012* |
| Changes to Initial Design | 2.80 | 15 | 2.99 | 3 | 3.42 | 11 | 2.775 | 0.043* |
| Charging of "Land Dues" by Locals (illegally) | 2.00 | 22 | 2.88 | 4 | 3.51 | 10 | 2.910 | 0.036* |
| Geotechnical Issues | 1.20 | 4 | 0.84 | 15 | 0.74 | 30 | 3.053 | 0.030* |
| Increased Duration of the Project | 4.20 | 17 | 4.47 | 13 | 4.62 | 1 | 3.129 | 0.027* |
| Over Measurements | 3.00 | 28 | 3.15 | 19 | 3.06 | 16 | 3.881 | 0.010* |
| Poor communication Amongst Parties | 3.00 | 25 | 3.06 | 20 | 3.52 | 9 | 2.947 | 0.035* |
| Shortage of Key Plant Items | 3.40 | 17 | 3.71 | 25 | 3.92 | 5 | 8.733 | 0.000* |
| Shortage of Key Skilled Labour | 2.60 | 16 | 2.77 | 26 | 3.02 | 18 | 5.218 | 0.002* |
| Under-estimating Project complexity | 2.60 | 18 | 2.99 | 30 | 3.38 | 12 | 3.676 | 0.014* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Ten of the thirty-one variables were considered to be statistically and significantly differnt by the respondents among project duration groupings. These are: "archaeological remains", "bad relationship between main and sub contractor", "changes to initial design", "charging of 'land dues' by locals (illegally)", "geotechnical issues", "increased duration of the projects", "over measurements", "poor communication amongst parties", "shortage of key plant items", "shortage of key skilled labour" and "under-estimating project complexity". "Increase in duration of the project" which ranked 1st overall, ranked 17th for projects of duration less than 12

months, and 13th for 12-34 months. Perhaps because the projects whith such short durations hardly get extended as a result of their simplicity. While the same factor ranked 1st for projects with duration "above 24 months". This is understandable because such projects are mostly complex in nature and may require several extensions of time to get actualised. "Change in currency exchange rates" ranked 2nd overalland also ranked 2nd for durations less than 12 months, 12-34 months, and for 'above 24 months' duration. This could be happening because of the nature of the Nigerian currency exchange market, where uncertainty is the order of the day. For both long and short term periods, the exchange can fluctuate so sharply that contractors are taken completely unawares. "High cost of materials" ranked 3rd overall 3rd for above 24 months, 12th for less than 12 months and 16th for 13-24 months. The sharp variation for the projects with shorter periods is not surprising because the longer a project takes the more it is susceptible to frequent rise in prices of materials. "Variations" ranked 4th overall but didn't quite rank very high for the durations 'less than 12 months', and '12-34 months' (8th and 31st respectively). This gives the impression that projects that last for between 13 and 24 months experience the highest number of change in specifications. "Shortage of key plant items" maintained a high rank only for projects with duration 'above 24 months. Key plant items are mostly required in complex project with long durations, thus explaining why the likelihood of occurence of the factor is highest for projects with the longest duration.

"Archaeological remains", "bad relationship between main and sub contractor", "geotechnical issues", and "shortage of key skilled labour" elicited significantly different opinions from the respondents. However, the factors ranked low in the overall and under the groupings. Thus it can be concluded that the factors need not to be considered for modelling.

Based on the analysis the null hypothesis for the duration of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-in Forecasts along project duration.

### 4.8.2 Occurence of Risk Factors Affecting cash-out Forecasts and Grouping by Value of Projects

Table 4.24 shows the ranking of the Likelihood of risk factor occurrence in cash-out Forecasts along project Value grouping. The values of the project executed by the respondents fell within 'less than 50 million naira', '51-100 million naira', '101-200 million naira' and 'above 200 million naira'.

Table 4.24: Occurence of Risk Factors in cash-out Forecasts across Project Values

| | **Less than 50 million Naira** | | **50-100 million Naira** | | **101-200 million Naira** | | **Above 200 million Naira** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Civil Disturbance | 2.60 | 21 | 1.93 | 23 | 2.65 | 19 | 3.48 | 7 | 3.125 | .028* |
| Client's Insolvency | 1.19 | 27 | 1.20 | 27 | 1.43 | 25 | 3.43 | 8 | 2.857 | .039* |
| _____ | | | | | | | | | | |
| Variations | 3.56 | 8 | 3.87 | 4 | 4.35 | 3 | 0.52 | 31 | 8.353 | .000* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Ten of the thirty-one variables were considered to be statistically and significantly differnt by the respondents among project duration groupings. These are: "civil disturbance", "client's insolvency", "delay in agreeing variation/day works", "delay in settling claims", "failure of subcontractors", "high cost of materials", "over measurements", "under-estimating project complexity", and "variations". "Increase in duration of the project" which ranked 1$^{st}$ overall, ranked 18$^{th}$ for projects of value above 200 million naira, but ranked very high for the other categories with less values. This

may be connected to the fact that project with such high values last for very long and thus hardly require extension of time. “Change in currency exchange rates” ranked 2nd overalland also ranked 2nd for projects less than 50 million naira, between 50 and 100 million naira, and 3rd for above 200 million naira. It ranked 1st for 101-200 million naira, suggesting that such type of peojects are very sensitive to exchange rates. “High cost of materials” ranked 3rd overall, 3rd for projects less than 50 million naira, and between 50 and 100 million naira. The same factor ranked 4th for 101-200 million naira. While it ranked 16th for projects above 200 million naira. The low ranking for the latter may be due to the the time frame whithin which the job is executed- it becomes so long that the hihg cost of materials become almost of no effect.“Variations” which is 4th overall had very low occurence only in projects above 200 million naira worth. “Shortage of key plant items” maintained a high rank for three out of the four categories.

“Civil disturbance”, “client’s insolvency”, and “failure of subcontractors”. However, the factors ranked low in the overall and under the groupings. Thus it can be concluded that the factors need not to be considered for modelling.

Based on the analysis the null hypothesis for the duration of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-out Forecasts along project value.

### 4.8.3 Occurence of Risk Factors Affecting cash-out Forecasts and Grouping by Organisations’ Annual Turnover

Table 4.25 shows the ranking of the Likelihood of risk factor occurrence in cash-out Forecasts along responding organisations’ annual turnover.

Table 4.25: Occurence of Risk Factors in cash-out Forecasts across Annual Turnover of Organisations.

| Risk Factors | Below 100m Mean | Rank | 101-200m Mean | Rank | 201-300m Mean | Rank | 301-400m Mean | Rank | 401-500m Mean | Rank | Above 500m Mean | Rank | F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Archaeological Remains | 0.17 | 31 | 0.42 | 31 | 0.00 | 31 | 0.00 | 29 | 0.38 | 29 | 0.00 | 28 | 2.554 | .070 |
| Bad Relationship Between Main and Sub Contractor | 2.83 | 16 | 1.70 | 24 | 2.90 | 18 | 2.91 | 19 | 2.50 | 20 | 2.00 | 22 | 29.358 | .700 |
| Change in Currency Exchange Rates | 4.17 | 2 | 4.16 | 1 | 4.81 | 2 | 4.00 | 4 | 3.94 | 5 | 5.00 | 1 | 9.123 | .065 |
| Change Orders | 2.72 | 18 | 2.40 | 17 | 3.71 | 9 | 0.00 | 30 | 0.25 | 30 | 1.00 | 23 | 40.802 | .056 |
| Changes to Initial Design | 2.33 | 21 | 2.58 | 14 | 2.19 | 19 | 4.00 | 5 | 3.94 | 6 | 5.00 | 2 | 43.112 | .000 |
| Charging of "Land Dues" by Locals (illegally) | 1.06 | 26 | 2.30 | 20 | 1.81 | 26 | 4.94 | 2 | 4.38 | 2 | 5.00 | 3 | 89.176 | .080 |
| Civil Disturbance | 2.67 | 19 | 3.19 | 11 | 4.61 | 3 | 0.00 | 31 | 0.25 | 31 | 1.00 | 24 | 47.213 | .091 |
| Under-estimating Project complexity | 2.33 | 22 | 2.33 | 19 | 3.90 | 8 | 3.20 | 13 | 3.81 | 8 | 4.00 | 12 | 43.980 | .700 |
| Variations | 3.33 | 12 | 3.28 | 9 | 4.90 | 1 | 4.09 | 3 | 3.44 | 13 | 4.00 | 13 | 43.858 | .600 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

All the thirty-one variables involved in the study, were considered not statistically and significantly differnt by the respondents. “Increase in duration of the project” which ranked 1st overall, ranked very high for all the categories. This implies that the occurence of the risk factor is frequently experienced by all the category of contractors. “Change in currency exchange rates” ranked 2nd overalland also ranked relatuvely high for all the categories. It ranked lowest for the 401-500m categories, suggesting that currency excahnge rate is not easily noticed by that category of contractors. This my be connected to the fact that large contractors, when compared with smaller organisations, deal more in hard currency and thus hardly notice a slight change in rates. Generally, all the organisations opined that the factor has a high levelof occurrence. “High cost of materials” ranked 3rd overall, and also ranked relatively high for all categories of

contractors. “Variations”, which is 4th overall generally did not rank very high with the categories, except 201-300m category, where it was ranked 1st. The fifth highest overall, “shortage of key plant items” did not rank so high across the groups.

Based on the analysis the null hypothesis for the duration of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-out Forecasts along Organisations’ size by annual turnover.

### 4.8.4 Occurence of Risk Factors Affecting cash-out Forecasts and Grouping by Nature of Client

Table 4.26 shows the ranking of the Likelihood of risk factor occurrence in cash-out Forecasts along projects executed for the two major category of clients in the country- the Federal and State Governments. Local government Authorities were discarded from the study because only two of the 169 respondents indicated them as clients.

Table 4.26: Occurence of Risk Factors in cash-out Forecasts and Projects' Client.

| | Federal Government | | State Government | | F | Sig. |
|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Archaeological Remains | 0.17 | 31 | 0.13 | 31 | 13.180 | .000* |
| Bad Relationship Between Main and Sub Contractor | 2.52 | 20 | 2.37 | 22 | 3.100 | .029* |
| Compliance With New Regulations | 1.12 | 28 | 1.21 | 28 | 2.772 | .043* |
| Contractor/Owner Dispute | 3.11 | 15 | 2.94 | 17 | 3.354 | .021* |
| Geotechnical Issues | 0.80 | 30 | 0.83 | 30 | 6.282 | .000* |
| Poor communication Amongst Parties | 3.43 | 9 | 3.07 | 12 | 4.873 | .003* |
| Problem with Foundation | 1.36 | 26 | 1.28 | 27 | 6.375 | .000* |
| Shortage of Key Skilled Labour | 3.12 | 14 | 2.58 | 20 | 7.964 | .000* |
| Strikes, Internal and External Military Actions | 2.29 | 22 | 2.54 | 21 | 1.355 | .259 |
| Under Measurements | 2.52 | 19 | 2.21 | 23 | 5.803 | .001* |
| Under-estimating Project complexity | 3.19 | 12 | 3.07 | 13 | .251 | .861 |
| Variations | 3.96 | 3 | 3.76 | 5 | .990 | .399 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Ten of the thirty-one variables were considered to be statistically and significantly differnt by the respondents among project client groupings. These are: "arcaeological remains", "bad relationship between main and subcontractor", "compliance with new regulations", "contractor/owner dispute", "geotechnical issues", "Increase in duration of the project", "poor communication amongst parties", "problem with foundation", "shortage of skilled labour" and "under measurements". "Incresed duration of the project" which ranked 1st overall, ranked 1sth in all the two categories too. An indication that the factor is very important to contractors' forecasts. "Change in currency exchange rates" ranked 2nd overalland also ranked 2nd for both categories of clients. "High cost of materials" ranked 3rd overall, 3rd for state government clients and 4th for projects sponsored by federal government. This indicates that the factor is very crucial to the forecasts of contractors. "Variations" which is 4th overall had high

occurences both category of clients. This implies that irrespective of the client type, variations have a hig Likelihood of occurence.

“Archaeological remains”, “bad relationship between main and subcontractor”, “compliance with new regulations”, “geotechnical issues”, “problem with foundation”, “shortage of skilled labour” and “under measurements” were statistically and significantly different according to the study. however, the factors had low ranking at both the overall and grouping levels. Thus it can be concluded that the factors need not to be considered for modelling.

Based on the analysis the null hypothesis for the duration of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the likelihood of occurrence of risk factors in cash-out Forecasts along nature of project client.

## 4.9. Impact of Risk Factors Affecting cash-out Forecasts and Grouping by Project Types

Table 4.27 shows the ranking of the degree of impact of risk factors on cash-out Forecasts along project type grouping. The most prevalent project types executed by the respondents are commercial buildings, hospital buildings, residential buildings and public/community buildings.

Table 4.27: Impact of Risk Factors on cash-out Forecasts across Project Types

| | Commercial | | Hospital | | Residential | | Public/Community | | F | Sig. |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Change in Currency Exchange Rates | 4.10 | 2 | 4.46 | 1 | 4.71 | 1 | 4.44 | 1 | 3.369 | 0.020* |
| Change Orders | 1.29 | 5 | 2.54 | 21 | 2.86 | 16 | 2.03 | 24 | 4.108 | 0.008* |
| Civil Disturbance | 1.40 | 6 | 3.13 | 9 | 3.57 | 8 | 2.49 | 21 | 5.782 | 0.001* |
| Client's Insolvency | 1.00 | 7 | 1.04 | 27 | 1.71 | 25 | 1.35 | 26 | 5.475 | 0.001* |
| Contractor/Owner Dispute | 2.84 | 9 | 2.67 | 18 | 3.00 | 11 | 3.30 | 11 | 6.281 | 0.000* |
| Delay in Agreeing Variation/Day Works | 3.25 | 10 | 3.00 | 13 | 3.14 | 10 | 3.35 | 10 | 3.608 | 0.015* |
| Delay in Payment from Client | 3.97 | 12 | 4.08 | 3 | 4.00 | 4 | 3.76 | 6 | 2.672 | 0.049* |
| Geotechnical Issues | 0.62 | 15 | 0.88 | 29 | 0.71 | 29 | 1.06 | 28 | 2.986 | 0.033* |
| High Cost of Materials | 4.00 | 16 | 3.83 | 5 | 4.00 | 5 | 4.22 | 3 | 6.613 | 0.000* |
| Inclement Weather | 3.56 | 17 | 2.92 | 14 | 2.43 | 21 | 2.95 | 17 | 4.478 | 0.005* |
| Increased Duration of the Project | 4.67 | 13 | 4.25 | 2 | 4.29 | 2 | 4.37 | 2 | 3.016 | 0.032* |
| Poor communication Amongst Parties | 2.94 | 20 | 2.83 | 16 | 3.29 | 9 | 3.65 | 8 | 6.381 | 0.000* |
| Poor Design | 1.52 | 21 | 1.50 | 26 | 1.29 | 27 | 1.49 | 25 | 0.238 | 0.869 |
| Problem with Foundation | 1.38 | 22 | 1.92 | 25 | 1.00 | 28 | 1.24 | 27 | 5.195 | 0.002* |
| Shortage of Key Plant Items | 3.73 | 25 | 3.71 | 6 | 4.00 | 7 | 3.95 | 4 | 3.368 | 0.020* |
| Under Measurements | 2.76 | 28 | 2.42 | 23 | 2.29 | 22 | 2.16 | 23 | 10.438 | 0.000* |
| Under-estimating Project complexity | 2.98 | 30 | 3.08 | 10 | 2.57 | 17 | 2.94 | 18 | 0.744 | 0.527 |
| Variations | 3.48 | 31 | 3.21 | 8 | 2.57 | 19 | 3.37 | 9 | 2.712 | 0.047* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Sixteen of the thirty-one variables were considered to be statistically and significantly different by the respondents among project type groupings. These are: “change in currency exchange rates”, “change orders”, “civil disturbance”, “client’s insolvency”, “contractor/owner dispute”, “delay in agreeing variation/day works”, “geotechnical issues”, “high cost of materials”, “inclement weather” “increased duration of the project”, “poor communication amongst parties”, “problem with foundation”, “shortage of key plant items”, “under measurements” and “variations”. “Incresed duration of the

project" which ranked 1st overall, ranked 13th for commercial buildings, suggesting that the construction of commercial buildings is not heavilly impacted by the factor. While the same factor highly ipacts the three other types of buildings in the study. "Change in currency exchange rates" ranked 2nd overalland also ranked very high for all the categories of buildings. This shows that the risk factor is crucial in all types of building projects. "High cost of materials" ranked 3rd overall, did not have much impact on commercial buildings but highly impacted on the other building types. This suggests that commercial buildings do not suffer much impact from the factor. "Delay in payment from client" which is 4th overall had high impact on the four catgory of buildings. "Shortage of key plant items" ranked 5th overall, 25th for commercial buildings, 6th for hospital buildings, 7th for residential buildings, and 4th for public/community buildings. The factor does not seem to have much impact on the commercial building as well.

"Change orders", "civil disturbance", "client's insolvency", "geotechnical issues", "problem with foundation", and "under measurements" were statistically and significantly different according to the study. However, the factors had low ranking at both the overall and grouping levels. Thus it can be concluded that the factors need not to be considered for modelling.

Based on the analysis the null hypothesis for the duration of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the degree of impact of the risk factors in cash-out Forecasts along project type.

### 4.9.1 Impact of Risk Factors Affecting cash-out Forecasts and Grouping by Project Duration

Table 4.28 shows the ranking of the degree of impact of risk factors on cash-out Forecasts along project duration grouping. The most prevalent project durations identified by the sudy include “lesst than 12 months’, “13-24 months”, and “above 24 months”.

Table 4.28: Impact of Risk Factors on cash-out Forecasts across Project Duration

| | **Less than 12 months** | | **13-24 Months** | | **Above 24 Months** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Changes to Initial Design | 2.80 | 14 | 2.98 | 14 | 3.42 | 10 | 2.863 | .039* |
| Charging of "Land Dues" by Locals (illegally) | 2.00 | 23 | 2.86 | 17 | 3.52 | 8 | 3.101 | .029* |
| _____ | | | | | | | | |
| Shortage of Key Skilled Labour | 2.80 | 17 | 2.81 | 19 | 3.03 | 18 | 3.286 | .022* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Nine out of the thirty-one variables were considered to be statistically and significantly different by the respondents among project type groupings. These are: “charging of ‘land dues’ by locals (illegally)”, “changes to initial design”, “contractor/owner dispute”, “inclement weather”, “long period of honouring certificates by clients”, “over measurements”, “problem with foundation”, “replacement of defective works”, and “shortage of key skilled labour”. “Incresed duration of the project” which ranked 1st overall, ranked 3rd for “lesst than 12 months’, 1st for “13-24 months”, and “above 24 months” respectively. “Change in currency exchange rates” ranked 2nd overalland also ranked very high for all the durations identified. This shows that the risk factor has crucial impact on all categories of durations. “High cost of materials” ranked 3rd overall, 4th for “less than 12 months”, 3rd for “13-24 months” and 3rd for “above 24

months". Insinuating that the risk factor has very high impact on the forecasts. "Delay in payment from client" which is 4th overall had relatively high impact on the three catgories of durations. "Shortage of key plant items" ranked 5th overall, 6th for "less than 12 months", 5th for "13-24 months", and 4th for "above 24 months".

"Long period of honouring certificates by client", "over measurements", "problem with foundation", and "shortage of key skilled labour" were statistically and significantly different according to the study. However, the factors had low ranking at both the overall and grouping levels. Thus it can be concluded that the factors need not to be considered for modelling.

Based on the analysis the null hypothesis for the duration of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the impact of risk factors in cash-out Forecasts along duration of projects category.

### 4.9.2 Impact of Risk Factors Affecting cash-out Forecasts and Grouping by Project Value

Table 4.29 shows the ranking of the degree of impact of risk factors on cash-out Forecasts along project values grouping.

Table 4.29: Impact of Risk Factors on cash-out Forecasts across Project Values

| Risk Factors | Less than 50 million Naira Mean | Rank | 50-100 million Naira Mean | Rank | 101-200 million Naira Mean | Rank | Above 200 million Naira Mean | Rank | F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|---|---|---|---|
| Civil Disturbance | 2.60 | 21 | 1.91 | 23 | 2.65 | 19 | 3.56 | 7 | 3.160 | .026* |
| Client's Insolvency | 1.19 | 27 | 1.18 | 27 | 1.38 | 26 | 3.52 | 8 | 3.653 | .014* |
| Inflation | 3.25 | 11 | 3.22 | 12 | 3.03 | 11 | 2.69 | 19 | 2.753 | .045* |
| Over Measurements | 3.31 | 9 | 3.13 | 14 | 2.97 | 14 | 2.43 | 20 | 3.426 | .019* |
| Under-estimating Project complexity | 2.87 | 18 | 2.84 | 18 | 2.97 | 15 | .82 | 30 | 2.773 | .043* |
| Variations | 3.38 | 8 | 3.58 | 8 | 3.00 | 13 | .17 | 31 | 3.329 | .021* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

"Civil disturbance", "client's insolvency", "inflation", "over measurements", "under-estimating project complexity", and "variations" were considered statistically and significantly different by the respondents. "Incresed duration of the project" which ranked 1st overall, ranked 1st for "less than 50 million naira', 1st for "50-100 million naira", 2nd for "101-200 million naira and 18th for "above 200 million naira". The low ranking for the Above 200 million naira value can be as a result of the duration been so long that the effect of the factor is hardly noticed. "Change in currency exchange rates" ranked 2nd overalland also ranked very high for all the values dentified. This shows that the risk factor has crucial impact on all categories of values. "High cost of materials" ranked 3rd overall, 3rd for "less than 50 million naira", 3rd for "51-100 million naira", 3rd for "101-200 million naira" and 16th for "above 200 million naira". Insinuating that the risk factor has very high impact on the forecasts of all the four values except for "above

200 million naira". "Delay in payment from client" which is 4th overall had relatively high impact on the four catgories of values. "Shortage of key plant items" ranked 5th overall, buth rather very low for all the value categories except for "above 200 million naira".

"Civil disturbance" and "client's insolvency" were considered statistically and significantly different by the respondents. However, the factors had low ranking at both the overall and grouping levels. Thus it can be concluded that the factors need not to be considered for modelling.

Based on the analysis the null hypothesis for the value of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to the impact of risk factors in cash-out Forecasts along value of projects category.

### 4.9.3 Impact of Risk Factors Affecting cash-out Forecasts and Grouping by Annual Turnover of the Responding Organisations

Table 4.30 shows the ranking of the degree of impact of risk factors on cash-out Forecasts along the several organisational annual turnover groupings.

Table 4.30: Impact of Risk Factors on cash-out Forecasts across Organisations' Annual Turnover

| | **Below 100m** | | **101-200m** | | **201-300m** | | **301-400m** | | **401-500m** | | **Above 500m** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | | | | | F STAT | (P.Values) |
| Archaeological Remains | 0.17 | 31 | 0.14 | 31 | 0.00 | 31 | 0.00 | 29 | .63 | 29 | 0.0000 | 28 | 3.678 | .064 |
| Under Measurements | 3.61 | 9 | 2.14 | 23 | 2.00 | 23 | 2.09 | 22 | 3.13 | 18 | 3.0000 | 20 | 85.642 | .071* |
| Under-estimating Project complexity | 2.33 | 22 | 2.47 | 17 | 3.00 | 17 | 3.20 | 13 | 3.50 | 11 | 4.0000 | 12 | 18.540 | .080 |
| Variations | 3.50 | 11 | 3.28 | 9 | 2.19 | 20 | 4.09 | 3 | 3.44 | 12 | 4.0000 | 13 | 43.396 | .700 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

All the thirty-one variables involved in the study, were considered not statistically and significantly differnt by the respondents among the categories of organisations based on annual turnover. “Increase in duration of the project” which ranked 1st overall, ranked very high for all the categories. This implies that the impact of the risk factor is very critical for all the categories of contractors. “Change in currency exchange rates” ranked 2nd overalland also ranked relatively high for all the categories. It ranked lowest for the 401-500m category but even at that the rank was very high. This suggests that irrespective of the contractor’s annual turnover, the factor occurs very highly. “High cost of materials” ranked 3rd overall, 1st for the 101-200m naira contractors, 6th for the below 100m category and 301-400m grouping, 6th for 201-300m contractors, 5th for 401-500m category and 8th for the above 500m group. The picture painted by the result is that the smaller contractors feel the impact of the factor more than the larger contractors. This is not surprising as the smaller contractors are bound to feel the impact of marginal changes in prices than the larger contractors. “Variations” which is 4th overall generally did no trank very high for all the categories of contractor. The fifth highest overall, “shortage of key plant items” did not rank so high across the groups.

Based on the analysis the null hypothesis for the duration of projects grouping is hereby accepted and the alternative hypothesis rejected. This implies that there is no significant difference in the perception of the contractors on the impact of risk factors in cash-out Forecasts along organisations turnover grouping.

### 4.9.3 Impact of Risk Factors Affecting cash-out Forecasts and Grouping by Nature of Client

Table 4.31 shows the ranking of the degree of impact of risk factors on cash-out Forecasts along nature of client divisions. Three types of clients were identified by the

study- federal government, state government and local government. Only two respondents identified local government authorities as their client and so the client was discarded from further analysis.

Table 4.31: Impact of Risk Factors on cash-out Forecasts across Nature of Client

| Risk Factors | Federal Government Mean | Rank | State Government Mean | Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|
| Archaeological Remains | 0.14 | 31 | 0.10 | 31 | .132 | .941 |
| Bad Relationship Between Main and Sub Contractor | 2.45 | 21 | 2.24 | 23 | 3.340 | .021* |
| Contractor/Owner Dispute | 3.12 | 15 | 2.92 | 16 | 3.733 | .013* |
| Long Period of Honouring Certificates by Client | 2.51 | 20 | 2.82 | 18 | 5.006 | .002* |
| Poor communication Amongst Parties | 3.42 | 9 | 3.06 | 13 | 4.608 | .004* |
| Poor Design | 1.53 | 25 | 1.42 | 25 | 4.883 | .003* |
| Shortage of Key Skilled Labour | 3.14 | 14 | 2.63 | 21 | 9.432 | .000* |
| Strikes, Internal and External Military Actions | 2.36 | 22 | 2.63 | 20 | 1.706 | .168 |
| Under Measurements | 2.61 | 19 | 2.25 | 22 | 4.599 | .004* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Seven factors involved in the study were considered to be statistically and significantly different by the respondents among nature of clients. These factors include “bad relationship between main and sub contractor”, “contractor/owner dispute”, “long period of honouring certificates by client”, “poor communication amongst parties”, “poor design”, “shortage of key skilled labour” and “under measurements”. “Increase in duration of the project” which ranked 1st overall, ranked very high for the two categories of client. This implies that the impact of the risfcator ifs very critical. “Change in currency exchange rates” ranked 2nd overalland also ranked relatively high for bith categories too. This suggests that irrespective of the client, the impact of the factor is highly critical should it occur. “High cost of materials” ranked 3rd overall, 3rd for federal government and 3rd for state government. This gives a picture of consistency of the risk factor as highly impacting of cash-out forecasts. “Variations” which is 4th overall generally did no trank very high for both categories, even as the ranks of 8th and

11th for federal and state government respectively are stil high. Comparatively the ranks are low for in conjuction with the overall rank. This gives the impression that variation does not impact heavily on projects. The fifth highest overall, “shortage of key plant items” ranked 5th across the groups, implying that the risk factor has very high impact on cash-out forecasts when it occurs.

Based on the analysis the null hypothesis for the region of execution of projects grouping is hereby rejected and the alternative hypothesis accepted. This implies that there is a significant difference in the perception of the contractors to impact risk factors in cash-out Forecasts along nature of client grouping.

## 4.10 Analysis of Variations Between Actual and Forecasted CashFlows at 30%, 50% and 70 % Completion.

This section examines the contractors' perception of the variation between actual and forecasted amounts at critical stages of a project as identified in literature. These periods are 30%, 50% and 70% completion. These milestones of any project have been identified as critical moments when actual and forcasted amount tend to vary (Kaka, 199; Odeyinka, 2003; Odeyinka 2013; Al-joburi *et al.*, 2012, etc) . The same data set was used to perform the analysis. The survey of the 40 and 31 risk factors associated with cash-in and cash-out respectively as derived from literature was carried out. Repondents were asked to indicate whether the variation from the forcast was either negative or positive (see appendix A).

IBMSPSS (version 21) was used to carry out the anlysis of the data from the respondents. The responses were entered as 1= negative variation, and 2= Positive variation. The mean for each of the risk factors was determined. This was followed by the calculation of a global mean indicating the net impact of all the risk factors as

opined by the contractors. The global mean was then used to determine the net effect of the factors at 30%, 50% and 70% completion stages.Table 4.12 below shows the respondents' estimation of variations between actual and forecstasted cash-in flows at the various completion stages. The Table shows an overall negative impact of the risk factors at the 30%, 50% and 70% stages of completion respectively. This implies that the overall impact of the risk factors for cash-in forecasts are negative for all the three stages of completion. This revelation for cash-in Forecasts, aligns with Kaka (1996) and Odeyinka (2013), etc.

Table 4.32: Variation Between Forecast and Actual cash-in

| Risk Factor | @30% | | @50% | | @70% | |
|---|---|---|---|---|---|---|
| | %Positive | %Negative | %Positive | %Negative | %Positive | %Negative |
| Accuracy of Estimates | 74.00 | 26.00 | 14.00 | 86.00 | 14.00 | 86.00 |
| Back/Front end Loading | 19.00 | 81.00 | 96.00 | 4.00 | 95.00 | 5.00 |
| Bad Relationship Between Contractor and Consulting Team | 22.00 | 78.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Bad Relationship Between Contractor and Owner | 44.00 | 56.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Bad Relationship Between Main and Sub Contractor | 23.00 | 77.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment | 5.00 | 95.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Change in Government Officials | 5.00 | 95.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Change in Interest Rates | 39.00 | 61.00 | 60.00 | 40.00 | 60.00 | 40.00 |
| Change Orders | 57.00 | 53.00 | 48.00 | 52.00 | 48.00 | 52.00 |
| Changes in Activities' Start Time | 26.00 | 74.00 | 27.00 | 73.00 | 26.00 | 74.00 |
| Changes to Initial Design | 26.00 | 74.00 | 47.00 | 53.00 | 48.00 | 52.00 |
| Labour Strikes | 16.00 | 84.00 | 10.00 | 90.00 | 36.00 | 64.00 |
| Large Retention Percentage | 34.00 | 66.00 | 40.00 | 60.00 | 26.00 | 74.00 |
| Listed Buildings | 44.00 | 56.00 | 26.00 | 74.00 | 33.00 | 67.00 |
| Overheads | 22.00 | 78.00 | 16.00 | 84.00 | 23.00 | 77.00 |
| Period of Honouring Certificates | 36.00 | 64.00 | 34.00 | 66.00 | 36.00 | 64.00 |
| Problems with Foundation | 36.00 | 64.00 | 44.00 | 56.00 | 36.00 | 64.00 |
| Production Time Slippage | 18.00 | 82.00 | 18.00 | 82.00 | 18.00 | 82.00 |
| Withholding Tax | 15.00 | 85.00 | 14.00 | 86.00 | 14.00 | 86.00 |
| **Overall Mean Percentage** | 31.13 | **69.13** | 30.03 | **69.97** | 30.59 | **69.41** |

Source: field survey, 2014.

## 4.11 Variations Between Actual and Forecasted Cash-out Flow at 30%, 50% and 70 % Completion.

Table 4.33 shows the respondents' estimation of variations between actual and forecstasted cash-out flows at the various completion stages.

Table 4.33: Variation Between Forecast and Actual Cash-out

| Risk Factors | Completion Stages 30% | | 50% | | 70% | |
|---|---|---|---|---|---|---|
| | **%Positive** | **%Negative** | **%Positive** | **%Negative** | **%Positive** | **%Negative** |
| Archaeological Remains | 32.00 | 68.00 | 61.00 | 39.00 | 100.00 | 0.00 |
| Change in Currency Exchange Rates | 32.00 | 68.00 | 61.00 | 39.00 | 100.00 | 0.00 |
| Changes to Initial Design | 28.00 | 72.00 | 44.00 | 56.00 | 100.00 | 0.00 |
| Charging of "Land Dues" by Locals (illegally) | 4.00 | 96.00 | 40.00 | 60.00 | 80.00 | 20.00 |
| Compliance With New Regulations | 15.00 | 85.00 | 49.00 | 51.00 | 96.00 | 4.00 |
| Contractor/Owner Dispute | 15.00 | 85.00 | 59.00 | 41.00 | 100.00 | 0.00 |
| Shortage of Key Skilled Labour | 29.00 | 71.00 | 73.00 | 27.00 | 100.00 | 0.00 |
| Strikes, Internal and External Military Actions | 29.00 | 71.00 | 74.00 | 26.00 | 100.00 | 0.00 |
| Under Measurements | 39.00 | 61.00 | 84.00 | 16.00 | 96.00 | 4.00 |
| Long Period of Honouring Certificates by Client | 1.00 | 99.00 | 3.00 | 97.00 | 54.00 | 46.00 |
| Under-estimating Project complexity | 85.00 | 14.00 | 80.00 | 20.00 | 100.00 | 0.00 |
| Variations | 12.00 | 87.00 | 57.00 | 43.00 | 100.00 | 0.00 |
| **OVERALL PERCENTAGE** | **25.65** | **74.29** | **60.10** | **39.58** | **95.90** | **4.10** |

Source: field survey, 2014.

The Table shows that the overall percentage for the impacts are different at different completion stages. At the 30% completion stage an overallnegative impact is experienced, at 50% and 70% completion stages, positive impacts are experienced, overall. This implies that the overall impact of the risk factors for cash-out forecasts vary for different stages of completion. This finding for cash-out Forecasts, aligns with Kaka (1996), Odeyinka (2013) and Zaid and Liu (2014).

However, review of previous studies showed that modelling cost flows (i.e cash-out flows) has been found to be more accurate than developing models for net cash flow and value flows (i.e. cash-in flows) (Kenley and Wilson, 1986; Kaka and Price, 1991; Kaka and Price, 1993; Evans and Kaka, 1998; Odeyinka *et al.*, 2013). Thus the decision to focus on developing the models which relate to the cost flow (i.e. cash-out) direction of the cash flow equation.

# CHAPTER FIVE

## 5.0 PRESENTATION AND VALIDATION OF THE MODELS

### 5.1 The Philosophy of Model Development

The purpose of developing the models in this study is to provide a structure, which can replicate and predict "cash-out" forecasts for projects of similar characteristics as those used for developing the original model. Four main steps were taken in the development of the models:

Step One-: Define the purpose of the model

Step Two- Collect Information: This is the main part of the model, which required collection of data from field survey. Sixteen critical risk factors impacting on the cost flow (i.e. cash-out) forecasts, identified from an initial survey of thirty-one risk factors were used for a questionnaire survey of a convenient sample (61 respondents) from the initial number of respondents (157) identified in the initial study. The accuracy of the model depends largely on the validity of the data collected.

Step Three- Build the Model: This stage involves selecting the appropriate tool for developing the model. Previous researches have used regression analysis and machine-learning techniques to predict outcomes. However, several researchers have found fault in the use of regression analysis, primarily because of its inability to predict accurately variables with non-linear relationships. Previous researchers in cash flow forecasting have determined that the relationships between the variables in cash flow predictions are non-linear. Consequently, it became apparent that the use of machine-learning techniques rather than regression analysis would be appropriate for developing the intended models.

Step Four- Implementation: This step involved a validation of the model by likely target audience i.e. construction contractors operating in the Nigerian construction industry.

## 5.2 The Models

The test of hypotheses suggested that modelling across identified project characteristics was necessary. This implies that several models will have to be developed. Each model comprises three general units- the architecture, the data classification matrix and the network information. Data classification matrix being the actual model while the other two provide information on data inputs. To illustrate the working and validation of the models, the three units (architecture, classification, and information) at several stages of completion, for federal government projects are shown below. A score of 3 on a 0-5 Likert scale was pre-set as critical. The cut off point was applied to the risk impact mean score only because some risk variables can be low in occurrence but high in impact. Table 5.1 shows the critical risk factors across project clients.

Table 5.1: Occurrence/Impact of Risk factors to Cash-out Forecasts across Project Clients

| | **likelihood of occurrence** | | **Degree of Impact** | |
|---|---|---|---|---|
| **Risk Factors** | Mean | Rank | Mean | Rank |
| Increased Duration of the Project | 4.51 | 1 | 4.46 | 1 |
| Change in Currency Exchange Rates | 4.31 | 2 | 4.32 | 2 |
| High Cost of Materials | 3.98 | 3 | 4.06 | 3 |
| Delay in Payment from Client | 3.87 | 4 | 3.90 | 4 |
| Shortage of Key Plant Items | 3.77 | 5 | 3.83 | 5 |
| Delay in Settling Claims | 3.73 | 6 | 3.77 | 6 |
| Replacement of Defective Works | 3.68 | 7 | 3.69 | 7 |
| Variations | 3.60 | 8 | 3.35 | 8 |
| Delay in Agreeing Variation/Day Works | 3.24 | 9 | 3.25 | 9 |
| Poor communication Amongst Parties | 3.21 | 10 | 3.22 | 10 |
| Inflation | 3.17 | 11 | 3.17 | 11 |
| Inclement Weather | 3.15 | 12 | 3.17 | 11 |
| Changes to Initial Design | 3.13 | 13 | 3.14 | 13 |
| Over Measurements | 3.10 | 14 | 3.11 | 14 |
| Charging of "Land Dues" by Locals (illegally) | 3.10 | 14 | 3.10 | 15 |
| Contractor/Owner Dispute | 3.05 | 16 | 3.01 | 16 |
| ********** | | | | |
| Archaeological Remains | 0.17 | 31 | 0.12 | 31 |

Source: field survey, 2014.

The sixteen risk factors were used to design a questionnaire to determine the likelihood of their occurrence. Sixty-one contractors that were conveniently sampled were asked to rank on a scale of 0 to 5 (Where 0= not applicable, 1= very low, 2= low, 3= medium, 4= high and 5= very high), the likelihood of occurence of the identified risk factors. A second table requested the contractors to indicate, in their experience, the difference in percentages between actual cash-out and forecasted cash-out (i.e. actual minus forecasted) as a result of the occurrence of the risk factors. The retrieved questionnaires were used to develop the models. The numerical data were compiled and entered into the Statistical Package for Socials (IBMSPSS version 21) software. The scores for the sixteen significant factors obtained from 50 respondents were entered as independent variables (or "predictors") while the percentage variations between actual and forecasted "cash-out" at 30%, 50% and 70% completion stages were entered as dependent variables in the "neural network" section of the soft ware. Seventy-nine percent of the questionnaires (38 number) were used for training the model, twenty percent (10 number) for testing and the remaining one percent were excluded for having outlier inputs. The IBM SPSS neural network software does the training and testing automatically.

### 5.2.2: Model at 30% Completion

Fig. 5.2 (appendix F) represents the neural network architecture for the model at 30% completion stage. Tables 5.2 and 5.3 provide the network's data classification and network information respectively.

Table 5.2: Data Classification for the neural network (at 30% completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 20.00 | 25.00 | 30.00 | Percent Correct |
| **Training** | 20.00 | 15 | 1 | 1 | 88.2% |
| | 25.00 | 1 | 7 | 1 | 77.8% |
| | 30.00 | 0 | 0 | 8 | 100.0% |
| | **Overall Percent** | **46.9%** | **53.1%** | **0%** | **88.2%** |
| **Testing** | 20.00 | 3 | 2 | 0 | 60.0% |
| | 25.00 | 0 | 7 | 0 | 100.0% |
| | 30.00 | 2 | 0 | 0 | 0.0% |
| | **Overall Percent** | **64.7%** | **35.3%** | **0.0%** | **52.9%** |

Table 5.3: Network information for the neural network (at 30% completion)

| Description | | Serial No. | Factors |
|---|---|---|---|
| Input Layer | | 1 | Change in Currency Exchange Rates |
| | | 2 | Changes to Initial Design |
| | | 3 | Charging of "Land Dues" by Locals (illegally) |
| | | 4 | Contractor/Owner Dispute |
| | | 5 | Delay in Agreeing Variation/Day Works |
| | | 6 | Delay in Settling Claims |
| | | 7 | Increased Duration ofthe Project |
| | | 8 | High Cost of Materials |
| | | 9 | Contractor/Owner Dispute |
| | | 10 | Inclement Weather |
| | | 11 | Inflation |
| | | 12 | Over Measurements |
| | | 13 | Poor communication Amongst Parties |
| | | 14 | Replacement of Defective Works |
| | | 15 | Shortage of Key Plant Items |
| | | 16 | Variations |
| | Number of Units[a] | | 49 |
| Hidden Layer(s) | Number of Hidden Layers | | 1 |
| | Number of Units in Hidden Layer 1[a] | | 10 |
| | Activation Function | | Hyperbolic tangent |
| Output Layer | Dependent Variables | 1 | Variation at 30% Completion |
| | Number of Units | | 3 |
| | Activation Function | | Softmax |
| | Error Function | | Cross-entropy |

a. Excluding the bias unit

Source: field survey, 2014

The figure is termed “feedforward” architecture because the connections in the network flow forward from the input layer to the output layer without any feedback loops. In this figure:

i. The input layer contains the sixteen significant factors, which are recognised by the neural network as the “predictors”. Each predictor is represented by a different colour and the scores entered by the respondents are indicated in

boxes. For example, the scores entered for risk factor number 1 (i.e. “change in currency exchange rates”) range from 4 to 5 only. This means that the respondents scored the factor “high” or “very high” for the chances of it occurring in projects. While serial number 2 (i.e. “changes to initial design”) had scores ranging from 3 to 5. The serial numbering and other information regarding the risk factors and others are presented in table 5.3 above.

ii. The hidden layer contains 10 unobservable nodes. The value of each hidden unit is some function of the predictors generated by the network. The hidden nodes determine the relationship between the inputs and the outputs in what is termed a “black box” manner. This means that Apart from defining the general architecture of a network and perhaps initially seeding it with a random numbers, the user has no other role than to feed it input and watch it train and await the output. The learning itself progresses on its own. The final product of this activity is a trained network that provides no equations or coefficients defining a relationship (as in regression) beyond its own internal mathematics. The network 'is' the final equation of the relationship.

iii. The output layer contains the 3 responses on the differences between the actual and predicted forecasts as depicted by the respondents, in percentages. Each output unit is some function of the hidden units. In this case, three output units are depicted. The network uses 70% of the data for training and 30% for testing, as shown on table 5.2. The classification table shows the practical results of using the network. For each sample, Cells on the diagonal of the cross-classification of cases are correct predictions while cells off the diagonal of the cross-classification of cases are incorrect predictions. Thus, of the 34 cases held for training the network, 15 out of 17 cases for 20% were correctly classified, 7

out of the 9 cases for 25% were correctly classified and all the eight cases for 30% were correctly classified. Overall, 88.2% of the cases are trained correctly.

iv. The testing sample shows an overall 52.9% correct classification of the cases. This implies that for five out of ten times the variation to the contractor's forecasts will be 20% (20% being the best forecast).

### 5.2.3: Model at 50% Completion

Fig. 5.3 (appendix F) represents the neural network architecture for the model at 50% completion stage. Tables 5.4 and 5.5 provide the network's data classification and network information respectively.

Table 5.4: Data Classification for the neural network (at 50% completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 1 | 2 | 0 | 0 | 33.3% |
| | 25.00 | 0 | 13 | 1 | 0 | 92.9% |
| | 30.00 | 1 | 8 | 2 | 0 | 18.2% |
| | 40.00 | 0 | 5 | 2 | 0 | 0.0% |
| | Overall Percent | **5.7%** | **80.0%** | **14.3%** | **0.0%** | **45.7%** |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 8 | 0 | 0 | 100.0% |
| | 30.00 | 0 | 1 | 1 | 0 | 50.0% |
| | 40.00 | 0 | 2 | 0 | 0 | 0.0% |
| | Overall Percent | **0.0%** | **92.3%** | **7.7%** | **0.0%** | **69.2%** |

Table 5.5: Network information for the neural network (at 50% completion)

| Description | | Serial No. | Factors |
|---|---|---|---|
| Input Layer | | 1 | Change in Currency Exchange Rates |
| | | 2 | Changes to Initial Design |
| | | 3 | Charging of "Land Dues" by Locals (illegally) |
| | | 4 | Contractor/Owner Dispute |
| | | 5 | Delay in Agreeing Variation/Day Works |
| | | 6 | Delay in Settling Claims |
| | | 7 | Increased Duration of the Project |
| | | 8 | High Cost of Materials |
| | | 9 | Contractor/Owner Dispute |
| | | 10 | Inclement Weather |
| | | 11 | Inflation |
| | | 12 | Over Measurements |
| | | 13 | Poor communication Amongst Parties |
| | | 14 | Replacement of Defective Works |
| | | 15 | Shortage of Key Plant Items |
| | | 16 | Variations |
| Hidden Layer(s) | Number of Units[a] | | 48 |
| | Number of Hidden Layers | | 1 |
| | Number of Units in Hidden Layer 1[a] | | 7 |
| | Activation Function | | Hyperbolic tangent |
| Output Layer | Dependent Variables | 1 | Variation at 50% Completion |
| | Number of Units | | 4 |
| | Activation Function | | Softmax |
| | Error Function | | Cross-entropy |

a. Excluding the bias unit

Source: field survey, 2014

Fig. 5.3 (appendix F) depicts the model for the cash-out forecasts at 50% completion of projects. In this figure:

i. The input layer contains the sixteen significant factors, which are recognised by the neural network as the “predictors”. Each predictor is represented by a different colour and the scores entered by the respondents are indicated in boxes.

ii. The hidden layer contains 7 unobservable nodes. The value of each hidden unit is some function of the predictors generated by the network. The hidden nodes determine the relationship between the inputs and the outputs in what is termed a “black box” manner.

iii. The output layer contains four predicted cases; 10%, 25%, 30% and 40%. Thus, of the 34 cases held for training the network, 1 out of 3 cases for 10% was correctly classified, 13 out of the 14 cases for 25% were correctly classified, 2 out of the 11 cases of 30% were correctly classified, and none of the seven cases for 40% were correctly classified. Overall, 45.7% of the cases are trained correctly.

iv. The testing sample shows an overall 69.2% correct classification of the cases. This implies that for seven out of ten times the variation to the contractor’s forecasts will be 25%.

### 5.2.4: Model at 70% Completion

Fig. 5.4 (appendix F) represents the neural network architecture for the model at 70% completion stage. Tables 5.6 and 5.7 provide the network’s data classification and network information respectively.

Table 5.6: Data Classification the neural network (at 70% completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 15.00 | 25.00 | 30.00 | Percent Correct |
| **Training** | 15.00 | 4 | 0 | 0 | 100.0% |
| | 25.00 | 0 | 24 | 0 | 100.0% |
| | 30.00 | 0 | 0 | 9 | 100.0% |
| | Overall Percent | **10.8%** | **64.9%** | **24.3%** | **100.0%** |
| **Testing** | 15.00 | 1 | 0 | 0 | 100.0% |
| | 25.00 | 0 | 9 | 1 | 90.0% |
| | 30.00 | 0 | 0 | 1 | 100.0% |
| | **Overall Percent** | **8.3%** | **75.0%** | **16.7%** | **91.7%** |

Table 5.7: Network information for the neural network (at 70% completion)

| Description | | Serial No. | Factors |
|---|---|---|---|
| Input Layer | | 1 | Change in Currency Exchange Rates |
| | | 2 | Changes to Initial Design |
| | | 3 | Charging of "Land Dues" by Locals (illegally) |
| | | 4 | Contractor/Owner Dispute |
| | | 5 | Delay in Agreeing Variation/Day Works |
| | | 6 | Delay in Settling Claims |
| | | 7 | Increased Duration of the Project |
| | | 8 | High Cost of Materials |
| | | 9 | Contractor/Owner Dispute |
| | | 10 | Inclement Weather |
| | | 11 | Inflation |
| | | 12 | Over Measurements |
| | | 13 | Poor communication Amongst Parties |
| | | 14 | Replacement of Defective Works |
| | | 15 | Shortage of Key Plant Items |
| | | 16 | Variations |
| Hidden Layer(s) | Number of Units[a] | | 49 |
| | Number of Hidden Layers | | 1 |
| | Number of Units in Hidden Layer 1[a] | | 10 |
| | Activation Function | | Hyperbolic tangent |
| Output Layer | Dependent Variables | 1 | Variation at 50% Completion |
| | Number of Units | | 3 |
| | Activation Function | | Softmax |
| | Error Function | | Cross-entropy |

a. Excluding the bias unit

i. The input layer contains the sixteen significant factors, which are recognised by the neural network as the “predictors”. Each predictor is represented by a different colour and the scores entered by the respondents are indicated in boxes.

ii. The hidden layer contains 7 unobservable nodes. The value of each hidden unit is some function of the predictors generated by the network. The hidden nodes determine the relationship between the inputs and the outputs in what is termed a “black box” manner.

iii. The output layer contains three predicted cases; 15%, 25%, and 30%. Thus, of the 37 cases held for training the network, all 4 cases for 15% was correctly classified, all 24 cases for 25% were correctly classified, and all 9 cases of 30% were correctly classified. Overall, 100% of the cases are trained correctly.

iv. The testing sample shows an overall 91.7% correct classification of the cases. This implies that for nine out of ten times the variation to the contractor’s forecasts will be 25%.

### 5.3: Validation of the Models

The remaining 11 data set were used to test the forecasting ability of the models. Input data regarding the probability of occurrence of the sixteen significant risk factors were entered and the network requested to forecast the percentage variation at 30%, 50%, and 70% completion stages. The validation tests conducted on the model are a comparison between the predicted and the actual (the actual being the percentage variations provided by the respondents in the 11 data sets). The relative mean deviation (RMD) was used as a statistical tool to verify the predictability of the models. The highest percentage variations predicted by the model were compared with the percentage variations entered by the respondents. This is because the respondents were

asked to enter the highest percentage variations on the table provided in the questionnaire.

Table 5.8: Performance of the Neural Network Models (at 30%, 50%, and 70% completion stages)

| | **at 30% completion** | | | **at 50% completion** | | | **at 70% completion** | | |
|---|---|---|---|---|---|---|---|---|---|
| Data set No. | Actual variation | Predicted variation | Relative absolute Percentage deviation | Actual variation | Predicted variation | Relative absolute Percentage deviation | Actual variation | Predicted variation | Relative absolute Percentage deviation |
| 1 | 30.00 | 25.00 | 17% | 35.00 | 25.00 | 29% | 35.00 | 25.00 | 29% |
| 2 | 30.00 | 25.00 | 17% | 35.00 | 25.00 | 29% | 35.00 | 25.00 | 29% |
| 3 | 30.00 | 20.00 | 33% | 15.00 | 25.00 | 67% | 35.00 | 25.00 | 29% |
| 4 | 35.00 | 20.00 | 43% | 35.00 | 25.00 | 29% | 40.00 | 25.00 | 38% |
| 5 | 30.00 | 20.00 | 33% | 35.00 | 25.00 | 29% | 35.00 | 25.00 | 29% |
| 6 | 30.00 | 25.00 | 17% | 40.00 | 25.00 | 38% | 45.00 | 25.00 | 44% |
| 7 | 25.00 | 25.00 | 0% | 30.00 | 25.00 | 17% | 40.00 | 25.00 | 38% |
| 8 | 25.00 | 20.00 | 20% | 35.00 | 25.00 | 29% | 45.00 | 25.00 | 44% |
| 9 | 30.00 | 20.00 | 33% | 35.00 | 25.00 | 29% | 35.00 | 25.00 | 29% |
| 10 | 35.00 | 20.00 | 43% | 35.00 | 25.00 | 29% | 35.00 | 25.00 | 29% |
| 11 | 25.00 | 25.00 | 0% | 20.00 | 25.00 | 25% | 20.00 | 25.00 | 25% |
| | **Mean Percentage Error=** | | **23%** | | **Mean Percentage Error=** | **31%** | | **Mean Percentage Error=** | **33%** |
| | **Mean Percentage Accuracy** | | **77%** | | **Mean Percentage Accuracy** | **69%** | | **Mean Percentage Accuracy** | **67%** |

The Relative percentage deviation measures for each of the 11 data sets used in testing the accuracy of the models are shown in Table 5.5. It is obvious from the table that the mean percentage error range between 23% and 33%. It is clear that the accuracy levels achieved at the 30% completion stage is highest. This may be connected to the fact that the respondents' experience is more difficult at the initial stage of construction projects and thus more likely to be remembered. Entries at the entry at the 50% completion are

less accurate owing, probably, to the fact that the tendency to forget the actual percentage variation is higher at those stages of projects. The finding disagrees with Odeyinka *et al.* (2013) model, which was found to be more accurate at the 50% completion.

$$Rel\ \%\ Deviation = (1/n)\sum_{i=1}^{n}(\mathrm{ti} - \mathrm{to})/\mathrm{ti}$$

Where $t_i$, and $t_o$, are actual and predicted variation respectively for the $i^{th}$ project, at a particular period, and n is the number of projects.

### 5.4 Models Along Project Characteristics

The test of hypotheses showed significant differences in the opinion of the respondents concerning the occurrence and impact of risk factors across four project characteristics identified from literature. These characteristics are client, values (monetary), project types, and duration. The data classification, which represents the actual model, for each of the characteristics, are presented in this section. A score of 3 on the 0-5 Likert scale was pre-set as critical as was done for determining the universal model. Below is a list of risk factors that were found to be critical for each category of characteristics'

i. **Client types**; increased duration of the project, change in currency exchange rates, high cost of materials, delay in payment from client, shortage of key plant items, delay in settling claims, replacement of defective works, variations, delay in agreeing variation/day works, poor communication amongst parties, inflation, inclement weather, change in initial design, over measurements, Charging of "Land Dues" by Locals (illegally), and contractor/owner dispute.

ii. **Monetary values of projects**; archaeological remains, bad relationship between main and subcontractor, change in currency exchange rates, change orders, changes to initial design, charging of "land dues" by locals (illegally), civil disturbance, delay in agreeing variation/day works, delay in payment from client, high cost of materials, inclement weather, increased duration of the project, inflation, poor communication amongst parties, replacement of defective works, shortage of key plant items, and variations.

iii. **Project types;** change in currency exchange rates, change orders, changes to initial design, charging of "land dues" by locals (illegally), contractor/owner disputes, delay in agreeing variation/day works, delay in payment from client, high cost of materials, increased duration of the project, inflation, poor communication amongst parties, replacement of defective works, shortage of key plant items, and variations.

iv. **Project Duration;** change in currency exchange rates, changes to initial design, charging of "land dues" by locals (illegally), contractor/owner disputes, delay in agreeing variation/day works, delay in payment from client, high cost of materials, increased duration of the project, inflation, poor communication amongst parties, replacement of defective works, shortage of key plant items, and variations.

### 5.4.1 Models across Client Type

The federal and state governments were found to be the major clients in Nigeria. As such modelling should be along both categories at 30%, 50% and 70% completion stages. Tables 5.9, 5.10, 5.11, 5.12. 5.13 and 5.14 represent the predictive models at various stages of completion

Table 5.9 Data Classification for Federal Government Projects (at 30% Completion)

| Sample | | Predicted 20.00 | 25.00 | 30.00 | Percent Correct |
|---|---|---|---|---|---|
| **Training** | 20.00 | 15 | 1 | 1 | 88.2% |
| | 25.00 | 1 | 7 | 1 | 77.8% |
| | 30.00 | 0 | 0 | 8 | 100.0% |
| | **Overall Percent** | **46.9%** | **53.1%** | **0%** | **88.2%** |
| **Testing** | 20.00 | 3 | 2 | 0 | 60.0% |
| | 25.00 | 0 | 7 | 0 | 100.0% |
| | 30.00 | 2 | 0 | 0 | 0.0% |
| | **Overall Percent** | **64.7%** | **35.3%** | **0.0%** | **52.9%** |

Table 5.10 Data Classification for State Government Projects (at 30% Completion)

| Sample | Observed | Predicted 20.00 | 25.00 | 30.00 | Percent Correct |
|---|---|---|---|---|---|
| Training | 20.00 | 13 | 2 | 2 | 76.5% |
| | 25.00 | 2 | 10 | 0 | 83.3% |
| | 30.00 | 0 | 1 | 6 | 85.7% |
| | Overall Percent | 41.7% | 36.1% | 22.2% | 80.6% |
| Testing | 20.00 | 3 | 1 | 0 | 75.0% |
| | 25.00 | 1 | 5 | 0 | 83.3% |
| | 30.00 | 1 | 0 | 1 | 50.0% |
| | **Overall Percent** | 41.7% | **50.0%** | 8.3% | **75.0%** |

The testing sample for both state and federal government shows an overall 75% correct cassification of the cases. This implies that for eight out of ten times the variation to the contractor's forecasts will be 25% at 30% completion stage.

Table 5.11 Data Classification for Federal Government Projects (at 50% Completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 1 | 2 | 0 | 0 | 33.3% |
| | 25.00 | 0 | 13 | 1 | 0 | 92.9% |
| | 30.00 | 1 | 8 | 2 | 0 | 18.2% |
| | 40.00 | 0 | 5 | 2 | 0 | 0.0% |
| | Overall Percent | **5.7%** | **80.0%** | **14.3%** | **0.0%** | **45.7%** |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 8 | 0 | 0 | 100.0% |
| | 30.00 | 0 | 1 | 1 | 0 | 50.0% |
| | 40.00 | 0 | 2 | 0 | 0 | 0.0% |
| | Overall Percent | **0.0%** | **92.3%** | **7.7%** | **0.0%** | **69.2%** |

Table 5.12 Data Classification for State Government Projects (at 50% Completion)

| Sample | Observed | Predicted | | | | |
|---|---|---|---|---|---|---|
| | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 0 | 3 | 0 | 1 | 0.0% |
| | 25.00 | 0 | 15 | 2 | 0 | 88.2% |
| | 30.00 | 0 | 5 | 4 | 1 | 40.0% |
| | 40.00 | 0 | 5 | 0 | 2 | 28.6% |
| | Overall Percent | 0.0% | 73.7% | 15.8% | 10.5% | 55.3% |
| Testing | 10.00 | 0 | 0 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 5 | 1 | 0 | 83.3% |
| | 30.00 | 0 | 3 | 0 | 0 | 0.0% |
| | 40.00 | 0 | 2 | 0 | 0 | 0.0% |
| | Overall Percent | 0.0% | 90.9% | 9.1% | 0.0% | 45.5% |

The testing sample for both state and federal government shows an overall correct classification of the cases to be 25% at 50% completion stage. This implies that for majority of times the variation to the contractor's forecasts will be 25%.

Table 5.13 Data Classification for Federal Government Projects (at 70% Completion)

| Sample | Observed | Predicted | | | |
|---|---|---|---|---|---|
| | | 15.00 | 25.00 | 30.00 | Percent Correct |
| Training | 15.00 | 0 | 5 | 0 | 0.0% |
| | 25.00 | 0 | 24 | 0 | 100.0% |
| | 30.00 | 0 | 5 | 0 | 0.0% |
| | Overall Percent | 0.0% | 100.0% | 0.0% | 70.6% |
| Testing | 15.00 | 0 | 1 | 0 | 0.0% |
| | 25.00 | 0 | 9 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 1 | 25.0% |
| | Overall Percent | 0.0% | 92.9% | 7.1% | 71.4% |

Table 5.14 Data Classification for State Government Projects (at 70% Completion)

| Sample | Observed | Predicted | | | |
|---|---|---|---|---|---|
| | | 15.00 | 25.00 | 30.00 | Percent Correct |
| Training | 15.00 | 0 | 5 | 0 | 0.0% |
| | 25.00 | 0 | 24 | 0 | 100.0% |
| | 30.00 | 0 | 5 | 0 | 0.0% |
| | Overall Percent | 0.0% | 100.0% | 0.0% | 70.6% |
| Testing | 15.00 | 0 | 1 | 0 | 0.0% |
| | 25.00 | 0 | 9 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 1 | 25.0% |
| | Overall Percent | 0.0% | 92.9% | 7.1% | 71.4% |

The testing sample for both state and federal government shows an overall 71% correct classification of the cases. This implies that for seven out of ten times the variation to the contractor's forecasts will be 25% at 70% completion stage.

### 5.4.2 Models across Projects' Value

The classification identified by this study include "less than 50 million naira", "51-100 million naira", "101-200m naira", and "above 200m naira". The classification matrix for each category at the different stages of completion is presented below

Table 5.15 Data Classification for projects less" than 50m naira" (at 30% Completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 20.00 | 25.00 | 30.00 | Percent Correct |
| Training | 20.00 | 8 | 4 | 0 | 66.7% |
| | 25.00 | 9 | 5 | 0 | 35.7% |
| | 30.00 | 4 | 2 | 0 | 0.0% |
| | Overall Percent | 65.6% | 34.4% | 0.0% | 40.6% |
| Testing | 20.00 | 7 | 2 | 0 | 77.8% |
| | 25.00 | 5 | 0 | 0 | 0.0% |
| | 30.00 | 1 | 1 | 1 | 33.3% |
| | Overall Percent | 76.5% | 17.6% | 5.9% | 47.1% |

Table 5.16 Data Classification for projects with value "51-100m naira" (at 30% Completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 20.00 | 25.00 | 30.00 | Percent Correct |
| Training | 20.00 | 8 | 4 | 0 | 66.7% |
| | 25.00 | 9 | 5 | 0 | 35.7% |
| | 30.00 | 4 | 2 | 0 | 0.0% |
| | Overall Percent | 65.6% | 34.4% | 0.0% | 40.6% |
| Testing | 20.00 | 7 | 2 | 0 | 77.8% |
| | 25.00 | 5 | 0 | 0 | 0.0% |
| | 30.00 | 1 | 1 | 1 | 33.3% |
| | Overall Percent | 76.5% | 17.6% | 5.9% | 77.1% |

Table 5.17 Data Classification for projects of Value "101-200m naira" (at 30% Completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 0 | 1 | 1 | 1 | 0.0% |
| | 25.00 | 0 | 14 | 2 | 1 | 82.4% |
| | 30.00 | 0 | 2 | 9 | 0 | 81.8% |
| | 40.00 | 0 | 1 | 1 | 5 | 71.4% |
| | Overall Percent | 0.0% | 47.4% | 34.2% | 18.4% | 73.7% |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 3 | 2 | 1 | 50.0% |
| | 30.00 | 0 | 3 | 0 | 0 | 0.0% |
| | 40.00 | 0 | 1 | 0 | 1 | 50.0% |
| | Overall Percent | 0.0% | 66.7% | 16.7% | 16.7% | 73.3% |

Table 5.18 Data Classification for projects of Value "Above 200m naira" (at 30% Completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 0 | 1 | 1 | 1 | 0.0% |
| | 25.00 | 0 | 14 | 2 | 1 | 82.4% |
| | 30.00 | 0 | 2 | 9 | 0 | 81.8% |
| | 40.00 | 0 | 1 | 1 | 5 | 71.4% |
| | Overall Percent | 0.0% | 47.4% | 34.2% | 18.4% | 73.7% |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 3 | 2 | 1 | 50.0% |
| | 30.00 | 0 | 3 | 0 | 0 | 0.0% |
| | 40.00 | 0 | 1 | 0 | 1 | 50.0% |
| | Overall Percent | 0.0% | 66.7% | 16.7% | 16.7% | 71.0% |

The testing sample from the tables show that at 30% completion stage the forecasts for the “less than 50m naira” and “51-100m naira” categories vary by 20%.meaning the actual expenditure is 20% more than the forecasted. The more accurate prediction being at the “51-100m naira” category. The results of the “101-200m naira” and the “above 200m naira” categories depict a 25 % variation at 71% accuracy.

Table 5.19 Data Classification for projects of Value "Less than 50m naira" (at 50% Completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 0 | 1 | 1 | 1 | 0.0% |
| | 25.00 | 0 | 14 | 2 | 1 | 82.4% |
| | 30.00 | 0 | 2 | 9 | 0 | 81.8% |
| | 40.00 | 0 | 1 | 1 | 5 | 71.4% |
| | Overall Percent | 0.0% | 47.4% | 34.2% | 18.4% | 73.7% |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 3 | 2 | 1 | 50.0% |
| | 30.00 | 0 | 3 | 0 | 0 | 0.0% |
| | 40.00 | 0 | 1 | 0 | 1 | 50.0% |
| | Overall Percent | 0.0% | 66.7% | 16.7% | 16.7% | 33.3% |

Table 5.20 Data Classification for projects of Value "51-100m naira" (at 50% Completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 0 | 1 | 1 | 1 | 0.0% |
| | 25.00 | 0 | 14 | 2 | 1 | 82.4% |
| | 30.00 | 0 | 2 | 9 | 0 | 81.8% |
| | 40.00 | 0 | 1 | 1 | 5 | 71.4% |
| | Overall Percent | 0.0% | 47.4% | 34.2% | 18.4% | 73.7% |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 3 | 2 | 1 | 50.0% |
| | 30.00 | 0 | 3 | 0 | 0 | 0.0% |
| | 40.00 | 0 | 1 | 0 | 1 | 50.0% |
| | Overall Percent | 0.0% | 66.7% | 16.7% | 16.7% | 33.3% |

Table 5.21 Data Classification for projects of Value "101-200m naira" (at 50% Completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 0 | 1 | 1 | 1 | 0.0% |
| | 25.00 | 0 | 14 | 2 | 1 | 82.4% |
| | 30.00 | 0 | 2 | 9 | 0 | 81.8% |
| | 40.00 | 0 | 1 | 1 | 5 | 71.4% |
| | Overall Percent | 0.0% | 47.4% | 34.2% | 18.4% | 73.7% |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 3 | 2 | 1 | 50.0% |
| | 30.00 | 0 | 3 | 0 | 0 | 0.0% |
| | 40.00 | 0 | 1 | 0 | 1 | 50.0% |
| | Overall Percent | 0.0% | 66.7% | 16.7% | 16.7% | 33.3% |

Table 5.22 Data Classification for projects of Value "Above 200m naira" (at 50% Completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 0 | 1 | 1 | 1 | 0.0% |
| | 25.00 | 0 | 14 | 2 | 1 | 82.4% |
| | 30.00 | 0 | 2 | 9 | 0 | 81.8% |
| | 40.00 | 0 | 1 | 1 | 5 | 71.4% |
| | Overall Percent | 0.0% | 47.4% | 34.2% | 18.4% | 73.7% |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 3 | 2 | 1 | 50.0% |
| | 30.00 | 0 | 3 | 0 | 0 | 0.0% |
| | 40.00 | 0 | 1 | 0 | 1 | 50.0% |
| | Overall Percent | 0.0% | 66.7% | 16.7% | 16.7% | 33.3% |

The testing sample from the tables show that at 50% completion stage the forecasts for all the categories by value vary by 25%. Meaning that actual expenditure is 25% more than the forecasted. The level of accuracy is weak for all the categories

Table 5.23 Data Classification for projects of Value "Less than 50 naira" (at 70% Completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 15.00 | 25.00 | 30.00 | Percent Correct |
| Training | 15.00 | 3 | 2 | 0 | 60.0% |
| | 25.00 | 0 | 28 | 0 | 100.0% |
| | 30.00 | 0 | 4 | 1 | 20.0% |
| | Overall Percent | 7.9% | 89.5% | 2.6% | 84.2% |
| Testing | 15.00 | 0 | 1 | 0 | 0.0% |
| | 25.00 | 1 | 5 | 0 | 83.3% |
| | 30.00 | 1 | 4 | 0 | 0.0% |
| | Overall Percent | 16.7% | 83.3% | 0.0% | 41.7% |

Table 5.24 Data Classification for projects of Value "51-100m naira" (at 70% Completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 15.00 | 25.00 | 30.00 | Percent Correct |
| Training | 15.00 | 3 | 2 | 0 | 60.0% |
| | 25.00 | 0 | 28 | 0 | 100.0% |
| | 30.00 | 0 | 4 | 1 | 20.0% |
| | Overall Percent | 7.9% | 89.5% | 2.6% | 84.2% |
| Testing | 15.00 | 0 | 1 | 0 | 0.0% |
| | 25.00 | 1 | 5 | 0 | 83.3% |
| | 30.00 | 1 | 4 | 0 | 0.0% |

| | | | | | |
|---|---|---|---|---|---|
| | Overall Percent | 16.7% | 83.3% | 0.0% | 71.7% |

Table 5.25 Data Classification for projects of Value "101-200m naira" (at 70% Completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 15.00 | 25.00 | 30.00 | Percent Correct |
| Training | 15.00 | 3 | 2 | 0 | 60.0% |
| | 25.00 | 0 | 28 | 0 | 100.0% |
| | 30.00 | 0 | 4 | 1 | 20.0% |
| | Overall Percent | 7.9% | 89.5% | 2.6% | 84.2% |
| Testing | 15.00 | 0 | 1 | 0 | 0.0% |
| | 25.00 | 1 | 5 | 0 | 83.3% |
| | 30.00 | 1 | 4 | 0 | 0.0% |
| | Overall Percent | 16.7% | 83.3% | 0.0% | 41.7% |

Table 5.26 Data Classification for projects of Value "Above 200m naira" (at 70% Completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 15.00 | 25.00 | 30.00 | Percent Correct |
| Training | 15.00 | 3 | 2 | 0 | 60.0% |
| | 25.00 | 0 | 28 | 0 | 100.0% |
| | 30.00 | 0 | 4 | 1 | 20.0% |
| | Overall Percent | 7.9% | 89.5% | 2.6% | 84.2% |
| Testing | 15.00 | 0 | 1 | 0 | 0.0% |
| | 25.00 | 1 | 5 | 0 | 83.3% |

| | | | | | |
|---|---|---|---|---|---|
| | 30.00 | 1 | 4 | 0 | 0.0% |
| | Overall Percent | 16.7% | 83.3% | 0.0% | 83.7% |

The testing sample from the tables show that at 70% completion stage the forecasts for all the categories by value vary by 25%. Meaning that actual expenditure is 25% more than the forecasted. The level of accuracy is highest for the "above 200m naira" category.

### 5.4.3 Models across Project Types

The types of projects identified in this study include "commercial buildings", "hospital buildings", "residential buildings", and "public/community buildings". The classification matrix for each category at the different stages of completion is presented below:

Table 5.27 Data Classification for commercial buildings (at 30% Completion)

| Sample | | Predicted | | | |
|---|---|---|---|---|---|
| | | 20.00 | 25.00 | 30.00 | Percent Correct |
| Training | 20.00 | 6 | 8 | 1 | 40.0% |
| | 25.00 | 1 | 11 | 1 | 84.6% |
| | 30.00 | 0 | 3 | 4 | 57.1% |
| | Overall Percent | 20.0% | 62.9% | 17.1% | 60.0% |
| Testing | 20.00 | 1 | 0 | 4 | 20.0% |
| | 25.00 | 1 | 4 | 1 | 66.7% |
| | 30.00 | 1 | 0 | 2 | 66.7% |
| | Overall Percent | 21.4% | 28.6% | 50.0% | 50.0% |

Table 5.28 Data Classification for hospital buildings (at 30% Completion)

| Sample | | Predicted | | | |
|---|---|---|---|---|---|
| | | 20.00 | 25.00 | 30.00 | Percent Correct |
| Training | 20.00 | 6 | 8 | 1 | 40.0% |
| | 25.00 | 1 | 11 | 1 | 84.6% |
| | 30.00 | 0 | 3 | 4 | 57.1% |
| | Overall Percent | 20.0% | 62.9% | 17.1% | 60.0% |

| | | | | | |
|---|---|---|---|---|---|
| Testing | 20.00 | 1 | 0 | 4 | 20.0% |
| | 25.00 | 1 | 4 | 1 | 66.7% |
| | 30.00 | 1 | 0 | 2 | 66.7% |
| | Overall Percent | 21.4% | 28.6% | 50.0% | 50.0% |

Table 5.29 Data Classification for residential buildings (at 30% Completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | Percent Correct |
| Training | 10.00 | 0 | 3 | 0 | 0.0% |
| | 25.00 | 0 | 14 | 0 | 100.0% |
| | 30.00 | 0 | 10 | 1 | 9.1% |
| | 40.00 | 0 | 6 | 0 | 14.3% |
| | Overall Percent | 0.0% | 94.3% | 2.9% | 45.7% |
| Testing | 10.00 | 0 | 1 | 0 | 0.0% |
| | 25.00 | 0 | 9 | 0 | 100.0% |
| | 30.00 | 0 | 1 | 1 | 50.0% |
| | 40.00 | 0 | 2 | 0 | 0.0% |
| | Overall Percent | 0.0% | 92.9% | 7.1% | 71.4% |

Table 5.30 Data Classification for public/community buildings (at 30% Completion)

| Sample | | Predicted | | | |
|---|---|---|---|---|---|
| | | 20.00 | 25.00 | 30.00 | Percent Correct |
| Training | 20.00 | 6 | 8 | 1 | 40.0% |
| | 25.00 | 1 | 11 | 1 | 84.6% |
| | 30.00 | 0 | 3 | 4 | 57.1% |
| | Overall Percent | 20.0% | 62.9% | 17.1% | 60.0% |
| Testing | 20.00 | 1 | 0 | 4 | 20.0% |
| | 25.00 | 1 | 4 | 1 | 66.7% |
| | 30.00 | 1 | 0 | 2 | 66.7% |
| | Overall Percent | 21.4% | 28.6% | 50.0% | 50.0% |

The testing sample from the tables show that at 30% completion stage the forecasts for residential buildings is the most accurate and represents a variation of 30% from the actual forecast. Commercial, hospital and public/community buildings also vary with 30% but with an accuracy level of 50%.

Table 5.31 Data Classification for commercial buildings (at 50% completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 0 | 3 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 14 | 0 | 0 | 100.0% |
| | 30.00 | 0 | 10 | 1 | 0 | 9.1% |
| | 40.00 | 0 | 6 | 0 | 1 | 14.3% |
| | Overall Percent | 0.0% | 94.3% | 2.9% | 2.9% | 45.7% |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 9 | 0 | 0 | 100.0% |
| | 30.00 | 0 | 1 | 1 | 0 | 50.0% |
| | 40.00 | 0 | 2 | 0 | 0 | 0.0% |
| | Overall Percent | 0.0% | 92.9% | 7.1% | 0.0% | 71.4% |

Table 5.32 Data Classification for hospital buildings (at 50% completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 15.00 | 25.00 | 30.00 | Percent Correct |
| Training | 15.00 | 0 | 3 | 1 | 0.0% |
| | 25.00 | 0 | 26 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 2 | 40.0% |
| | Overall Percent | 0.0% | 91.4% | 8.6% | 80.0% |
| Testing | 15.00 | 0 | 2 | 0 | 0.0% |
| | 25.00 | 0 | 7 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 2 | 40.0% |
| | Overall Percent | 0.0% | 85.7% | 14.3% | 64.3% |

Table 5.33 Data Classification for residential buildings (at 50% completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 20.00 | 25.00 | 30.00 | Percent Correct |
| Training | 20.00 | 6 | 8 | 1 | 40.0% |
| | 25.00 | 1 | 11 | 1 | 84.6% |
| | 30.00 | 0 | 3 | 4 | 57.1% |
| | Overall Percent | 20.0% | 62.9% | 17.1% | 60.0% |
| Testing | 20.00 | 1 | 0 | 4 | 20.0% |
| | 25.00 | 1 | 4 | 1 | 66.7% |
| | 30.00 | 1 | 0 | 2 | 66.7% |
| | Overall Percent | 21.4% | 28.6% | 50.0% | 50.0% |

Table 5.34 Data Classification for Public/community buildings (at 50% completion)

| Sample | | Predicted 20.00 | 25.00 | 30.00 | Percent Correct |
|---|---|---|---|---|---|
| Training | 20.00 | 6 | 8 | 1 | 40.0% |
| | 25.00 | 1 | 11 | 1 | 84.6% |
| | 30.00 | 0 | 3 | 4 | 57.1% |
| | Overall Percent | 20.0% | 62.9% | 17.1% | 60.0% |
| Testing | 20.00 | 1 | 0 | 4 | 20.0% |
| | 25.00 | 1 | 4 | 1 | 66.7% |
| | 30.00 | 1 | 0 | 2 | 66.7% |
| | Overall Percent | 21.4% | 28.6% | 50.0% | 50.0% |

The testing sample from the tables show that at 50% completion stage the forecasts for commercial and hospital buildings are 25% less than the actual. While the variation of 30% accrues for residential and public/community buildings.

Table 5.35 Data Classification for commercial buildings (at 70% completion)

| Sample | | Predicted 15.00 | 25.00 | 30.00 | Percent Correct |
|---|---|---|---|---|---|
| Training | 15.00 | 0 | 3 | 1 | 0.0% |
| | 25.00 | 0 | 26 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 2 | 40.0% |
| | Overall Percent | 0.0% | 91.4% | 8.6% | 80.0% |
| Testing | 15.00 | 0 | 2 | 0 | 0.0% |
| | 25.00 | 0 | 7 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 2 | 40.0% |
| | Overall Percent | 0.0% | 85.7% | 14.3% | 64.3% |

Table 5.36 Data Classification for hospital buildings (at 70% completion)

| Sample | | Predicted 15.00 | 25.00 | 30.00 | Percent Correct |
|---|---|---|---|---|---|
| Training | 15.00 | 0 | 3 | 1 | 0.0% |
| | 25.00 | 0 | 26 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 2 | 40.0% |
| | Overall Percent | 0.0% | 91.4% | 8.6% | 80.0% |
| Testing | 15.00 | 0 | 2 | 0 | 0.0% |
| | 25.00 | 0 | 7 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 2 | 40.0% |
| | Overall Percent | 0.0% | 85.7% | 14.3% | 64.3% |

Table 5.37 Data Classification for residential buildings (at 70% completion)

| Sample | | Predicted 15.00 | 25.00 | 30.00 | Percent Correct |
|---|---|---|---|---|---|
| Training | 15.00 | 0 | 3 | 1 | 0.0% |
| | 25.00 | 0 | 26 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 2 | 40.0% |
| | Overall Percent | 0.0% | 91.4% | 8.6% | 80.0% |
| Testing | 15.00 | 0 | 2 | 0 | 0.0% |
| | 25.00 | 0 | 7 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 2 | 40.0% |
| | Overall Percent | 0.0% | 85.7% | 14.3% | 64.3% |

Table 5.38 Data Classification for public/community buildings (at 70% completion)

| Sample | | Predicted 15.00 | 25.00 | 30.00 | Percent Correct |
|---|---|---|---|---|---|
| Training | 15.00 | 0 | 3 | 1 | 0.0% |
| | 25.00 | 0 | 26 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 2 | 40.0% |
| | Overall Percent | 0.0% | 91.4% | 8.6% | 80.0% |
| Testing | 15.00 | 0 | 2 | 0 | 0.0% |
| | 25.00 | 0 | 7 | 0 | 100.0% |
| | 30.00 | 0 | 3 | 2 | 40.0% |
| | Overall Percent | 0.0% | 85.7% | 14.3% | 64.3% |

The testing sample from the tables show that at 70% completion stage the forecasts for all the building types are 25% more than the actual.

### 5.4.4 Models across Duration of Projects

Three categories of duration were studied in the work, “less than 12 months”, “13-24 months”, and “above 24 months”. The classification matrix for each category is presented below:

Table 5.39 Data Classification for "less than 12 months" duration (at 30% completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 15 | 25 | 30 | Percent Correct |
| Training | 15.00 | 12 | 1 | 1 | 85.7% |
| | 25.00 | 5 | 8 | 0 | 61.5% |
| | 30.00 | 4 | 1 | 2 | 28.6% |
| | Overall Percent | 61.8% | 29.4% | 8.8% | 64.7% |
| Testing | 15.00 | 6 | 1 | 0 | 85.7% |
| | 25.00 | 4 | 2 | 0 | 33.3% |
| | 30.00 | 1 | 1 | 1 | 33.3% |
| | Overall Percent | 68.8% | 25.0% | 6.3% | 56.3% |

Table 5.40 Data Classification for "12-24 months" duration (at 30% completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 20.00 | 25.00 | 30.00 | Percent Correct |
| Training | 20.00 | 12 | 1 | 1 | 85.7% |
| | 25.00 | 5 | 8 | 0 | 61.5% |
| | 30.00 | 4 | 1 | 2 | 28.6% |
| | Overall Percent | 61.8% | 29.4% | 8.8% | 64.7% |
| Testing | 20.00 | 6 | 1 | 0 | 85.7% |
| | 25.00 | 4 | 2 | 0 | 33.3% |
| | 30.00 | 1 | 1 | 1 | 33.3% |
| | Overall Percent | 68.8% | 25.0% | 6.3% | 56.3% |

Table 5.41 Data Classification for "above 24 months" duration (at 30% completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 20.00 | 25.00 | 30.00 | Percent Correct |
| Training | 20.00 | 12 | 1 | 1 | 85.7% |
| | 25.00 | 5 | 8 | 0 | 61.5% |
| | 30.00 | 4 | 1 | 2 | 28.6% |
| | Overall Percent | 8.8% | 29.4% | 61.8% | 64.7% |
| Testing | 20.00 | 6 | 1 | 0 | 85.7% |
| | 25.00 | 4 | 2 | 0 | 33.3% |
| | 30.00 | 1 | 1 | 1 | 33.3% |
| | Overall Percent | 8.8% | 25.0% | 61.8% | 56.3% |

The tables show that at 30% completion stage the forecasts for “below 12 months” there is a 15% variation, 20% variation f0r “13-24 months” and 30% variation for “above 24 months”.

Table 5.42 Data Classification for "less than 12 months" duration (at 50% completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 1 | 2 | 0 | 0 | 33.3% |
| | 25.00 | 0 | 12 | 0 | 1 | 92.3% |
| | 30.00 | 0 | 11 | 2 | 0 | 15.4% |
| | 40.00 | 0 | 2 | 0 | 3 | 60.0% |
| | Overall Percent | 2.9% | 79.4% | 5.9% | 11.8% | 52.9% |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 8 | 0 | 2 | 80.0% |
| | 30.00 | 0 | 0 | 1 | 0 | 100.0% |
| | 40.00 | 0 | 1 | 0 | 3 | 75.0% |
| | Overall Percent | 0.0% | 62.5% | 6.3% | 31.3% | 75.0% |

Table 5.43 Data Classification for "13-24 months" duration (at 50% completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 1 | 2 | 0 | 0 | 33.3% |
| | 25.00 | 0 | 12 | 0 | 1 | 92.3% |
| | 30.00 | 0 | 11 | 2 | 0 | 15.4% |
| | 40.00 | 0 | 2 | 0 | 3 | 60.0% |
| | Overall Percent | 79.4% | 2.9% | 5.9% | 11.8% | 52.9% |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 8 | 0 | 2 | 80.0% |
| | 30.00 | 0 | 0 | 1 | 0 | 100.0% |
| | 40.00 | 0 | 1 | 0 | 3 | 75.0% |
| | Overall Percent | 62.5% | 0.0% | 6.3% | 31.3% | 75.0% |

Table 5.44 Data Classification for "above 24 months" duration (at 50% completion)

| | | Predicted | | | | |
|---|---|---|---|---|---|---|
| Sample | | 10.00 | 25.00 | 30.00 | 40.00 | Percent Correct |
| Training | 10.00 | 1 | 2 | 0 | 0 | 33.3% |
| | 25.00 | 0 | 12 | 0 | 1 | 92.3% |
| | 30.00 | 0 | 11 | 2 | 0 | 15.4% |
| | 40.00 | 0 | 2 | 0 | 3 | 60.0% |
| | Overall Percent | 2.9% | 79.4% | 5.9% | 11.8% | 52.9% |
| Testing | 10.00 | 0 | 1 | 0 | 0 | 0.0% |
| | 25.00 | 0 | 8 | 0 | 2 | 80.0% |
| | 30.00 | 0 | 0 | 1 | 0 | 100.0% |
| | 40.00 | 0 | 1 | 0 | 3 | 75.0% |
| | Overall Percent | 62.5% | 0.0% | 6.3% | 31.3% | 75.0% |

The tables show that at 50% completion stage the forecasts for “below 12 months” there is a 25% variation, 10% variation f0r “13-24 months” and 10% variation for “above 24 months”.

Table 5.45 Data Classification for "less than 12 months" duration (at 70% completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 15.00 | 25.00 | 30.00 | Percent Correct |
| Training | 15.00 | 0 | 3 | 0 | 0.0% |
| | 25.00 | 0 | 21 | 2 | 91.3% |
| | 30.00 | 0 | 5 | 3 | 37.5% |
| | Overall Percent | 0.0% | 85.3% | 14.7% | 70.6% |
| Testing | 15.00 | 0 | 3 | 0 | 0.0% |
| | 25.00 | 0 | 10 | 1 | 90.9% |
| | 30.00 | 0 | 1 | 1 | 50.0% |
| | Overall Percent | 87.5% | 0.0% | 12.5% | 68.8% |

Table 5.46 Data Classification for "13-24 months" duration (at 70% completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 15.00 | 25.00 | 30.00 | Percent Correct |
| Training | 15.00 | 0 | 3 | 0 | 0.0% |
| | 25.00 | 0 | 21 | 2 | 91.3% |
| | 30.00 | 0 | 5 | 3 | 37.5% |
| | Overall Percent | 0.0% | 85.3% | 14.7% | 70.6% |
| Testing | 15.00 | 0 | 3 | 0 | 0.0% |
| | 25.00 | 0 | 10 | 1 | 90.9% |
| | 30.00 | 0 | 1 | 1 | 50.0% |
| | Overall Percent | 87.5% | 0.0% | 12.5% | 68.8% |

Table 5.47 Data Classification for "above 24 months" duration (at 70% completion)

| | | Predicted | | | |
|---|---|---|---|---|---|
| Sample | | 15.00 | 25.00 | 30.00 | Percent Correct |
| Training | 15.00 | 0 | 3 | 0 | 0.0% |
| | 25.00 | 0 | 21 | 2 | 91.3% |
| | 30.00 | 0 | 5 | 3 | 37.5% |
| | Overall Percent | 0.0% | 85.3% | 14.7% | 70.6% |
| Testing | 15.00 | 0 | 3 | 0 | 0.0% |
| | 25.00 | 0 | 10 | 1 | 90.9% |
| | 30.00 | 0 | 1 | 1 | 50.0% |
| | Overall Percent | 87.5% | 0.0% | 12.5% | 68.8% |

The tables show that at 70% completion stage the variation between forecasted and actual cash-out is 15% across all the three durations.

# CHAPTER SIX

## 6.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Summary of Findings

Within the limitations of the data collected, the following can be drawn as the findings of this study. For the sake of clarity, the findings are presented under cash-in forecasts and cash-out forecasts:

1. cash-in **forecasts**

i. From the forty (40) risk factors affecting cash-in forecasts identified from literature, seventeen (17) were found to have the highest chances of occurring. These are - "delay in receiving retention", "accuracy of estimates", "change in government officials", "bureaucracy in processing payment", "increase in duration of the project", "delay in payment from client", "delay in releasing advance payment", "withholding tax", "discount on materials purchased", "delay in paying creditors", "dispute between contractor and Owner", "variations, under valuation", "changes in activities' start time", "change in interest rates", "production time slippage" and "changes to initial design".

ii. There is a is a significant difference in the perception of contractors in Nigeria on the likelihood of occurrence of risk factors in cash-in forecasts along project characteristics.

iii. Eighteen (18) risk factors were found to have critical impact on cash-in forecasts. These are - delay in receiving retention, accuracy of estimates, change in government officials, bureaucracy in processing payment, increase in duration of the project, delay in payment from client, delay in releasing advance payment, withholding tax, discount on materials purchased, delay in paying creditors, dispute between contractor and Owner, variations, under valuation,

changes in activities' start time, change in interest rates, production time slippage, changes to initial design and long interval between two certificates.

iv. There is a is a significant difference in the perception of contractors in Nigeria on the impact of risk factors in cash-in forecasts along project characteristics.

2. **Cash-out forecasts**

i Eighteen (18) of the Thirty-one (31) risk factors affecting cash-out forecasts identified from literature have a high likelihood of occurrence in the Nigerian construction industry. These factors are – “Increased Duration of the Project”, “Change in Currency Exchange Rates”, “High Cost of Materials”, “Variations”, “Shortage of Key Plant Items”, “Replacement of Defective Works”, “Delay in Payment from Client”, “Delay in Settling Claims”, “Poor communication Amongst Parties”, “Inclement Weather”, “Inflation”, “Changes to Initial Design”, “Under-estimating Project complexity”, “Charging of "Land Dues" by Locals (illegally)”, “Over Measurements”, “Delay in Agreeing Variation/Day Works”, and “Contractor/Owner Dispute”.

ii Variation between forecasted and actual cash-out at 30%, 50% and 70% completion stages for federal government projects are +20%, +25% and +25% respectively. The variations differ severally across differnt project characteristics.

iii Sixteen (16) of the thirty-one (31) risk factors affecting cash-out forecasts identified from literature have critical impacts in the Nigerian construction industry. These factors are – “Increased Duration of the Project”, “Change in Currency Exchange Rates”, “High Cost of Materials”, “Delay in Payment from Client”, “Shortage of key plant items”, “Delay in Settling Claims”, “Replacement of Defective Works”, “Variations”, “Delay in Agreeing Variation/Day Works”, “Poor communication

Amongst Parties", "Inflation", "Inclement Weather", "Changes to Initial Design", "Over Measurements", "Charging of "Land Dues" by Locals (illegally)", and "Contractor/Owner Dispute".

iv There is a significant difference in the perception of contractors in Nigeria on the likelihood of occurrence of risk factors in cash-out forecasts along project characterics

v There is a significant difference in the perception of contractors in Nigeria on the impact of risk factors on cash-out forecasts along project characterics.

## 6.2 Conclusions

The objectives of this study have been achieved and the following conclusions can be drawn:

Seventeen risk factors significantly impact cash-in forecasts, Eighteen risk factors significantly impact on cash-out forecasts. The average variations between actual and predicted cash-out forecasts in the Nigerian construction industry are 20% above the Forecasts at 30% completion stage, 25% above the forecasts at 50% completion stage, and 25% above the forecasts at 70% completion stage. However, the variations differ across different project characteristics. There is a significant differnce in the perception of contractors in Nigeria on the likelihood of occurence and impact of risk factors on cash-in and cash-out forecasts.

## 6.3 Recommendations

The following recommendations are proffered in light of the findings of this research. Construction Contractors in Nigeria should consider the following when embarking on projects;

i. The seventeen (17) risk factors with the highest occurrence and the eighteen (18) risk factors with the highest impact on “cash-in” forecasts.

ii. The Eighteen (18) risk factors with the highest occurrence and the sixteen (16) risk factors with the highest impact on “cash-out” forecasts.

### 6.4 Recommendation for further Research

i. It is recommended that more empirical researches be carried out on risk factors affecting cash flow forecasts at other completion stages than the ones adopted in this research. This will make comparison of the differences at those stages of completion possible.

ii. Modelling of likelihood of occurrence of risk factors influencing availability of clients’ cash-in for construction projects should be explored.

iii. Modelling of impact of risk factors influencing clients’ cash-in forecasts for construction projects should be explored.

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# APPENDICES

## APPENDIX A: QUESTIONNAIRE SURVEY (1) INSTRUMENT

**QUESTIONNAIRE**

Department of Quantity Surveying,

Faculty of Environmental Design,
Ahmadu Bello University,
Zaria.
August, 2014.

Dear Sir/Madam,

**A SURVEY OF THE RISK FACTORS INVOLVED IN CONSTRUCTION CASH FLOW FORECASTS IN NIGERIA.**

I am a student of the above-named Institution pursuing a Doctor of Philosophy (PhD) in Quantity Surveying. As part of the requirements for the award of the degree, I am to conduct a research and submit a thesis to the Institution's Post Graduate School.

My focus is on Risk factors impacting on construction contractors' cash flow forecasts. Hence I have chosen the topic above with the aim of improving the predictive ability of contractors before the commencement of construction projects and provide literature with information concerning risks in the Nigerian construction industry. It would be appreciated if you would be kind enough to complete the questionnaire as conscientiously as possible. Your participation in the survey will be immensely appreciated. Your response will be treated with utmost confidentiality and your anonymity guaranteed. The results will be presented in grouped data form.

Thank you for your anticipated co-operation.

Yours faithfully,

Mustapha Abdulrazaq.
(08094300081, 08035904160)
(musteezee2005@yahoo.co.uk)

## SECTION A

**GENERAL INFORMATION**

**1)**. Name of Organisation

……

**2).** Position of Respondent

……..

**3)** What types of projects do you commonly execute? (i) Commercial building(s) (ii) Hospital building(s) (iii)Residential building(s) (iv) Public and Community building(s) (v) Other (Please specify) ----------

**4)**. What is the average construction duration in months?

……..

**5)**. What is the average project value (in millions of Naira)? i) Below 50. ii) 51-100. iii) 101-200. iv) Above 200.

**6).** Which procurement option is commonly adopted? (i) Traditional (ii) Project Management (iii) Design and build

(iv) Other (please specify)

**7)**. What is the annual turnover of your organisation (in millions of Naira)? (i) Below 100 (ii) 101-200 (iii) 201-300 (iv) 301-400 (v) 401-500 (vi) Above 500

**8)** What is the Nature of the project Client? (i)Federal Government (ii) State Government (iii) Local Government (iv) Private (v) Other (Please Specify)

## SECTION B

**RISK FACTORS INVOLVED IN CONSTRUCTION CASH FLOW FORECASTING**

**9)** Table 1 is a list of risk factors that have been identified to contribute to variations in "cash-in" (payments from Client) to a contractor's forecasts:

**a) Please score on a scale of 0 to 5 in column (a) in terms of the likelihood of the factor occurring (see guide to scoring on page 2).**

**b) In addition, kindly score in column (b) in the box provided the order of impact you would place on the factor should it occur (see guide to scoring on page 2).**

**c)Also, kindly estimate in column (c) the difference between actual and forecasted cash flow (i.e. negative or positive) that might have occurred to your forecast cash flow profile at 30%, 50% and 70% completions of the project as a result of the occurrence of each of the risk factors.**

**10)** Table 2 (page 4) is a checklist of risk factors that have been identified to contribute to variations in cost flow ("cash-out" to a contractor- i.e. contractor's expenditure). **Please repeat the same exercise as in table 1.**

**Note: (a) (Probability of Occurrence) 0= no occurrence, 1= very low, 2= low, 3= medium, 4= high, 5= very high.**
**Note: (b) (Degree of Impact) 0= no impact, 1= little impact, 2= fairly critical impact, 3=critical impact, 4= very critical impact, 5= extreme critical impact**
**Note: (c) (Percentage completion) 30%(-ve or +ve), 50%(-ve or +ve), 70%(-ve or +ve).**

**Table 1: Risk Factors Impacting on Cash-in Forecasts**

| | | **Probability of Occurrence** | | | | | | **Degree of Impact** | | | | | | **Percentage Variation (-ve or +ve)** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **N/A** | | **(a)** | | | **V. High** | **N/I** | | **(b)** | | | **Extremely Critical** | **(c)** | | |
| | **Risk Factors** | 0 | 1 | 2 | 3 | 4 | 5 | 0 | 1 | 2 | 3 | 4 | 5 | 30% completion | 50% completion | 70% completion |
| 1 | **Accuracy of estimates** | | | | | | | | | | | | | | | |
| 2 | **Unavailability of credit facilities** | | | | | | | | | | | | | | | |
| 3 | **Back/front end loading** | | | | | | | | | | | | | | | |
| 4 | **Bureaucracy in processing payments (giving bribes to "speed up" payment files)** | | | | | | | | | | | | | | | |
| 5 | **Change in government officials** | | | | | | | | | | | | | | | |
| 6 | **Change in interest rates** | | | | | | | | | | | | | | | |
| 7 | **Changes to initial** | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **design** | | | | | | | | | | | | | | | |
| 8 | **Change in activities' start time** | | | | | | | | | | | | | | | |
| 9 | **Civil disturbance** | | | | | | | | | | | | | | | |
| 10 | **Client's insolvency** | | | | | | | | | | | | | | | |
| 11 | **Compliance with new regulations** | | | | | | | | | | | | | | | |
| 12 | **Contractual specification of minimum amount valuation** | | | | | | | | | | | | | | | |
| 13 | **Change orders** | | | | | | | | | | | | | | | |
| 14 | **Delay in paying creditors** | | | | | | | | | | | | | | | |
| 15 | **Delay in payment from client** | | | | | | | | | | | | | | | |
| 16 | **Delay in receiving retention** | | | | | | | | | | | | | | | |
| 17 | **Delay in releasing advance payment** | | | | | | | | | | | | | | | |
| 18 | **Discount on materials purchased** | | | | | | | | | | | | | | | |
| 19 | **Dispute between contractor and owner** | | | | | | | | | | | | | | | |
| 20 | **Increase in duration of the project** | | | | | | | | | | | | | | | |
| 21 | **Geotechnical issues** | | | | | | | | | | | | | | | |
| 22 | **Inclement weather** | | | | | | | | | | | | | | | |
| 23 | **Long interval between two certificates** | | | | | | | | | | | | | | | |
| 24 | **Incompetent consulting teams** | | | | | | | | | | | | | | | |
| 25 | **Labour strikes** | | | | | | | | | | | | | | | |
| 26 | **Large retention percentage** | | | | | | | | | | | | | | | |
| 27 | **Listed buildings** | | | | | | | | | | | | | | | |
| 28 | **Overheads** | | | | | | | | | | | | | | | |
| 29 | **Period of honouring certificates** | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | **Problems with foundation** | | | | | | | | | | | | | | | |
| 31 | **Production target slippage** | | | | | | | | | | | | | | | |
| 32 | **Receiving advance payment** | | | | | | | | | | | | | | | |
| 33 | **Bad relationship between contractor and consulting team** | | | | | | | | | | | | | | | |
| 34 | **Bad relationship between contractor and owner** | | | | | | | | | | | | | | | |
| 35 | **Bad relationship between main and sub-contractor** | | | | | | | | | | | | | | | |
| 36 | **Replacement of defective work** | | | | | | | | | | | | | | | |
| 37 | **Subcontractor's insolvency** | | | | | | | | | | | | | | | |
| 38 | **Under valuation** | | | | | | | | | | | | | | | |
| 39 | **Variations** | | | | | | | | | | | | | | | |
| 40 | **Withholding tax** | | | | | | | | | | | | | | | |
| 41 | **Others(Please Specify)** | | | | | | | | | | | | | | | |

**Note: (a) (Probability of Occurrence) 0= not applicable, 1= very low, 2= low, 3= medium, 4= high, 5= very high.**
**Note: (b) (Degree of Impact) 0= no impact, 1= little impact, 2= fairly critical impact, 3=critical impact, 4= very critical impact, 5= extreme critical impact**
**Note: (c) (Percentage completion) 30%(-ve or +ve), 50%(-ve or +ve), 70%(-ve or +ve)**

## Table 2: Risk Factors Impacting on Cash-out (Contractor's Expenditure)

| | Risk Factors | Probability of Occurrence | | | | | | Degree of Impact | | | | | | Percentage Variation (Negative (-) or Positive (+) at: | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N/A | | | | | V. High | N/I | | | | | Extremely Critical | | | |
| 1 | Archaeological remains | 0 | 1 | 2 | 3 | 4 | 5 | 0 | 1 | 2 | 3 | 4 | 5 | 30% completion | 50% completion | 70% completion |
| 2 | Changes in currency exchange rates | | | | | | | | | | | | | | | |
| 3 | Changes to initial design | | | | | | | | | | | | | | | |
| 4 | Charging of "land dues" by locals | | | | | | | | | | | | | | | |
| 5 | Change orders | | | | | | | | | | | | | | | |
| 6 | Civil disturbances | | | | | | | | | | | | | | | |
| 7 | Client's insolvency | | | | | | | | | | | | | | | |
| 8 | Compliance with new regulations | | | | | | | | | | | | | | | |
| 9 | Contractor/owner dispute | | | | | | | | | | | | | | | |
| 10 | Delay in agreeing variation/day works | | | | | | | | | | | | | | | |
| 11 | Delay in settling claims | | | | | | | | | | | | | | | |
| 12 | Delay of payment from client | | | | | | | | | | | | | | | |
| 13 | Increased duration of the project | | | | | | | | | | | | | | | |
| 14 | Failure of sub-contractors | | | | | | | | | | | | | | | |
| 15 | Geotechnical issues | | | | | | | | | | | | | | | |
| 16 | High cost of materials | | | | | | | | | | | | | | | |
| 17 | Inclement weather | | | | | | | | | | | | | | | |
| 18 | Inflation | | | | | | | | | | | | | | | |
| 19 | Over measurements | | | | | | | | | | | | | | | |
| 20 | Poor communication amongst parties | | | | | | | | | | | | | | | |
| 21 | Poor design | | | | | | | | | | | | | | | |
| 22 | Problem with foundation | | | | | | | | | | | | | | | |
| 23 | Replacement of defective work | | | | | | | | | | | | | | | |
| 24 | Bad relationship between main and sub-contractor | | | | | | | | | | | | | | | |
| 25 | Shortage of key plant items | | | | | | | | | | | | | | | |
| 26 | Shortage of skilled labour | | | | | | | | | | | | | | | |
| 27 | Strikes, internal and external military action | | | | | | | | | | | | | | | |
| 28 | Under measurements | | | | | | | | | | | | | | | |
| 29 | Long period of honouring certificates by client | | | | | | | | | | | | | | | |
| 30 | Under-estimating project complexity | | | | | | | | | | | | | | | |
| 31 | Variations | | | | | | | | | | | | | | | |
| 32 | Others (Please Specify) | | | | | | | | | | | | | | | |

# APPENDIX B: QUESTIONNAIRE SURVEY (2) INSTRUMENT

## QUESTIONNAIRE

Department of Quantity Surveying,
Faculty of Environmental Design,
Ahmadu Bello University,
Zaria.
December, 2014.

Dear Sir/Madam,

**A SURVEY OF THE RISK FACTORS INVOLVED IN CONSTRUCTION CASH FLOW FORECASTS IN NIGERIA.**

Thank you for agreeing to participate in the second phase of this research. Please recall that I am a student of the above-named Institution pursuing a Doctor of Philosophy (PhD) in Quantity Surveying. As part of the requirements for the award of the degree, I am to conduct a research and submit a thesis to the Institution's Post Graduate School.

My present focus is on Risk factors impacting on construction contractors' cost (cash-out) flow forecasts. The 31 risk factors impacting on cash out flow forecast have been reduced to 16 significant risk factors following the analysis of the data collected in the initial survey. It would be appreciated if you would be kind enough to complete the questionnaire as conscientiously as possible. Your participation in the survey will be immensely appreciated. Your response will be treated with utmost confidentiality and your anonymity guaranteed. The results will be presented in grouped data form.

Thank you for your anticipated co-operation.

Yours faithfully,

Mustapha Abdulrazaq.

(08094300081, 08035904160)
(musteezee2005@yahoo.co.uk)

**SECTION A-GENERAL INFORMATION**

**1)**. Name of Organisation

……

**2)** Position of Respondent ……

**3)** What types of projects do you commonly execute? (i) Commercial building(s) (ii) Hospital building(s) (iii) Residential building (s) (iv) Public and Community building(s) (v) Other (Please specify) ----------

**4)**. What is the average construction duration in months?

……..

**5)**. What is the average project value (in millions of Naira)? i) Below 50. ii) 51-100. iii) 101-200. iv) Above 200.

**6).** Which procurement option is commonly adopted? (i) Traditional (ii) Project Management (iii) Design and build (iv) Other (please specify)

**7)**. What is the average annual turnover for your organisation (in millions of Naira)? i) Below 100. ii) 101-500. iii) Above 500.

**8)** What is the Nature of the project Client? (i)Federal Government (ii) State Government (iii) Local Government (iv) Private (v) other (Please Specify)

**SECTION B**

**RISK FACTORS INVOLVED IN CONSTRUCTION COST FLOW FORECASTS**

**9)** The table below is a list of risk factors that have been identified to contribute to variations in cost flow ("cash-out" to a contractor- i.e. contractor's expenditure) forecasts: Please score on a scale of 0 to 5 the likelihood of the factor occurring.

| | Risk Factors | Probability of Occurrence<br>N/A | | | | | V. High |
|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 |
| 1 | **Changes in currency exchange rates** | | | | | | |
| 2 | **Changes to initial design** | | | | | | |
| 3 | **Charging of "land dues" by locals** | | | | | | |
| 4 | **Contractor/owner dispute** | | | | | | |
| 5 | **Delay in agreeing variation/day works** | | | | | | |
| 6 | **Delay in settling claims** | | | | | | |
| 7 | **Delay of payment from client** | | | | | | |
| 8 | **Increased duration of the project** | | | | | | |
| 9 | **High cost of materials** | | | | | | |
| 10 | **Inclement weather** | | | | | | |
| 11 | **Inflation** | | | | | | |
| 12 | **Over measurements** | | | | | | |
| 13 | **Poor communication amongst parties** | | | | | | |
| 14 | **Replacement of defective work** | | | | | | |
| 15 | **Shortage of key plant items** | | | | | | |
| 16 | **Variations** | | | | | | |

**10) Kindly estimate on the table below, the approximate percentage difference between actual and forecasted expenditure at 30%, 50% and 70% completions of executed projects as a result of the risks occurrence (e.g. (+ or -) 60%, (+ or -) 60% and (+ or -) 60% respectively)**

| **Completion Stage** | **30%** | **50%** | **70%** |
|---|---|---|---|
| **Percentage Variation** | | | |

# APPENDIX C: SUMMARY OF SOURCES OF RISK FACTORS IMPACTING ON CASH FLOW FORECASTS

Table 1: Risk Factors Affecting "Cash-In" Forecasts

| | **Factor** | **Source(s)** |
|---|---|---|
| 1 | Accuracy of estimates | Zayed and Liu(2014), Buertey *et al.* (2010), Odeyinka *et al.* (2008) |
| 2 | Availability of credit facilities | Hawas and Cifuentes (2013), Buertey *et al.* (2010), Buertey *et al.* (2010), Khosrowshahi (2000) |
| 3 | Back /front end loading | Odeyinka *et al.* (2008), Xu and Tiong (2000), Kaka (1996) |
| 4 | Bureaucracy in Processing Payments (Giving bribes to "speed up" payment files) | Shehu *et al.* (2014), Dantata (2007), Dusai (2011) |
| 5 | Change in Government Officials | Dantata (2007), Dusai (2011) |
| 6 | Changes in interest rates | Annamalai and Jain (2013), Bickerton and Gruneberg (2013), Han *et al.* (2013), Odeyinka *et al.* (2013), Hwang *et al.* (2013), Lucko (2011), Mbachu (2011), Odeyinka (2008), Khosrowshahi (2000) |
| 7 | Changes to initial design | Shehu *et al.* (2014), Odeyinka *et al.* (2013), Hawas and Cifuentes (2013), Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 8 | Change in activities' start time | Alghazi *et al.* (2013), Rose *et al.* (2013), Aljoburi *et al.* (2012) |
| 9 | Civil disturbance | Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 10 | Client's insolvency | Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 11 | Compliance with new regulations | Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 12 | Contractual specification of minimum amount valuation | Buertey *et al.* (2010) |
| 13 | Change orders | Zayed and Liu(2014), Cheng (2013), Odeyinka *et al.* (2013) |
| 14 | Delay in paying creditors | Buertey *et al.* (2010) |
| 15 | Delay in payment from client | Zayed and Liu(2014), Buertey *et al.* (2010), Mahamid (2013), Odeyinka *et al.* (2013), Ramachandra and Rotimi (2012), Lucko (2011), Mbachu (2011), Odeyinka and Lowe (2000), Kaka and Cheetham (1997), Kaka (1996), Kaka and Price (1991) |
| 16 | Delay in receiving retention | Zayed and Liu(2014), Odeyinka *et al.* (2013), Odeyinka *et al.* (2008), Kaka and Khosrowshahi (1996) |
| 17 | Delay in releasing advance payment | Shehu *et al.* (2014), |
| 18 | Discount on materials purchased | Buertey *et al.* (2010) |
| 19 | Dispute between contractor and owner | Zayed and Liu(2014), Cheng (2013) |
| 20 | Duration of the project | Zayed and Liu(2014), Cheng (2013), Odeyinka *et al.* (2013) |
| 21 | Geotechnical issues | McLain *et al.* (2014), Cheng (2013) |
| 22 | Inclement weather | Zayed and Liu(2014), Cheng (2013), Odeyinka *et al.* (2013), Odeyinka *et al.* (2008), Aibinu and Jagboro (2002) |
| 23 | Interval between two certificates | Odeyinka *et al.* (2013), Buertey *et al.* (2010), Odeyinka *et al.* (2008), Odeyinka and Lowe (2000) |
| 24 | Incompetent Consulting Team | Cheng (2013) |
| 25 | Labour strikes | Odeyinka *et al.* (2013), Odeyinka *et al.* (2008), Enshassi *et al.* (2009) |
| 26 | Large retention percentage | Zayed and Liu(2014), Ross *et al.* (2013), Lucko (2011), Jiang *et al.* (2011) Buertey *et al.* (2010), Cui *et al.* (2009), Hughes *et al.* (2000) |
| 27 | Listed buildings | Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 28 | Overheads | Buertey *et al.* (2010), Cui *et al.* (2009) |
| 29 | Period of honouring certificate by client | Buertey *et al.* (2010) |
| 30 | Problems with foundation | Shehu *et al.* (2014), Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 31 | Production target slippage | Buertey (2010), Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 32 | Receiving advance payment | Zayed and Liu (2014), Buertey *et al.* (2010) |
| 33 | Relationship between contractor and consulting team | Zayed and Liu (2014) |
| 34 | Relationship between contractor and owner | Dada (2014), Zayed and Liu (2014), Jarkas (2013), Aljoburi *et al.* (2012), Ramachandra and Rotimi (2012) |
| 35 | Relationship between main and sub-contractor | Dada (2014), Shehu *et al.* (2014) |
| 36 | Replacement of defective work | Zayed and Liu (2014) |
| 37 | Subcontractor's insolvency | Hawas and Cifuentes (2013), Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 38 | Under valuation | Cheng (2013), Odeyinka *et al.* (2008), Khosrowshahi (2000) |
| 39 | Variations | Zayed and Liu (2014), Odeyinka *et al.* (2013), Mbachu (2011), Odeyinka *et al.* (2008), Hwee and Tiong (2001), Aibinu and Jagboro (2002) |
| 40 | Withholding tax | Hawas and Cifuentes (2013), Buertey *et al.* (2010) |

Table 2: Risk Factors Affecting "Cash-Out" Forecasts

| | **Factor** | **Source(s)** |
|---|---|---|
| 1 | Archaeological remains | Odeyinka *et al.* (2008) |
| 2 | Changes in currency exchange rate | Zayed and Liu (2014), Hang *et al.* (2013), Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 3 | Changes to initial design | Shehu *et al.* (2014), Odeyinka *et al.* (2013), Hawas and Cifuentes (2013), Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 4 | Charging of "land dues" by locals | Dantata (2007) |
| 5 | Change orders | Zayed and Liu(2014), Cheng (2013), Odeyinka *et al.* (2013) |
| 6 | Civil disturbance | Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 7 | Client's insolvency | Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 8 | Compliance with new regulations | Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 9 | Contractor/owner dispute | Zayed and Liu (2014) |
| 10 | Delay in agreeing variation/day work | Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 11 | Delay in settling claims | Hawas and Cifuentes(2013), Zayed and Liu (2014), Mbachu (2011), Odeyinka *et al.* (2008) |
| 12 | Delay in payment from client | Zayed and Liu(2014), Buertey *et al.* (2010), Mahamid (2013), Odeyinka *et al.* (2013), Ramachandra and Rotimi (2012), Lucko (2011), Mbachu (2011), Odeyinka and Lowe (2000), Kaka and Cheetham (1997), Kaka (1996), Kaka and Price (1991) |
| 13 | Duration of the project | Zayed and Liu(2014), Cheng (2013), Odeyinka *et al.* (2013) |
| 14 | Failure of subcontractors | Zayed and Liu(2014), Odeyinka *et al.* (2008) |
| 15 | Geotechnical issues | McLain *et al.* (2014), Cheng (2013) |
| 16 | High cost of materials | Cheng (2013), Dantata (2007), Aibinu and Jagboro (2002) |
| 17 | Inclement weather | Zayed and Liu(2014), Cheng (2013), Odeyinka *et al.* (2013), Odeyinka *et al.* (2008), Aibinu and Jagboro (2002) |
| 18 | Inflation | Bickerton and Gruneberg (2013), Mahamid (2013), Odeyinka *et al.* (2008), Dantata (2007) |
| 19 | Over measurements | Zayed and Liu(2014) |
| 20 | Poor communication amongst parties | Mahamid (2013), McLain *et al.* (2014), Shehu *et al.* (2014), Famakin and Ogunsemi (2012) |
| 21 | Poor design | Zayed and Liu(2014), Mbachu (2011) |
| 22 | Problems with foundation | Shehu *et al.* (2014), Odeyinka *et al.* (2013), Odeyinka *et al.* (2008) |
| 23 | Replacement of defective work | Zayed and Liu (2014) |
| 24 | Relationship between main and sub contractor | Shehu *et al.* (2014), Zayed and Liu (2014) |
| 25 | Shortage of key plant items | Mahamid (2013), Shehu *et al.* (2014), Cheng (2013), Odeyinka *et al.* (2013) |
| 26 | Shortage of skilled labour | Shehu *et al.* (2014), Zayed and Liu(2014), Cheng(2013), Odeyinka *et al.* (2013), Enshassi *et al.* (2009), Tang and Leung (2009), Odeyinka *et al.* (2008), Dantata (2007), Aibinu and Jagboro (2002) |
| 27 | Strikes, internal and external military action | Zayed and Liu(2014), Enshassi *et al.* (2009), Odeyinka *et al.* (2008), Dantata (2007), Aibinu and Jagboro (2002) |
| 28 | Under measurements | Dada (2014), Zayed and Liu (2014), Mbachu (2011), Enshassi *et al.* (2009), Odeyinka *et al.* (2008), Hwee and Tiong (2002), Kaka and Khosrowshahi (1996), Kaka (1996) |
| 29 | Period of honouring certificate by client | Buertey *et al.* (2010) |
| 30 | Under-estimating project complexity | Shehu *et al.* (2014), Jarkas (2013), Odeyinka *et al.* (2013), Mbachu (2011), Odeyinka *et al.* (2008)) |
| 31 | Variations | Zayed and Liu (2014), Odeyinka *et al.* (2013), Mbachu (2011), Odeyinka *et al.* (2008), Hwee and Tiong (2001), Aibinu and Jagboro (2002) |

## APPENDIX D: Cochran's (1977) Table

# APPENDIX E: FULL DETAILS OF TABLES IN CHAPTER 4

Table 4.9: Impact of Risk Factors on cash-in Forecasts.

| Risk Factor | Mean | Std. Error | Std. Deviation | Rank |
|---|---|---|---|---|
| Delay in Receiving Retention | 4.60 | 0.0625 | 0.78 | 1 |
| Accuracy of Estimates | 4.60 | 0.0510 | 0.64 | 1 |
| Change in Government Officials | 4.59 | 0.0564 | 0.71 | 3 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.33 | 0.0567 | 0.71 | 4 |
| Increase in duration of the Project | 4.27 | 0.0905 | 1.13 | 5 |
| Delay in Payment from Client | 4.26 | 0.0793 | 0.99 | 6 |
| Withholding Tax | 4.11 | 0.0979 | 1.23 | 7 |
| Discount on Materials Purchased | 4.08 | 0.0349 | 0.44 | 8 |
| Delay in Paying Creditors | 3.97 | 0.0964 | 1.21 | 9 |
| Delay in Releasing Advance Payment | 3.90 | 0.0851 | 1.07 | 10 |
| Variations | 3.77 | 0.0618 | 0.78 | 11 |
| Dispute Between Contractor and Owner | 3.70 | 0.0779 | 0.98 | 12 |
| Under Valuation | 3.64 | 0.0783 | 0.98 | 13 |
| Changes in Activities' Start Time | 3.42 | 0.0982 | 1.23 | 14 |
| Change in Interest Rates | 3.38 | 0.0753 | 0.94 | 15 |
| Production Time Slippage | 3.36 | 0.0711 | 0.89 | 16 |
| Changes to Initial Design | 3.22 | 0.0589 | 0.74 | 17 |
| Long Interval Between Two Certificates | 3.02 | 0.0667 | 0.84 | 18 |
| Geotechnical Issues | 2.97 | 0.07718 | 0.97 | 19 |

| | | | | |
|---|---|---|---|---|
| Inclement Weather | 2.89 | 0.1207 | 1.51 | 20 |
| Overheads | 2.73 | 0.1012 | 1.27 | 21 |
| Replacement of Defective Work | 2.55 | 0.1144 | 1.43 | 22 |
| Problems with Foundation | 2.38 | 0.1267 | 1.59 | 23 |
| Bad Relationship Between Contractor and Consulting Team | 2.22 | 0.0466 | 0.58 | 24 |
| Compliance With New Regulations | 2.03 | 0.0945 | 1.18 | 25 |
| Bad Relationship Between Contractor and Owner | 1.86 | 0.2771 | 3.47 | 26 |
| Unavailability of credit facilities | 1.81 | 0.0857 | 1.07 | 27 |
| Incompetent Consulting Team | 1.71 | 0.0936 | 1.17 | 28 |
| Bad Relationship Between Main and Sub Contractor | 1.60 | 0.07334 | 0.92 | 29 |
| Back/Front end Loading | 1.57 | 0.05207 | 0.65 | 30 |
| Listed Buildings | 1.41 | 0.1077 | 1.35 | 31 |
| Change Orders | 1.38 | 0.1375 | 1.72 | 32 |
| Receiving | 1.14 | 0.0958 | 1.20 | 33 |
| Advance Payment | | | | |
| Period of Honouring Certificates | 1.13 | 0.0961 | 1.20 | 34 |
| Contractual Specification of Minimum Amount Valuation | 1.11 | 0.1408 | 1.76 | 35 |
| Client's | 1.10 | 0.0783 | 0.98 | 36 |
| Insolvency | | | | |
| Large Retention Percentage | 1.08 | 0.1127 | 1.41 | 37 |
| Civil Disturbance | 0.93 | 0.0543 | 0.68 | 38 |
| Labour Strikes | 0.84 | 0.1085 | 1.30 | 39 |

| | | | | |
|---|---|---|---|---|
| Subcontractor's Insolvency | 0.41 | 0.08571 | 1.07 | 40 |

Source: field survey, 2014.

Table 4.10: Occurence of Risk Factors on cash-out Forecasts

| Risk Factor | Mean | Std. Error | Std. Deviation | Rank |
|---|---|---|---|---|
| Increased Duration of the Project | 4.51 | .05081 | .63668 | 1 |
| Change in Currency Exchange Rates | 4.31 | .06106 | .76512 | 2 |
| High Cost of Materials | 3.98 | .04649 | .58256 | 3 |
| Variations | 3.87 | .06332 | .79337 | 4 |
| Shortage of Key Plant Items | 3.77 | .05336 | .66864 | 5 |
| Replacement of Defective Works | 3.73 | .06088 | .76277 | 6 |
| Delay in Payment from Client | 3.68 | .05272 | .66060 | 7 |
| Delay in Settling Claims | 3.60 | .04225 | .52939 | 8 |
| Poor communication Amongst Parties | 3.24 | .08592 | 1.07656 | 9 |
| Inclement Weather | 3.21 | .08763 | 1.09797 | 10 |
| Inflation | 3.17 | .03021 | .37857 | 11 |
| Changes to Initial Design | 3.15 | .09767 | 1.22378 | 12 |
| Under-estimating Project complexity | 3.13 | .07235 | .90650 | 13 |
| Charging of "Land Dues" by Locals (illegally) | 3.10 | .13829 | 1.73273 | 14 |
| Over Measurements | 3.10 | .05252 | .65812 | 14 |
| Delay in Agreeing Variation/Day Works | 3.05 | .05175 | .64843 | 16 |
| Contractor/Owner Dispute | 3.01 | .06128 | .76784 | 17 |
| Shortage of Key Skilled Labour | 2.85 | .06892 | .86355 | 18 |
| Long Period of Honouring Certificates by Client | 2.64 | .07342 | .91995 | 19 |
| Bad Relationship Between Main and Sub Contractor | 2.45 | .06021 | .75443 | 20 |
| Strikes, Internal and External Military Actions | 2.41 | .07288 | .91318 | 21 |
| Under Measurements | 2.36 | .04795 | .60078 | 22 |
| Civil Disturbance | 2.20 | .17863 | 2.23819 | 23 |
| Change Orders | 1.82 | .14705 | 1.84259 | 24 |
| Poor Design | 1.43 | .04632 | .58038 | 25 |
| Problem with Foundation | 1.36 | .06063 | .75966 | 26 |
| Client's Insolvency | 1.22 | .05057 | .63366 | 27 |
| Compliance With New Regulations | 1.17 | .05435 | .68105 | 28 |
| Failure of Subcontractors | 0.91 | .07472 | .93628 | 29 |
| Geotechnical Issues | 0.82 | .06548 | .82044 | 30 |
| Archaeological Remains | 0.17 | .05435 | .68105 | 31 |

Source: field survey, 2014.

Table 4.11: Impact of Risk Factors on Cash-out Forecasts.

| Risk Factors | Mean | | Std. Deviation | Rank |
|---|---|---|---|---|
| | Statistic | Std. Error | Statistic | |
| Increased Duration of the Project | 4.46 | 0.0575 | 0.7208 | 1 |
| Change in Currency Exchange Rates | 4.32 | 0.0613 | 0.7682 | 2 |
| High Cost of Materials | 4.06 | 0.0334 | 0.4188 | 3 |
| Delay in Payment from Client | 3.90 | 0.0441 | 0.5522 | 4 |
| Shortage of Key Plant Items | 3.83 | 0.0375 | 0.4693 | 5 |
| Delay in Settling Claims | 3.77 | 0.0371 | 0.4651 | 6 |
| Replacement of Defective Works | 3.69 | 0.0657 | 0.8232 | 7 |
| Variations | 3.35 | 0.068 | 0.8539 | 8 |
| Delay in Agreeing Variation/Day Works | 3.25 | 0.0369 | 0.4621 | 9 |
| Poor communication Amongst Parties | 3.22 | 0.0865 | 1.0837 | 10 |
| Inflation | 3.17 | 0.0315 | 0.3951 | 11 |
| Inclement Weather | 3.17 | 0.0947 | 1.1867 | 11 |
| Changes to Initial Design | 3.14 | 0.0975 | 1.2219 | 13 |
| Over Measurements | 3.11 | 0.0547 | 0.6848 | 14 |
| Charging of "Land Dues" by Locals (illegally) | 3.10 | 0.1388 | 1.7386 | 15 |
| Contractor/Owner Dispute | 3.01 | 0.0610 | 0.7637 | 16 |
| Under-estimating Project complexity | 2.96 | 0.0651 | 0.8156 | 17 |
| Shortage of Key Skilled Labour | 2.89 | 0.0603 | 0.7560 | 18 |

| | | | | |
|---|---|---|---|---|
| Long Period of Honouring Certificates by Client | 2.64 | 0.0745 | 0.9338 | 19 |
| Strikes, Internal and External Military Actions | 2.49 | 0.0674 | 0.8444 | 20 |
| Under Measurements | 2.45 | 0.0530 | 0.6641 | 21 |
| Bad Relationship Between Main and Sub Contractor | 2.33 | 0.0567 | 0.7106 | 22 |
| Civil Disturbance | 2.20 | 0.1788 | 2.2401 | 23 |
| Change Orders | 1.85 | 0.1494 | 1.8714 | 24 |
| Poor Design | 1.50 | 0.0562 | 0.7040 | 25 |
| Problem with Foundation | 1.39 | 0.0637 | 0.7978 | 26 |
| Client's Insolvency | 1.18 | 0.0515 | 0.6455 | 27 |
| Compliance With New Regulations | 1.00 | 0.0383 | 0.4804 | 28 |
| Failure of Subcontractors | 0.96 | 0.0818 | 1.02460 | 29 |
| Geotechnical Issues | 0.84 | 0.0685 | 0.8587 | 30 |
| Archaeological Remains | 0.12 | 0.0446 | 0.5587 | 31 |

Source: field survey, 2014.

Table 4.12: Occurence of Risk Factors in cash-in Forecasts across Project Types

| Risk Factors | Mean | | Std. Deviation | Rank |
|---|---|---|---|---|
| | Statistic | Std. Error | Statistic | |
| Increased Duration of the Project | 4.46 | 0.0575 | 0.7208 | 1 |
| Change in Currency Exchange Rates | 4.32 | 0.0613 | 0.7682 | 2 |
| High Cost of Materials | 4.06 | 0.0334 | 0.4188 | 3 |
| Delay in Payment from Client | 3.90 | 0.0441 | 0.5522 | 4 |
| Shortage of Key Plant Items | 3.83 | 0.0375 | 0.4693 | 5 |
| Delay in Settling Claims | 3.77 | 0.0371 | 0.4651 | 6 |
| Replacement of Defective Works | 3.69 | 0.0657 | 0.8232 | 7 |
| Variations | 3.35 | 0.068 | 0.8539 | 8 |
| Delay in Agreeing Variation/Day Works | 3.25 | 0.0369 | 0.4621 | 9 |
| Poor communication Amongst Parties | 3.22 | 0.0865 | 1.0837 | 10 |
| Inflation | 3.17 | 0.0315 | 0.3951 | 11 |
| Inclement Weather | 3.17 | 0.0947 | 1.1867 | 11 |
| Changes to Initial Design | 3.14 | 0.0975 | 1.2219 | 13 |
| Over Measurements | 3.11 | 0.0547 | 0.6848 | 14 |
| Charging of "Land Dues" by Locals (illegally) | 3.10 | 0.1388 | 1.7386 | 15 |
| Contractor/Owner Dispute | 3.01 | 0.0610 | 0.7637 | 16 |
| Under-estimating Project complexity | 2.96 | 0.0651 | 0.8156 | 17 |
| Shortage of Key Skilled Labour | 2.89 | 0.0603 | 0.7560 | 18 |

| | | | | |
|---|---|---|---|---|
| Long Period of Honouring Certificates by Client | 2.64 | 0.0745 | 0.9338 | 19 |
| Strikes, Internal and External Military Actions | 2.49 | 0.0674 | 0.8444 | 20 |
| Under Measurements | 2.45 | 0.0530 | 0.6641 | 21 |
| Bad Relationship Between Main and Sub Contractor | 2.33 | 0.0567 | 0.7106 | 22 |
| Civil Disturbance | 2.20 | 0.1788 | 2.2401 | 23 |
| Change Orders | 1.85 | 0.1494 | 1.8714 | 24 |
| Poor Design | 1.50 | 0.0562 | 0.7040 | 25 |
| Problem with Foundation | 1.39 | 0.0637 | 0.7978 | 26 |
| Client's Insolvency | 1.18 | 0.0515 | 0.6455 | 27 |
| Compliance With New Regulations | 1.00 | 0.0383 | 0.4804 | 28 |
| Failure of Subcontractors | 0.96 | 0.0818 | 1.02460 | 29 |
| Geotechnical Issues | 0.84 | 0.0685 | 0.8587 | 30 |
| Archaeological Remains | 0.12 | 0.0446 | 0.5587 | 31 |

Source: field survey, 2014.

Table 4.13: Occurence of Risk Factors in cash-in Forecasts across Project Durations

| | **Less than 12 months** | | **13-24 Months** | | **Above 24 Months** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Accuracy of Estimates | 4.80 | 1 | 4.72 | 2 | 4.45 | 4 | 4.312 | 0.015* |
| Back/Front end Loading | 2.00 | 25 | 1.62 | 27 | 1.43 | 31 | 3.221 | 0.043* |
| Bad Relationship Between Contractor and Consulting Team | 2.00 | 28 | 2.17 | 24 | 2.15 | 23 | 0.284 | 0.753 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Bad Relationship Between Contractor and Owner | 1.40 | 32 | 1.41 | 30 | 1.63 | 27 | 2.384 | 0.096 |
| Bad Relationship Between Main and Sub Contractor | 1.40 | 33 | 1.49 | 29 | 1.55 | 28 | 0.190 | 0.827 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.20 | 6 | 4.27 | 6 | 4.54 | 2 | 2.125 | 0.123 |
| Change in Government Officials | 4.60 | 3 | 4.64 | 3 | 4.49 | 3 | 1.105 | 0.334 |
| Change in Interest Rates | 3.40 | 14 | 3.52 | 16 | 3.17 | 16 | 2.422 | 0.092 |
| Change Orders | 1.00 | 38 | 1.38 | 31 | 1.51 | 30 | 0.267 | 0.766 |
| Changes in Activities' Start Time | 3.00 | 19 | 3.59 | 15 | 3.42 | 14 | 0.870 | 0.421 |
| Changes to Initial Design | 3.00 | 18 | 3.21 | 17 | 3.32 | 15 | 0.677 | 0.509 |
| Civil Disturbance | 1.80 | 29 | 1.06 | 37 | 0.82 | 39 | 3.974 | 0.021* |
| Client's Insolvency | 1.40 | 31 | 1.26 | 33 | 0.88 | 38 | 3.054 | 0.050* |
| Compliance With New Regulations | 2.00 | 26 | 2.12 | 25 | 1.78 | 26 | 1.037 | 0.357 |
| Contractual Specification of Minimum Amount Valuation | 1.00 | 37 | 1.16 | 34 | 1.12 | 33 | 0.021 | 0.979 |
| Delay in Paying Creditors | 4.00 | 7 | 4.14 | 9 | 3.80 | 11 | 2.014 | 0.137 |
| Delay in Payment from Client | 4.40 | 4 | 4.35 | 4 | 4.12 | 8 | 1.183 | 0.309 |
| Delay in Receiving Retention | 4.80 | 2 | 4.74 | 1 | 4.71 | 1 | 0.248 | 0.781 |
| Delay in Releasing Advance Payment | 3.60 | 11 | 4.16 | 8 | 4.32 | 6 | 4.702 | 0.010* |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Discount on Materials Purchased | 3.80 | 8 | 4.01 | 10 | 4.17 | 7 | 2.600 | 0.078 |
| Dispute Between Contractor and Owner | 3.80 | 9 | 3.79 | 12 | 3.92 | 10 | 0.378 | 0.686 |
| Geotechnical Issues | 3.20 | 16 | 2.88 | 21 | 3.09 | 17 | 0.875 | 0.419 |
| Inclement Weather | 2.60 | 21 | 2.91 | 20 | 3.05 | 18 | 0.252 | 0.778 |
| Incompetent Consulting Team | 2.00 | 27 | 1.55 | 28 | 1.92 | 25 | 2.064 | 0.130 |
| Increase in duration of the Project | 4.40 | 5 | 4.19 | 7 | 4.40 | 5 | 0.566 | 0.569 |
| Labour Strikes | 1.20 | 34 | 0.62 | 39 | 1.03 | 36 | 3.048 | 0.050* |
| Large Retention Percentage | 1.20 | 35 | 0.76 | 38 | 0.95 | 37 | 0.835 | 0.436 |
| Listed Buildings | 1.20 | 36 | 1.08 | 36 | 1.40 | 32 | 1.357 | 0.261 |
| Long Interval Between Two Certificates | 2.80 | 20 | 2.69 | 22 | 2.85 | 20 | 0.540 | 0.584 |
| Overheads | 3.20 | 17 | 3.00 | 18 | 2.14 | 24 | 8.139 | 0.000* |
| Period of Honouring Certificates | 1.60 | 30 | 1.29 | 32 | 1.09 | 34 | 0.587 | 0.557 |
| Problems with Foundation | 2.40 | 23 | 2.95 | 19 | 2.25 | 22 | 3.956 | 0.021* |
| Production Time Slippage | 3.40 | 15 | 3.62 | 14 | 2.94 | 19 | 12.301 | 0.000* |
| Receiving Advance Payment | 1.00 | 39 | 1.14 | 35 | 1.09 | 35 | 0.032 | 0.968 |
| Replacement of Defective Work | 2.20 | 24 | 2.49 | 23 | 2.51 | 21 | 0.112 | 0.894 |
| Subcontractor's Insolvency | 0.60 | 40 | 0.36 | 40 | 0.55 | 40 | 0.845 | 0.432 |
| Unavailability of credit facilities | 2.40 | 22 | 1.88 | 26 | 1.54 | 29 | 3.410 | 0.036* |
| Under Valuation | 3.80 | 10 | 3.77 | 13 | 3.57 | 13 | 1.338 | 0.265 |
| Variations | 3.60 | 12 | 3.79 | 11 | 3.57 | 12 | 2.669 | 0.073 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Withholding Tax | 3.60 | 13 | 4.29 | 5 | 3.98 | 9 | 1.816 | 0.166 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.14: Occurence of Risk Factors in cash-in Forecasts across Project Values

| Risk Factors | Less than 50 million Naira Mean | Rank | 50-100 million Naira Mean | Rank | 101-200 million Naira Mean | Rank | Above 200 million Naira Mean | Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|---|---|---|---|
| Accuracy of Estimates | 4.73 | 1 | 4.52 | 2 | 4.69 | 3 | 4.38 | 2 | 2.045 | 0.110 |
| Back/Front end Loading | 1.61 | 27 | 1.63 | 28 | 1.64 | 27 | 1.08 | 38 | 4.633 | 0.004* |
| Bad Relationship Between Contractor and Consulting Team | 2.14 | 24 | 2.20 | 24 | 2.14 | 23 | 2.17 | 25 | 0.140 | 0.936 |
| Bad Relationship Between Contractor and Owner | 1.45 | 29 | 1.50 | 29 | 1.33 | 34 | 1.88 | 28 | 3.294 | 0.022* |
| Bad Relationship Between Main and Sub Contractor | 1.55 | 28 | 1.50 | 30 | 1.36 | 33 | 1.71 | 31 | 0.729 | 0.536 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.41 | 6 | 4.28 | 5 | 4.39 | 5 | 4.38 | 2 | 0.313 | 0.816 |
| Change in Government Officials | 4.69 | 3 | 4.50 | 3 | 4.69 | 2 | 4.25 | 4 | 2.462 | 0.065 |
| Change in Interest Rates | 3.45 | 16 | 3.43 | 15 | 3.47 | 12 | 2.96 | 1.08264 | 19 | 0.158 |
| Change Orders | 1.25 | 33 | 1.43 | 31 | 1.39 | 32 | 1.83 | 1.80980 | 30 | 0.491 |
| Changes in Activities' Start Time | 3.84 | 11 | 3.63 | 14 | 2.78 | 19 | 3.58 | .97431 | 13 | 0.001* |
| Changes to Initial Design | 3.33 | 17 | 3.24 | 17 | 2.94 | 17 | 3.54 | .65801 | 14 | 0.031 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Civil Disturbance | 0.90 | 36 | 1.11 | 33 | 1.03 | 37 | 0.88 | .99181 | 40 | 0.639 |
| Client's Insolvency | 1.31 | 31 | 1.09 | 34 | 0.97 | 38 | 2.17 | 1.73623 | 25 | 0.234 |
| Compliance With New Regulations | 1.86 | 25 | 2.11 | 25 | 1.92 | 24 | 1.54 | 2.10546 | 33 | 0.558 |
| Contractual Specification of Minimum Amount Valuation | 0.88 | 37 | 1.30 | 32 | 1.11 | 35 | 3.71 | 1.30148 | 11 | 0.366 |
| Delay in Paying Creditors | 4.35 | 7 | 4.13 | 9 | 3.42 | 13 | 4.17 | 5 | 5.443 | 0.001* |
| Delay in Payment from Client | 4.55 | 5 | 4.26 | 6 | 3.86 | 9 | 4.42 | 1 | 3.422 | 0.019* |
| Delay in Receiving Retention | 4.71 | 2 | 4.80 | 1 | 4.83 | 1 | 4.17 | 5 | 2.412 | 0.069 |
| Delay in Releasing Advance Payment | 4.24 | 8 | 4.24 | 7 | 4.14 | 7 | 3.88 | 10 | 0.334 | 0.801 |
| Discount on Materials Purchased | 4.16 | 10 | 4.04 | 10 | 4.08 | 8 | 3.67 | 12 | 1.555 | 0.203 |
| Dispute Between Contractor and Owner | 3.76 | 12 | 3.78 | 11 | 4.14 | 6 | 3.04 | 18 | 2.715 | 0.047* |
| Geotechnical Issues | 2.92 | 20 | 2.93 | 20 | 3.06 | 15 | 3.25 | 17 | 0.228 | 0.876 |
| Inclement Weather | 3.12 | 18 | 3.15 | 18 | 2.25 | 22 | 1.58 | 32 | 3.047 | 0.031* |
| Incompetent Consulting Team | 1.29 | 32 | 1.67 | 27 | 2.47 | 21 | 4.08 | 7 | 8.107 | 0.000* |
| Increase in duration of the Project | 4.24 | 9 | 4.13 | 8 | 4.64 | 4 | 1.00 | 39 | 1.958 | 0.123 |
| Labour Strikes | 0.39 | 40 | 0.65 | 38 | 1.53 | 29 | 1.17 | 36 | 7.787 | 0.000* |
| Large Retention Percentage | 0.61 | 38 | 0.54 | 39 | 1.44 | 31 | 1.88 | 28 | 5.183 | 0.002* |
| Listed Buildings | 0.90 | 35 | 1.07 | 36 | 1.47 | 30 | 2.63 | 23 | 3.867 | 0.011* |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Long Interval Between Two Certificates | 2.63 | 23 | 2.83 | 21 | 2.94 | 18 | 2.38 | 24 | 0.834 | 0.477 |
| Overheads | 2.84 | 21 | 2.72 | 22 | 2.53 | 20 | 1.92 | 27 | 0.774 | 0.510 |
| Period of Honouring Certificates | 1.39 | 30 | 1.09 | 35 | 0.72 | 39 | 2.79 | 22 | 6.378 | 0.000* |
| Problems with Foundation | 3.02 | 19 | 2.96 | 19 | 1.58 | 28 | 2.88 | 20 | 7.202 | 0.000* |
| Production Time Slippage | 3.67 | 15 | 3.39 | 16 | 3.03 | 16 | 1.38 | 34 | 6.132 | 0.001* |
| Receiving Advance Payment | 1.22 | 34 | 1.00 | 37 | 1.03 | 36 | 2.83 | 21 | 0.914 | 0.436 |
| Replacement of Defective Work | 2.67 | 22 | 2.61 | 23 | 1.83 | 25 | 1.13 | 37 | 3.249 | 0.024* |
| Subcontractor's Insolvency | 0.45 | 39 | 0.24 | 40 | 0.31 | 40 | 1.17 | 35 | 4.950 | 0.003* |
| Unavailability of credit facilities | 1.86 | 26 | 1.87 | 26 | 1.81 | 26 | 3.46 | 15 | 2.812 | 0.041* |
| Under Valuation | 3.75 | 14 | 3.72 | 12 | 3.67 | 11 | 3.33 | 16 | 0.573 | 0.634 |
| Variations | 3.76 | 13 | 3.70 | 13 | 3.78 | 10 | 3.96 | 8 | 2.460 | 0.065 |
| Withholding Tax | 4.59 | 4 | 4.33 | 4 | 3.33 | 14 | 3.95 | 9 | 8.330 | 0.000* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.15: Occurence of Risk Factors in cash-in Forecasts across organisations' annual turn over.

| | **Below 100m** | | **101-200m** | | **201-300m** | | **301-400m** | | **401-500m** | | **Above 500m** | | **Sig.** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Accuracy of Estimates | 5.00 | 1 | 5.00 | 1 | 4.86 | 1 | 4.00 | 9 | 3.69 | 12 | 5.00 | 1 | 57.050 | 0.000* |
| Back/Front end Loading | 1.72 | 27 | 2.00 | 24 | 1.86 | 28 | 0.97 | 34 | 1.31 | 29 | 1.00 | 27 | 21.425 | 0.000* |
| Bad Relationship Between Contractor and Consulting Team | 2.00 | 25 | 2.00 | 26 | 2.00 | 27 | 2.63 | 25 | 2.19 | 24 | 2.00 | 23 | 10.271 | 0.000* |
| Bad Relationship Between Contractor and Owner | 1.00 | 33 | 1.00 | 32 | 1.14 | 33 | 2.09 | 28 | 2.31 | 21 | 2.00 | 24 | 56.802 | 0.000* |
| Bad Relationship Between Main and Sub Contractor | 1.00 | 34 | 1.00 | 33 | 1.14 | 34 | 2.37 | 27 | 1.81 | 25 | 2.00 | 25 | 25.844 | 0.000* |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.28 | 8 | 4.00 | 6 | 3.81 | 10 | 5.00 | 1 | 4.69 | 2 | 5.00 | 2 | 28.155 | 0.000* |
| Change in Government Officials | 4.72 | 4 | 5.00 | 2 | 4.72 | 4 | 4.17 | 6 | 3.63 | 14 | 5.00 | 3 | 19.003 | 0.000* |
| Change in Interest Rates | 4.00 | 10 | 4.00 | 7 | 4.00 | 8 | 2.89 | 22 | 2.94 | 18 | 1.00 | 28 | 231.530 | 0.000* |
| Change Orders | 0.28 | 36 | 0.87 | 34 | 0.60 | 36 | 3.74 | 14 | 1.31 | 30 | 1.00 | 30 | 37.168 | 0.000* |
| Changes in Activities' Start Time | 4.28 | 9 | 1.48 | 28 | 3.81 | 11 | 4.17 | 7 | 3.75 | 10 | 4.00 | 11 | 74.042 | 0.000* |
| Changes to Initial Design | 3.28 | 16 | 2.16 | 23 | 3.00 | 20 | 4.00 | 10 | 3.69 | 13 | 4.00 | 10 | 122.729 | 0.000* |
| Civil Disturbance | 2.00 | 24 | 1.00 | 29 | 1.23 | 31 | 0.17 | 39 | 0.94 | 37 | 1.00 | 29 | 21.084 | 0.000* |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Client's Insolvency | 1.00 | 29 | 1.00 | 30 | 2.21 | 26 | 0.37 | 38 | 1.00 | 36 | 0.00 | 37 | 43.600 | 0.000* |
| Compliance With New Regulations | 1.72 | 28 | 2.00 | 25 | 2.37 | 24 | 2.89 | 21 | 1.06 | 34 | 0.00 | 38 | 26.358 | 0.000* |
| Contractual Specification of Minimum Amount Valuation | 0.28 | 35 | 0.84 | 35 | 0.84 | 35 | 3.14 | 17 | 0.31 | 39 | 0.00 | 39 | 19.927 | 0.000* |
| Delay in Paying Creditors | 4.72 | 5 | 2.48 | 20 | 4.58 | 5 | 4.17 | 8 | 3.94 | 9 | 4.00 | 12 | 24.670 | 0.000* |
| Delay in Payment from Client | 4.72 | 6 | 3.32 | 13 | 4.77 | 2 | 3.74 | 13 | 4.56 | 3 | 5.00 | 4 | 19.756 | 0.000* |
| Delay in Receiving Retention | 4.72 | 7 | 5.00 | 3 | 4.77 | 3 | 4.60 | 3 | 4.06 | 8 | 5.00 | 5 | 7.476 | 0.000* |
| Delay in Releasing Advance Payment | 4.00 | 11 | 4.00 | 8 | 3.81 | 12 | 5.00 | 2 | 4.31 | 5 | 4.00 | 13 | 68.260 | 0.000* |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Discount on Materials Purchased | 4.00 | 12 | 4.00 | 9 | 3.86 | 9 | 4.37 | 4 | 4.19 | 7 | 4.00 | 14 | 6.080 | 0.000* |
| Dispute Between Contractor and Owner | 3.28 | 17 | 4.81 | 5 | 3.65 | 17 | 4.00 | 11 | 3.50 | 15 | 3.00 | 20 | 24.475 | 0.000* |
| Geotechnical Issues | 3.00 | 19 | 3.13 | 15 | 2.91 | 21 | 1.77 | 29 | 4.56 | 4 | 4.00 | 15 | 82.142 | 0.000* |
| Inclement Weather | 3.28 | 18 | 0.48 | 36 | 2.86 | 22 | 3.89 | 12 | 3.75 | 11 | 5.00 | 7 | 113.863 | 0.000* |
| Incompetent Consulting Team | 1.00 | 30 | 3.52 | 12 | 1.19 | 32 | 1.43 | 31 | 1.75 | 26 | 1.00 | 32 | 45.337 | 0.000* |
| Increase in duration of the Project | 5.00 | 2 | 5.00 | 4 | 4.12 | 7 | 2.91 | 20 | 4.81 | 1 | 5.00 | 6 | 32.064 | 0.000* |
| Labour Strikes | 0.00 | 37 | 2.52 | 18 | 0.37 | 38 | 0.17 | 40 | 0.94 | 38 | 1.00 | 33 | 43.152 | 0.000* |
| Large Retention Percentage | 0.00 | 38 | 2.52 | 19 | 0.37 | 39 | 0.69 | 36 | 0.25 | 40 | 1.00 | 34 | 29.078 | 0.000* |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Listed Buildings | 0.00 | 39 | 1.68 | 27 | 0.42 | 37 | 2.66 | 24 | 1.00 | 35 | 1.00 | 35 | 34.128 | 0.000* |
| Long Interval Between Two Certificates | 3.00 | 20 | 3.00 | 16 | 3.05 | 19 | 2.46 | 26 | 3.44 | 16 | 1.00 | 31 | 22.055 | 0.000* |
| Overheads | 3.00 | 21 | 3.00 | 17 | 3.72 | 13 | 1.00 | 33 | 1.25 | 32 | 4.00 | 16 | 89.951 | 0.000* |
| Period of Honouring Certificates | 1.00 | 31 | 0.16 | 39 | 1.60 | 29 | 1.34 | 32 | 1.63 | 28 | 2.00 | 22 | 8.895 | 0.000* |
| Problems with Foundation | 3.00 | 22 | 0.48 | 37 | 3.40 | 18 | 3.06 | 19 | 2.25 | 22 | 4.00 | 17 | 33.188 | 0.000* |
| Production Time Slippage | 4.00 | 13 | 3.16 | 14 | 3.72 | 14 | 2.86 | 23 | 2.19 | 23 | 4.00 | 18 | 19.171 | 0.000* |
| Receiving Advance Payment | 1.00 | 32 | 1.00 | 31 | 1.33 | 30 | 1.46 | 30 | 1.31 | 31 | 0.00 | 40 | 3.764 | 0.003* |
| Replacement of Defective Work | 3.00 | 23 | 0.48 | 38 | 2.30 | 25 | 3.71 | 15 | 3.13 | 17 | 3.00 | 21 | 59.812 | 0.000* |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subcontractor's Insolvency | 0.00 | 40 | 0.00 | 40 | 0.28 | 40 | 0.54 | 37 | 1.69 | 27 | 1.00 | 36 | 9.429 | 0.000* |
| Unavailability of credit facilities | 1.72 | 26 | 2.32 | 22 | 2.51 | 23 | 0.89 | 35 | 1.13 | 33 | 1.00 | 26 | 23.611 | 0.000* |
| Under Valuation | 4.00 | 14 | 4.00 | 10 | 3.72 | 15 | 3.11 | 18 | 2.63 | 20 | 5.00 | 8 | 32.745 | 0.000* |
| Variations | 4.00 | 15 | 4.00 | 11 | 3.72 | 16 | 3.40 | 16 | 2.94 | 19 | 4.00 | 19 | 10.927 | 0.000* |
| Withholding Tax | 5.00 | 3 | 2.48 | 21 | 4.53 | 6 | 4.20 | 5 | 4.31 | 6 | 5.00 | 9 | 27.051 | 0.000* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.16: Occurence of Risk Factors in cash-in Forecasts across Projects' Client.

| Risk Factors | Federal Government Mean | Rank | State Government Mean | Rank | F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|
| Accuracy of Estimates | 4.54 | 2 | 4.67 | 3 | 1.20 | 0.30 |
| Back/Front end Loading | 1.46 | 32 | 1.63 | 27 | 1.77 | 0.17 |
| Bad Relationship Between Contractor and Consulting Team | 2.22 | 24 | 2.10 | 24 | 1.15 | 0.32 |
| Bad Relationship Between Contractor and Owner | 1.54 | 29 | 1.47 | 30 | 0.81 | 0.45 |
| Bad Relationship Between Main and Sub Contractor | 1.55 | 28 | 1.49 | 29 | 0.52 | 0.60 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.42 | 4 | 4.31 | 6 | 0.76 | 0.47 |
| Change in Government Officials | 4.43 | 3 | 4.71 | 2 | 3.46 | 0.03* |
| Change in Interest Rates | 3.27 | 17 | 3.49 | 15 | 1.47 | 0.23 |
| Change Orders | 1.76 | 27 | 1.07 | 34 | 3.53 | 0.03* |
| Changes in Activities' Start Time | 3.42 | 14 | 3.57 | 14 | 0.46 | 0.63 |
| Changes to Initial Design | 3.30 | 16 | 3.19 | 17 | 0.50 | 0.61 |
| Civil Disturbance | 1.01 | 35 | 0.96 | 36 | 0.08 | 0.92 |
| Client's Insolvency | 0.87 | 37 | 1.35 | 33 | 5.75 | 0.00* |
| Compliance With New Regulations | 2.08 | 25 | 1.89 | 26 | 0.51 | 0.60 |
| Contractual Specification of Minimum Amount Valuation | 1.49 | 31 | 0.79 | 39 | 3.35 | 0.04* |
| Delay in Paying Creditors | 3.80 | 11 | 4.15 | 9 | 2.63 | 0.08 |
| Delay in Payment from Client | 4.05 | 7 | 4.46 | 4 | 4.03 | 0.02* |
| Delay in Receiving Retention | 4.69 | 1 | 4.75 | 1 | 0.44 | 0.65 |
| Delay in Releasing Advance | 4.22 | 5 | 4.19 | 8 | 0.18 | 0.84 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Payment | | | | | | |
| Discount on Materials Purchased | 4.04 | 8 | 4.10 | 10 | 0.35 | 0.70 |
| Dispute Between Contractor and Owner | 3.80 | 10 | 3.89 | 11 | 0.28 | 0.76 |
| Geotechnical Issues | 3.07 | 18 | 2.86 | 20 | 0.92 | 0.40 |
| Inclement Weather | 2.98 | 19 | 2.92 | 18 | 0.03 | 0.97 |
| Incompetent Consulting Team | 1.86 | 26 | 1.58 | 28 | 1.39 | 0.25 |
| Increase in duration of the Project | 4.18 | 6 | 4.39 | 5 | 0.70 | 0.50 |
| Labour Strikes | 0.86 | 38 | 0.81 | 38 | 0.53 | 0.59 |
| Large Retention Percentage | 0.88 | 36 | 0.88 | 37 | 0.50 | 0.61 |
| Listed Buildings | 1.46 | 33 | 1.00 | 35 | 3.54 | 0.03* |
| Long Interval Between Two Certificates | 2.64 | 21 | 2.89 | 19 | 1.39 | 0.25 |
| Overheads | 2.61 | 22 | 2.69 | 21 | 0.47 | 0.63 |
| Period of Honouring Certificates | 1.02 | 34 | 1.46 | 32 | 2.50 | 0.09 |
| Problems with Foundation | 2.80 | 20 | 2.43 | 22 | 1.32 | 0.27 |
| Production Time Slippage | 3.34 | 15 | 3.28 | 16 | 0.64 | 0.53 |
| Receiving Advance Payment | 0.86 | 39 | 1.46 | 31 | 5.20 | 0.01* |
| Replacement of Defective Work | 2.57 | 23 | 2.40 | 23 | 0.40 | 0.67 |
| Subcontractor's Insolvency | 0.47 | 40 | 0.46 | 40 | 0.20 | 0.82 |
| Unavailability of credit facilities | 1.54 | 30 | 1.94 | 25 | 4.47 | 0.01* |
| Under Valuation | 3.66 | 13 | 3.68 | 12 | 0.16 | 0.86 |
| Variations | 3.67 | 12 | 3.68 | 13 | 0.23 | 0.79 |
| Withholding Tax | 4.04 | 9 | 4.21 | 7 | 0.85 | 0.43 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.17: Impact of Risk Factors on cash-in Forecasts across Project Types

| Risk Factors | Commercial Mean | Commercial Rank | Hospital Mean | Hospital Rank | Residential Mean | Residential Rank | Public/Community Mean | Public/Community Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|---|---|---|---|
| Accuracy of Estimates | 4.55 | 1 | 4.83 | 1 | 5.00 | 1 | 4.67 | 1 | 1.290 | 0.280 |
| Back/Front end Loading | 4.52 | 2 | 4.74 | 2 | 4.71 | 2 | 4.62 | 2 | 0.403 | 0.751 |
| Bad Relationship Between Contractor and Consulting Team | 4.50 | 3 | 4.65 | 3 | 4.71 | 3 | 4.56 | 3 | 5.750 | 0.001* |
| Bad Relationship Between Contractor and Owner | 4.42 | 4 | 4.30 | 4 | 4.57 | 4 | 4.43 | 4 | 0.665 | 0.575 |
| Bad Relationship Between Main and Sub Contractor | 4.36 | 5 | 4.22 | 5 | 4.43 | 5 | 4.27 | 5 | 0.851 | 0.468 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.31 | 6 | 4.04 | 6 | 4.29 | 6 | 4.14 | 6 | 2.149 | 0.096 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Change in Government Officials | 4.27 | 7 | 4.00 | 7 | 4.29 | 6 | 4.13 | 7 | 0.791 | 0.501 |
| Change in Interest Rates | 4.08 | 8 | 3.96 | 8 | 3.86 | 8 | 4.11 | 8 | 0.980 | 0.404 |
| Change Orders | 4.06 | 9 | 3.91 | 9 | 3.71 | 9 | 4.05 | 9 | 0.966 | 0.410 |
| Changes in Activities' Start Time | 3.83 | 10 | 3.87 | 10 | 3.71 | 9 | 4.05 | 10 | 4.703 | 0.004* |
| Changes to Initial Design | 3.66 | 11 | 3.87 | 11 | 3.57 | 11 | 3.87 | 11 | 3.531 | 0.016 |
| Civil Disturbance | 3.47 | 12 | 3.83 | 12 | 3.57 | 11 | 3.84 | 12 | 1.813 | 0.147 |
| Client's Insolvency | 3.45 | 13 | 3.74 | 13 | 3.29 | 13 | 3.83 | 13 | 0.066 | 0.978 |
| Compliance With New Regulations | 3.39 | 14 | 3.61 | 14 | 3.29 | 14 | 3.60 | 14 | 0.404 | 0.750 |
| Contractual Specification of Minimum Amount | 3.33 | 15 | 3.57 | 15 | 3.14 | 15 | 3.37 | 15 | 0.665 | 0.575 |
| Valuation Delay in Paying Creditors | 3.30 | 16 | 3.26 | 16 | 2.86 | 16 | 3.32 | 16 | 5.568 | 0.001* |
| Delay in Payment from Client | 3.28 | 17 | 3.17 | 17 | 2.86 | 17 | 3.32 | 17 | 1.200 | 0.312 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Delay in Receiving Retention | 3.19 | 18 | 3.04 | 18 | 2.71 | 18 | 3.16 | 18 | 0.432 | 0.730 |
| Delay in Releasing Advance Payment | 3.05 | 19 | 2.96 | 19 | 2.57 | 19 | 3.10 | 19 | 0.672 | 0.571 |
| Discount on Materials Purchased | 3.00 | 20 | 2.96 | 20 | 2.57 | 20 | 2.70 | 20 | 1.234 | 0.299 |
| Dispute Between Contractor and Owner | 2.86 | 21 | 2.48 | 21 | 2.57 | 21 | 2.54 | 21 | 4.627 | 0.004* |
| Geotechnical Issues | 2.78 | 22 | 2.26 | 22 | 2.29 | 22 | 2.49 | 22 | 3.837 | 0.011* |
| Inclement Weather | 2.59 | 23 | 2.13 | 23 | 1.86 | 23 | 2.44 | 23 | 5.215 | 0.002* |
| Incompetent Consulting Team | 2.31 | 24 | 2.13 | 24 | 1.71 | 24 | 2.33 | 24 | 4.879 | 0.003* |
| Increase in duration of the Project | 2.23 | 25 | 2.13 | 25 | 1.71 | 25 | 2.11 | 25 | 2.223 | 0.088 |
| Labour Strikes | 1.95 | 26 | 1.96 | 26 | 1.71 | 26 | 1.86 | 26 | 5.222 | 0.002* |
| Large Retention Percentage | 1.66 | 27 | 1.74 | 27 | 1.71 | 27 | 1.68 | 27 | 3.986 | 0.009 |
| Listed Buildings | 1.63 | 28 | 1.61 | 28 | 1.43 | 28 | 1.65 | 28 | 0.300 | 0.826 |
| Long Interval | 1.61 | 29 | 1.39 | 29 | 1.29 | 29 | 1.65 | 28 | 1.435 | 0.235 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Between Two Certificates | | | | | | | | | | |
| Overheads | 1.58 | 30 | 1.35 | 30 | 1.29 | 30 | 1.63 | 30 | 1.759 | 0.157 |
| Period of Honouring Certificates | 1.41 | 31 | 1.30 | 31 | 1.29 | 31 | 1.51 | 31 | 1.835 | 0.143 |
| Problems with Foundation | 1.28 | 32 | 1.30 | 32 | 1.14 | 32 | 1.46 | 32 | 5.548 | 0.001* |
| Production Time | 1.11 | 33 | 1.22 | 33 | 1.00 | 33 | 1.35 | 33 | 0.492 | 0.688 |
| Slippage | | | | | | | | | | |
| Receiving Advance Payment | 0.98 | 34 | 1.22 | 34 | 1.00 | 34 | 1.33 | 34 | 0.609 | 0.610 |
| Replacement of Defective Work | 0.97 | 35 | 1.17 | 35 | 0.86 | 35 | 1.25 | 35 | 9.077 | 0.000* |
| Subcontractor's Insolvency | 0.97 | 36 | 1.09 | 36 | 0.71 | 36 | 1.13 | 36 | 1.166 | 0.325 |
| Unavailability of credit facilities | 0.94 | 37 | 1.04 | 37 | 0.71 | 37 | 1.00 | 37 | 1.181 | 0.319 |
| Under Valuation | 0.89 | 38 | 1.00 | 38 | 0.57 | 38 | 0.83 | 38 | 3.596 | 0.015* |
| Variations | 0.63 | 39 | 1.00 | 39 | 0.57 | 39 | 0.78 | 39 | 0.908 | 0.439 |
| Withholding Tax | 0.36 | 40 | 0.35 | 40 | 0.14 | 40 | 0.40 | 40 | 4.301 | 0.006* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.18: Impact of Risk Factors on cash-in Forecasts across Project Durations

| Risk Factors | Less than 12 months Mean | Rank | 13-24 Months Mean | Rank | Above 24 Months Mean | Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|---|---|
| Accuracy of Estimates | 4.80 | 1 | 4.72 | 1 | 4.43 | 4 | 3.125 | 0.028* |
| Back/Front end Loading | 2.00 | 25 | 1.65 | 3 | 1.46 | 31 | 3.901 | 0.010* |
| Bad Relationship Between Contractor and Consulting Team | 2.20 | 23 | 2.26 | 33 | 2.18 | 24 | 0.232 | 0.874 |
| Bad Relationship Between Contractor and Owner | 1.80 | 30 | 1.50 | 34 | 2.34 | 22 | 0.717 | 0.543 |
| Bad Relationship Between Main and Sub Contractor | 1.60 | 31 | 1.57 | 35 | 1.63 | 28 | 0.116 | 0.950 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.20 | 6 | 4.23 | 4 | 4.51 | 3 | 6.073 | 0.001* |
| Change in Government Officials | 4.60 | 2 | 4.67 | 5 | 4.51 | 2 | 2.457 | 0.065 |
| Change in Interest Rates | 3.40 | 13 | 3.52 | 6 | 3.18 | 16 | 1.757 | 0.158 |
| Change Orders | 1.00 | 39 | 1.34 | 13 | 1.45 | 32 | 0.171 | 0.916 |
| Changes in Activities' Start Time | 3.00 | 20 | 3.56 | 8 | 3.28 | 15 | 0.885 | 0.450 |
| Changes to Initial Design | 3.00 | 19 | 3.17 | 7 | 3.31 | 14 | 0.586 | 0.625 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Civil Disturbance | 1.40 | 33 | 1.03 | 9 | 0.74 | 39 | 4.270 | 0.006* |
| Client's Insolvency | 1.40 | 34 | 1.26 | 10 | 0.88 | 38 | 2.039 | 0.111 |
| Compliance With New Regulations | 2.00 | 26 | 2.15 | 11 | 1.83 | 27 | 3.133 | 0.027* |
| Contractual Specification of Minimum Amount Valuation | 1.00 | 38 | 1.13 | 12 | 1.06 | 35 | 0.918 | 0.434 |
| Delay in Paying Creditors | 4.00 | 7 | 4.16 | 14 | 3.77 | 10 | 3.501 | 0.017* |
| Delay in Payment from Client | 4.40 | 3 | 4.38 | 15 | 4.11 | 7 | 1.535 | 0.208 |
| Delay in Receiving Retention | 4.40 | 4 | 4.69 | 16 | 4.52 | 1 | 2.097 | 0.103 |
| Delay in Releasing Advance Payment | 3.40 | 14 | 3.94 | 17 | 3.91 | 8 | 0.643 | 0.588 |
| Discount on Materials Purchased | 3.80 | 9 | 4.01 | 18 | 4.22 | 6 | 6.002 | 0.001* |
| Dispute Between Contractor and Owner | 3.60 | 12 | 3.67 | 19 | 3.75 | 11 | 0.270 | 0.847 |
| Geotechnical Issues | 3.20 | 17 | 2.88 | 21 | 3.09 | 18 | 1.003 | 0.393 |
| Inclement Weather | 2.60 | 22 | 2.86 | 22 | 2.97 | 20 | 0.243 | 0.866 |
| Incompetent Consulting Team | 2.00 | 27 | 1.55 | 24 | 1.89 | 26 | 1.208 | 0.309 |
| Increase in duration of the Project | 4.40 | 5 | 4.19 | 20 | 4.38 | 5 | 0.815 | 0.488 |
| Labour Strikes | 1.50 | 32 | 0.65 | 25 | 1.02 | 36 | 2.284 | 0.082 |
| Large Retention Percentage | 1.80 | 28 | 0.93 | 26 | 1.18 | 33 | 1.505 | 0.216 |
| Listed Buildings | 1.40 | 35 | 1.23 | 27 | 1.63 | 29 | 1.554 | 0.203 |
| Long Interval Between Two | 3.40 | 15 | 2.93 | 23 | 3.11 | 17 | 0.913 | 0.436 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Certificates | | | | | | | | |
| Overheads | 3.20 | 18 | 3.00 | 28 | 2.29 | 23 | 5.630 | 0.001* |
| Period of Honouring Certificates | 1.40 | 36 | 1.21 | 29 | 0.98 | 37 | 1.336 | 0.265 |
| Problems with Foundation | 1.80 | 29 | 2.71 | 30 | 1.98 | 25 | 2.925 | 0.036 |
| Production Time Slippage | 3.40 | 16 | 3.62 | 31 | 3.03 | 19 | 6.778 | 0.000* |
| Receiving Advance Payment | 1.20 | 37 | 1.15 | 32 | 1.08 | 34 | 1.995 | 0.117 |
| Replacement of Defective Work | 2.20 | 24 | 2.59 | 36 | 2.54 | 21 | 0.172 | 0.915 |
| Subcontractor's Insolvency | 0.40 | 40 | 0.28 | 37 | 0.55 | 40 | 1.562 | 0.201 |
| Unavailability of credit facilities | 2.60 | 21 | 1.93 | 2 | 1.62 | 30 | 3.027 | 0.031* |
| Under Valuation | 3.80 | 10 | 3.79 | 38 | 3.45 | 13 | 2.570 | 0.056 |
| Variations | 4.00 | 8 | 3.88 | 39 | 3.63 | 12 | 3.345 | 0.021* |
| Withholding Tax | 3.80 | 11 | 4.30 | 40 | 3.91 | 9 | 2.449 | 0.066 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.19: Impact of Risk Factors on cash-in Forecasts across Project Values

| | Less than 50 million Naira | | 50-100 million Naira | | 101-200 million Naira | | Above 200 million Naira | | F | Sig. |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Accuracy of Estimates | 4.73 | 2 | 4.52 | 3 | 4.69 | 2 | 4.33 | 2 | 2.619 | 0.053 |
| Back/Front end Loading | 1.67 | 28 | 1.65 | 28 | 1.67 | 28 | 1.08 | 36 | 5.824 | 0.001* |
| Bad Relationship Between Contractor and Consulting Team | 2.22 | 25 | 2.22 | 24 | 2.17 | 23 | 2.33 | 23 | 0.397 | 0.756 |
| Bad Relationship Between Contractor and Owner | 2.33 | 24 | 1.57 | 29 | 1.50 | 32 | 1.96 | 27 | 0.557 | 0.644 |
| Bad Relationship Between Main and Sub Contractor | 1.63 | 29 | 1.57 | 30 | 1.42 | 33 | 1.88 | 28 | 1.237 | 0.298 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.35 | 7 | 4.26 | 6 | 4.36 | 5 | 4.38 | 1 | 0.214 | 0.886 |
| Change in Government Officials | 4.75 | 1 | 4.52 | 2 | 4.69 | 3 | 4.25 | 3 | 3.206 | 0.025* |
| Change in Interest Rates | 3.47 | 16 | 3.46 | 15 | 3.44 | 12 | 2.96 | 19 | 1.943 | 0.125 |
| Change Orders | 1.27 | 33 | 1.48 | 31 | 1.19 | 34 | 1.67 | 29 | 0.469 | 0.704 |
| Changes in Activities' Start Time | 3.78 | 12 | 3.54 | 14 | 2.75 | 19 | 3.42 | 15 | 5.668 | 0.001* |
| Changes to Initial Design | 3.25 | 17 | 3.24 | 17 | 2.94 | 18 | 3.54 | 12 | 3.379 | 0.020* |
| Civil Disturbance | 0.90 | 36 | 1.02 | 36 | 0.89 | 38 | 0.88 | 39 | 0.399 | 0.754 |
| Client's Insolvency | 1.31 | 31 | 1.09 | 34 | 1.00 | 36 | 0.83 | 40 | 1.539 | 0.207 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Compliance With New Regulations | 1.92 | 26 | 2.13 | 25 | 1.97 | 24 | 2.17 | 25 | 0.383 | 0.765 |
| Contractual Specification of Minimum Amount Valuation | 0.82 | 37 | 1.26 | 32 | 1.06 | 35 | 1.54 | 33 | 1.051 | 0.372 |
| Delay in Paying Creditors | 4.41 | 6 | 4.11 | 8 | 3.39 | 13 | 3.67 | 9 | 6.340 | 0.000* |
| Delay in Payment from Client | 4.57 | 5 | 4.28 | 5 | 3.89 | 8 | 4.13 | 4 | 3.639 | 0.014* |
| Delay in Receiving Retention | 4.65 | 3 | 4.76 | 1 | 4.75 | 1 | 3.96 | 7 | 7.306 | 0.000* |
| Delay in Releasing Advance Payment | 4.00 | 10 | 4.02 | 10 | 3.81 | 10 | 3.63 | 10 | 0.973 | 0.407 |
| Discount on Materials Purchased | 4.16 | 9 | 4.04 | 9 | 4.08 | 6 | 4.00 | 6 | 0.894 | 0.446 |
| Dispute Between Contractor and Owner | 3.63 | 15 | 3.70 | 12 | 3.97 | 7 | 3.46 | 13 | 1.530 | 0.209 |
| Geotechnical Issues | 2.92 | 19 | 2.93 | 20 | 3.08 | 17 | 3.00 | 18 | 0.231 | 0.875 |
| Inclement Weather | 3.06 | 18 | 3.09 | 18 | 2.19 | 22 | 3.21 | 16 | 3.524 | 0.017* |
| Incompetent Consulting Team | 1.27 | 32 | 1.70 | 27 | 2.42 | 21 | 1.58 | 32 | 7.669 | 0.000* |
| Increase in duration of the Project | 4.24 | 8 | 4.11 | 7 | 4.64 | 4 | 4.08 | 5 | 1.840 | 0.142 |
| Labour Strikes | 0.34 | 40 | 0.72 | 38 | 1.58 | 30 | 1.05 | 37 | 6.917 | 0.000* |
| Large Retention Percentage | 0.73 | 38 | 0.72 | 39 | 1.64 | 29 | 1.67 | 30 | 5.840 | 0.001* |
| Listed Buildings | 1.06 | 35 | 1.24 | 33 | 1.69 | 27 | 2.08 | 26 | 4.160 | 0.007* |
| Long Interval Between Two Certificates | 2.86 | 20 | 3.02 | 19 | 3.19 | 15 | 3.08 | 17 | 1.175 | 0.321 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Overheads | 2.84 | 21 | 2.72 | 21 | 2.64 | 20 | 2.63 | 22 | 0.249 | 0.862 |
| Period of Honouring Certificates | 1.33 | 30 | 1.07 | 35 | 0.58 | 39 | 1.67 | 31 | 4.939 | 0.003* |
| Problems with Foundation | 2.78 | 22 | 2.65 | 23 | 1.50 | 31 | 2.29 | 24 | 5.751 | 0.001* |
| Production Time Slippage | 3.67 | 14 | 3.43 | 16 | 3.14 | 16 | 2.88 | 21 | 5.694 | 0.001* |
| Receiving Advance Payment | 1.22 | 34 | 1.02 | 37 | 1.00 | 37 | 1.42 | 34 | 0.801 | 0.495 |
| Replacement of Defective Work | 2.69 | 23 | 2.70 | 22 | 1.92 | 25 | 2.96 | 20 | 3.457 | 0.018* |
| Subcontractor's Insolvency | 0.37 | 39 | 0.26 | 40 | 0.31 | 40 | 0.92 | 38 | 2.264 | 0.083 |
| Unavailability of credit facilities | 1.92 | 27 | 1.89 | 26 | 1.86 | 26 | 1.33 | 35 | 1.903 | 0.131 |
| Under Valuation | 3.75 | 13 | 3.57 | 13 | 3.69 | 11 | 3.46 | 14 | 0.590 | 0.623 |
| Variations | 3.86 | 11 | 3.72 | 11 | 3.83 | 9 | 3.58 | 11 | 0.856 | 0.466 |
| Withholding Tax | 4.59 | 4 | 4.33 | 4 | 3.28 | 14 | 3.92 | 8 | 10.340 | 0.000* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.20: Impact of Risk Factors on cash-in Forecasts across Annual Turnover

| | **Below 100m** | | **101-200m** | | **201-300m** | | **301-400m** | | **401-500m** | | **Above 500m** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | | | | | F STAT | (P.Values) |
| Accuracy of Estimates | 5.00 | 1 | 5.00 | 1 | 4.86 | 1 | 4.00 | 9 | 3.63 | 11 | 5.00 | 1 | 53.785 | 0.781 |
| Back/Front end Loading | 2.00 | 25 | 2.00 | 24 | 1.86 | 28 | 0.97 | 34 | 1.31 | 31 | 1.00 | 27 | 26.179 | 0.477 |
| Bad Relationship Between Contractor and Consulting Team | 2.00 | 28 | 2.00 | 26 | 2.00 | 27 | 2.63 | 25 | 1.94 | 25 | 3.00 | 22 | 18.324 | 0.064 |
| Bad Relationship Between Contractor and Owner | 1.00 | 33 | 1.00 | 32 | 1.19 | 32 | 2.09 | 28 | 4.81 | 1 | 3.00 | 23 | 3.902 | 0.082 |
| Bad Relationship Between Main and Sub Contractor | 1.00 | 34 | 1.00 | 33 | 1.14 | 34 | 2.37 | 27 | 1.75 | 27 | 3.00 | 24 | 40.413 | 0.076 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.00 | 8 | 4.00 | 6 | 3.81 | 11 | 5.00 | 1 | 4.69 | 3 | 5.00 | 2 | 32.491 | 0.871 |
| Change in Government Officials | 5.00 | 2 | 5.00 | 2 | 4.72 | 3 | 4.17 | 6 | 3.56 | 13 | 5.00 | 3 | 23.815 | 0.674 |
| Change in Interest Rates | 4.00 | 9 | 4.00 | 7 | 4.00 | 8 | 2.89 | 22 | 3.00 | 19 | 1.00 | 28 | 279.920 | 0.091 |
| Change Orders | 0.00 | 36 | 0.87 | 34 | 0.60 | 36 | 3.74 | 14 | 1.13 | 36 | 1.00 | 30 | 41.041 | 0.678 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Changes in Activities' Start Time | 4.00 | 10 | 1.48 | 28 | 3.81 | 12 | 4.17 | 7 | 3.31 | 17 | 4.00 | 11 | 56.114 | 0.712 |
| Changes to Initial Design | 3.00 | 16 | 2.16 | 23 | 3.00 | 20 | 4.00 | 10 | 3.75 | 9 | 4.00 | 10 | 164.817 | 0.871 |
| Civil Disturbance | 2.00 | 26 | 1.00 | 29 | 1.14 | 33 | 0.17 | 39 | 0.63 | 38 | 1.00 | 29 | 48.028 | 0.613 |
| Client's Insolvency | 1.00 | 29 | 1.00 | 30 | 2.21 | 26 | 0.37 | 38 | 1.00 | 37 | 0.00 | 35 | 43.896 | 0.441 |
| Compliance With New Regulations | 2.00 | 27 | 2.00 | 25 | 2.37 | 24 | 2.89 | 21 | 1.13 | 34 | 0.00 | 36 | 26.124 | 0.073 |
| Contractual Specification of Minimum Amount Valuation | 0.00 | 35 | 0.84 | 35 | 0.84 | 35 | 3.14 | 17 | 0.19 | 40 | 0.00 | 37 | 21.697 | 0.718 |
| Delay in Paying Creditors | 5.00 | 3 | 2.48 | 20 | 4.58 | 5 | 4.17 | 8 | 3.63 | 10 | 4.00 | 12 | 26.714 | 0.672 |
| Delay in Payment from Client | 5.00 | 4 | 3.32 | 13 | 4.77 | 2 | 3.74 | 13 | 4.38 | 5 | 5.00 | 4 | 22.224 | 0.087 |
| Delay in Receiving Retention | 5.00 | 5 | 5.00 | 3 | 4.72 | 4 | 4.60 | 3 | 3.56 | 12 | 4.00 | 13 | 14.281 | 0.882 |
| Delay in Releasing Advance Payment | 4.00 | 11 | 4.00 | 8 | 3.91 | 9 | 5.00 | 2 | 3.75 | 8 | 1.00 | 31 | 292.301 | 0.491 |
| Discount on Materials Purchased | 4.00 | 12 | 4.00 | 9 | 3.86 | 10 | 4.37 | 4 | 4.38 | 6 | 4.00 | 14 | 8.948 | 0.875 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dispute Between Contractor and Owner | 3.00 | 17 | 4.81 | 5 | 3.65 | 17 | 4.00 | 11 | 3.31 | 16 | 2.00 | 25 | 50.053 | 0.785 |
| Geotechnical Issues | 3.00 | 18 | 3.13 | 15 | 2.91 | 21 | 1.77 | 29 | 4.56 | 4 | 4.00 | 15 | 82.142 | 0.074 |
| Inclement Weather | 3.00 | 19 | 0.48 | 36 | 2.86 | 22 | 3.89 | 12 | 3.50 | 14 | 5.00 | 6 | 114.683 | 0.704 |
| Incompetent Consulting Team | 1.00 | 30 | 3.52 | 12 | 1.19 | 31 | 1.43 | 31 | 1.63 | 28 | 1.00 | 32 | 48.257 | 0.087 |
| Increase in duration of the Project | 5.00 | 6 | 5.00 | 4 | 4.12 | 7 | 2.91 | 20 | 4.75 | 2 | 5.00 | 5 | 31.566 | 0.771 |
| Labour Strikes | 0.00 | 37 | 2.52 | 18 | 0.42 | 37 | 0.17 | 40 | 1.13 | 35 | | 40 | 37.335 | 0.081 |
| Large Retention Percentage | 0.00 | 38 | 2.52 | 19 | 0.42 | 38 | 0.69 | 36 | 0.44 | 39 | 3.00 | 20 | 35.183 | 0.065 |
| Listed Buildings | 0.00 | 39 | 1.68 | 27 | 0.37 | 39 | 2.66 | 24 | 1.19 | 33 | 3.00 | 21 | 48.407 | 0.0721 |
| Long Interval Between Two Certificates | 3.00 | 20 | 3.00 | 16 | 3.05 | 19 | 2.46 | 26 | 3.38 | 15 | 4.00 | 16 | 9.756 | 0.078 |
| Overheads | 3.00 | 21 | 3.00 | 17 | 3.72 | 14 | 1.00 | 33 | 1.88 | 26 | 4.00 | 17 | 84.059 | 0.777 |
| Period of Honouring Certificates | 1.00 | 31 | 0.16 | 39 | 1.60 | 29 | 1.34 | 32 | 1.56 | 29 | 1.00 | 33 | 7.272 | 0.089 |
| Problems with Foundation | 3.00 | 22 | 0.48 | 37 | 3.40 | 18 | 3.06 | 19 | 2.31 | 22 | 1.00 | 34 | 33.124 | 0.061 |
| Production Time Slippage | 4.00 | 13 | 3.16 | 14 | 3.72 | 15 | 2.86 | 23 | 2.56 | 21 | 4.00 | 18 | 13.830 | 0.679 |
| Receiving Advance | 1.00 | 32 | 1.00 | 31 | 1.37 | 30 | 1.46 | 30 | 1.25 | 32 | 0.00 | 38 | 3.808 | 0.811 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Payment | | | | | | | | | | | | | | |
| Replacement of Defective Work | 3.00 | 23 | 0.48 | 38 | 2.26 | 25 | 3.71 | 15 | 3.06 | 18 | 4.00 | 19 | 66.670 | 0.066 |
| Subcontractor's Insolvency | 0.00 | 40 | 0.00 | 40 | 0.28 | 40 | 0.54 | 37 | 2.06 | 24 | 0.00 | 39 | 13.520 | 0.091 |
| Unavailability of credit facilities | 2.00 | 24 | 2.32 | 22 | 2.56 | 23 | 0.89 | 35 | 1.31 | 30 | 1.00 | 26 | 21.967 | 0.902 |
| Under Valuation | 4.00 | 14 | 4.00 | 10 | 3.72 | 16 | 3.11 | 18 | 2.25 | 23 | 5.00 | 7 | 28.603 | 0.850 |
| Variations | 4.00 | 15 | 4.00 | 11 | 3.77 | 13 | 3.40 | 16 | 2.81 | 20 | 5.00 | 8 | 25.848 | 0.771 |
| Withholding Tax | 5.00 | 7 | 2.48 | 21 | 4.58 | 6 | 4.20 | 5 | 4.00 | 7 | 5.00 | 9 | 30.083 | 0.888 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.21: Impact of Risk Factors on cash-in Forecasts across Nature of Client

| | **Federal Government** | | **State Government** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Accuracy of Estimates | 4.54 | 2 | 4.65 | 2 | 0.976 | 0.379 |
| Back/Front end Loading | 1.52 | 32 | 1.63 | 28 | 0.951 | 0.389 |
| Bad Relationship Between Contractor and Consulting Team | 2.28 | 24 | 2.17 | 24 | 0.835 | 0.436 |
| Bad Relationship Between Contractor and Owner | 1.66 | 27 | 2.11 | 25 | 0.381 | 0.684 |
| Bad Relationship Between Main and Sub Contractor | 1.66 | 28 | 1.54 | 30 | 0.762 | 0.469 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment) | 4.36 | 4 | 4.31 | 6 | 0.336 | 0.715 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Change in Government Officials | 4.48 | 3 | 4.71 | 1 | 2.356 | 0.098 |
| Change in Interest Rates | 3.27 | 16 | 3.50 | 15 | 1.641 | 0.197 |
| Change Orders | 1.66 | 29 | 1.07 | 35 | 2.601 | 0.077 |
| Changes in Activities' Start Time | 3.33 | 15 | 3.51 | 14 | 0.675 | 0.511 |
| Changes to Initial Design | 3.25 | 17 | 3.19 | 17 | 0.211 | 0.810 |
| Civil Disturbance | 0.95 | 35 | 0.90 | 37 | 0.110 | 0.896 |
| Client's Insolvency | 0.88 | 38 | 1.33 | 33 | 5.236 | 0.006* |
| Compliance With New Regulations | 2.14 | 25 | 1.90 | 27 | 0.802 | 0.450 |
| Contractual Specification of Minimum Amount Valuation | 1.41 | 33 | 0.79 | 38 | 2.535 | 0.083 |
| Delay in Paying Creditors | 3.81 | 10 | 4.14 | 8 | 2.215 | 0.113 |
| Delay in Payment from Client | 4.10 | 6 | 4.43 | 4 | 2.799 | 0.064 |
| Delay in Receiving Retention | 4.61 | 1 | 4.57 | 3 | 0.327 | 0.722 |
| Delay in Releasing Advance Payment | 3.89 | 9 | 3.92 | 10 | 0.019 | 0.982 |
| Discount on Materials Purchased | 4.05 | 7 | 4.13 | 9 | 0.626 | 0.536 |
| Dispute Between Contractor and Owner | 3.63 | 12 | 3.78 | 11 | 0.554 | 0.576 |
| Geotechnical Issues | 3.07 | 18 | 2.86 | 20 | 0.919 | 0.401 |
| Inclement Weather | 2.88 | 20 | 2.90 | 19 | 0.010 | 0.990 |
| Incompetent Consulting Team | 1.84 | 26 | 1.57 | 29 | 1.428 | 0.243 |
| Increase in duration of the Project | 4.19 | 5 | 4.36 | 5 | 0.478 | 0.621 |
| Labour Strikes | 0.91 | 37 | 0.79 | 39 | 0.557 | 0.574 |
| Large Retention Percentage | 1.17 | 34 | 1.00 | 36 | 0.862 | 0.424 |
| Listed Buildings | 1.65 | 30 | 1.18 | 34 | 3.564 | 0.031* |
| Long Interval Between Two Certificates | 2.95 | 19 | 3.10 | 18 | 0.581 | 0.561 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Overheads | 2.63 | 22 | 2.82 | 21 | 0.820 | 0.442 |
| Period of Honouring Certificates | 0.94 | 36 | 1.35 | 32 | 2.341 | 0.100 |
| Problems with Foundation | 2.47 | 23 | 2.24 | 23 | 0.926 | 0.398 |
| Production Time Slippage | 3.37 | 14 | 3.32 | 16 | 0.595 | 0.553 |
| Receiving Advance Payment | 0.88 | 39 | 1.44 | 31 | 4.471 | 0.013* |
| Replacement of Defective Work | 2.70 | 21 | 2.40 | 22 | 0.972 | 0.380 |
| Subcontractor's Insolvency | 0.41 | 40 | 0.42 | 40 | 0.145 | 0.865 |
| Unavailability of credit facilities | 1.61 | 31 | 2.00 | 26 | 3.860 | 0.023* |
| Under Valuation | 3.59 | 13 | 3.68 | 13 | 0.299 | 0.742 |
| Variations | 3.78 | 11 | 3.75 | 12 | 0.122 | 0.885 |
| Withholding Tax | 4.01 | 8 | 4.19 | 7 | 0.959 | 0.385 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.22: Occurence of Risk Factors in cash-out Forecasts across Project Types

| | Commercial | | Hospital | | Residential | | Public/Community | | F | Sig. |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Archaeological Remains | 0.21 | 31 | 0.25 | 31 | 0.00 | 31 | 0.13 | 31 | 0.394 | 0.757 |
| Bad Relationship Between Main and Sub Contractor | 2.48 | 20 | 2.08 | 24 | 2.86 | 18 | 2.51 | 20 | 2.811 | 0.041* |
| Change in Currency Exchange Rates | 4.06 | 2 | 4.46 | 1 | 4.71 | 1 | 4.44 | 2 | 3.996 | 0.009* |
| Change Orders | 1.21 | 26 | 2.54 | 20 | 2.86 | 17 | 2.03 | 24 | 4.917 | 0.003* |
| Changes to Initial Design | 3.37 | 10 | 2.88 | 14 | 2.57 | 19 | 3.10 | 16 | 1.636 | 0.183 |
| Charging of "Land Dues" by Locals (illegally) | 3.21 | 11 | 2.46 | 21 | 2.86 | 16 | 3.27 | 11 | 1.436 | 0.235 |
| Civil Disturbance | 1.43 | 24 | 3.13 | 10 | 3.57 | 8 | 2.48 | 21 | 5.494 | 0.001* |
| Client's Insolvency | 1.03 | 28 | 1.13 | 28 | 1.71 | 25 | 1.38 | 26 | 5.194 | 0.002* |
| Complince With New Regulations | 1.08 | 27 | 1.21 | 27 | 1.71 | 26 | 1.19 | 28 | 1.941 | 0.125 |
| Contractor/Owner Dispute | 2.81 | 17 | 2.75 | 17 | 3.00 | 13 | 3.32 | 10 | 6.298 | 0.000* |
| Delay in Agreeing Variation/Day Works | 3.11 | 13 | 2.83 | 15 | 2.29 | 22 | 3.16 | 14 | 5.320 | 0.002* |
| Delay in Payment from | 3.79 | 6 | 3.83 | 3 | 3.29 | 10 | 3.56 | 8 | 2.716 | 0.047* |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Client | | | | | | | | | | |
| Delay in Settling Claims | 3.68 | 8 | 3.75 | 4 | 3.29 | 9 | 3.49 | 9 | 2.955 | 0.034* |
| Failure of Subcontractors | 1.00 | 29 | 0.75 | 30 | 0.43 | 30 | 0.94 | 30 | 1.063 | 0.367 |
| Geotechnical Issues | 0.63 | 30 | 0.88 | 29 | 0.71 | 29 | 1.00 | 29 | 2.204 | 0.090 |
| High Cost of Materials | 3.83 | 4 | 3.75 | 5 | 4.00 | 4 | 4.22 | 3 | 7.106 | 0.000* |
| Inclement Weather | 3.57 | 9 | 3.00 | 13 | 2.43 | 21 | 3.02 | 17 | 4.722 | 0.004* |
| Increased Duration of the Project | 4.67 | 1 | 4.25 | 2 | 4.29 | 3 | 4.48 | 1 | 3.072 | 0.030* |
| Inflation | 3.16 | 12 | 3.04 | 11 | 3.00 | 14 | 3.25 | 12 | 2.511 | 0.061 |
| Long Period of Honouring Certificates by Client | 2.48 | 21 | 2.63 | 19 | 2.43 | 20 | 2.84 | 19 | 1.824 | 0.145 |
| Over Measurements | 3.03 | 15 | 3.04 | 12 | 3.14 | 12 | 3.17 | 13 | 0.561 | 0.641 |
| Poor communication Amongst Parties | 2.97 | 16 | 2.79 | 16 | 3.29 | 11 | 3.68 | 7 | 7.003 | 0.000* |
| Poor Design | 1.43 | 23 | 1.42 | 26 | 1.29 | 27 | 1.46 | 25 | 0.201 | 0.895 |
| Problem with Foundation | 1.37 | 25 | 1.83 | 25 | 1.00 | 28 | 1.21 | 27 | 4.819 | 0.003* |
| Replacement of Defective Works | 3.79 | 5 | 3.29 | 8 | 4.00 | 5 | 3.81 | 6 | 3.465 | 0.018* |
| Shortage of Key Plant Items | 3.71 | 7 | 3.54 | 7 | 4.00 | 6 | 3.89 | 4 | 2.060 | 0.108 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Shortage of Key Skilled Labour | 2.79 | 18 | 2.71 | 18 | 3.00 | 15 | 2.94 | 18 | 0.581 | 0.629 |
| Strikes, Internal and External Military Actions | 2.41 | 22 | 2.42 | 22 | 2.00 | 24 | 2.46 | 22 | 0.529 | 0.663 |
| Under Measurements | 2.60 | 19 | 2.38 | 23 | 2.29 | 23 | 2.13 | 23 | 7.464 | 0.000* |
| Under-estimating Project complexity | 3.08 | 14 | 3.21 | 9 | 3.71 | 7 | 3.10 | 15 | 1.127 | 0.340 |
| Variations | 3.83 | 3 | 3.71 | 6 | 4.71 | 2 | 3.87 | 5 | 3.167 | 0.026* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.23: Occurence of Risk Factors in cash-out Forecasts across Project Durations

| | Less than 12 months | | 13-24 Months | | Above 24 Months | | F | Sig. |
|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Archaeological Remains | 0.60 | 31 | 0.17 | 1 | 0.09 | 31 | 7.547 | 0.000* |
| Bad Relationship Between Main and Sub Contractor | 2.00 | 24 | 2.35 | 24 | 2.63 | 19 | 3.773 | 0.012* |
| Change in Currency Exchange Rates | 4.20 | 1 | 4.35 | 2 | 4.28 | 2 | 1.127 | 0.340 |
| Change Orders | 2.00 | 23 | 2.07 | 5 | 1.49 | 25 | 1.570 | 0.199 |
| Changes to Initial Design | 2.80 | 15 | 2.99 | 3 | 3.42 | 11 | 2.775 | 0.043* |
| Charging of "Land Dues" by Locals (illegally) | 2.00 | 22 | 2.88 | 4 | 3.51 | 10 | 2.910 | 0.036* |
| Civil Disturbance | 2.40 | 19 | 2.51 | 6 | 1.82 | 23 | 1.547 | 0.205 |
| Client's Insolvency | 1.00 | 29 | 1.26 | 7 | 1.18 | 27 | 0.394 | 0.757 |
| Compliance With New Regulations | 1.20 | 10 | 1.16 | 8 | 1.15 | 28 | 2.495 | 0.062 |
| Contractor/Owner Dispute | 3.00 | 11 | 2.92 | 9 | 3.14 | 14 | 1.013 | 0.389 |
| Delay in Agreeing Variation/Day Works | 3.00 | 3 | 3.07 | 10 | 3.03 | 17 | 0.056 | 0.982 |
| Delay in Payment from Client | 4.00 | 5 | 3.67 | 12 | 3.68 | 7 | 0.743 | 0.528 |
| Delay in Settling Claims | 3.80 | 30 | 3.60 | 11 | 3.58 | 8 | 0.682 | 0.564 |
| Failure of Subcontractors | 1.00 | 27 | 0.84 | 14 | 0.97 | 29 | 1.973 | 0.120 |
| Geotechnical Issues | 1.20 | 4 | 0.84 | 15 | 0.74 | 30 | 3.053 | 0.030* |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| High Cost of Materials | 4.00 | 12 | 3.97 | 16 | 4.02 | 3 | 1.045 | 0.375 |
| Inclement Weather | 3.00 | 9 | 3.12 | 17 | 3.38 | 13 | 2.219 | 0.088 |
| Increased Duration ofthe Project | 4.20 | 17 | 4.47 | 13 | 4.62 | 1 | 3.129 | 0.027* |
| Inflation | 3.20 | 13 | 3.20 | 18 | 3.14 | 15 | 0.375 | 0.771 |
| Long Period of Honouring Certificates by Client | 2.60 | 14 | 2.81 | 29 | 2.42 | 22 | 2.436 | 0.067 |
| Over Measurements | 3.00 | 28 | 3.15 | 19 | 3.06 | 16 | 3.881 | 0.010* |
| Poor communication Amongst Parties | 3.00 | 25 | 3.06 | 20 | 3.52 | 9 | 2.947 | 0.035* |
| Poor Design | 1.20 | 6 | 1.35 | 21 | 1.55 | 24 | 2.177 | 0.093 |
| Problem with Foundation | 1.40 | 7 | 1.44 | 22 | 1.23 | 26 | 1.205 | 0.310 |
| Replacement of Defective Works | 3.40 | 6 | 3.67 | 23 | 3.88 | 6 | 6.078 | 0.001 |
| Shortage of Key Plant Items | 3.40 | 17 | 3.71 | 25 | 3.92 | 5 | 8.733 | 0.000* |
| Shortage of Key Skilled Labour | 2.60 | 16 | 2.77 | 26 | 3.02 | 18 | 5.218 | 0.002* |
| Strikes, Internal and External Military Actions | 2.40 | 20 | 2.40 | 27 | 2.48 | 20 | 2.516 | 0.060 |
| Under Measurements | 2.40 | 21 | 2.30 | 28 | 2.45 | 21 | 0.833 | 0.478 |
| Under-estimating Project complexity | 2.60 | 18 | 2.99 | 30 | 3.38 | 12 | 3.676 | 0.014* |
| Variations | 3.40 | 8 | 3.80 | 31 | 4.00 | 4 | 1.802 | 0.149 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.24: Occurence of Risk Factors in cash-out Forecasts across Project Values

| Risk Factors | Less than 50 million Naira Mean | Rank | 50-100 million Naira Mean | Rank | 101-200 million Naira Mean | Rank | Above 200 million Naira Mean | Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|---|---|---|---|
| Archaeological Remains | 0.08 | 31 | 0.16 | 31 | 0.11 | 31 | 4.43 | 1 | 2.551 | .058 |
| Bad Relationship Between Main and Sub Contractor | 2.38 | 22 | 2.49 | 20 | 2.59 | 20 | 4.13 | 2 | 1.106 | .349 |
| Change in Currency Exchange Rates | 4.40 | 2 | 4.13 | 2 | 4.49 | 1 | 3.78 | 3 | 2.186 | .092 |
| Change Orders | 2.10 | 24 | 1.62 | 24 | 2.16 | 24 | 3.65 | 4 | 2.582 | .056 |
| Changes to Initial Design | 3.21 | 13 | 3.29 | 10 | 2.86 | 16 | 3.61 | 5 | .907 | .439 |
| Charging of "Land Dues" by Locals (illegally) | 2.98 | 15 | 3.18 | 13 | 2.86 | 17 | 3.61 | 6 | 1.000 | .395 |
| Civil Disturbance | 2.60 | 21 | 1.93 | 23 | 2.65 | 19 | 3.48 | 7 | 3.125 | .028* |
| Client's Insolvency | 1.19 | 27 | 1.20 | 27 | 1.43 | 25 | 3.43 | 8 | 2.857 | .039* |
| Compliance With New Regulations | 1.02 | 28 | 1.11 | 28 | 1.41 | 26 | 3.43 | 9 | 2.653 | .051 |
| Contractor/Owner Dispute | 2.96 | 16 | 2.89 | 17 | 3.05 | 11 | 3.39 | 10 | 1.628 | .185 |
| Delay in Agreeing Variation/Day Works | 3.17 | 14 | 3.18 | 12 | 2.68 | 18 | 3.39 | 11 | 5.952 | .001* |
| Delay in Payment from | 3.83 | 5 | 3.71 | 7 | 3.49 | 8 | 3.30 | 12 | 2.080 | .105 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Client | | | | | | | | | | |
| Delay in Settling Claims | 3.75 | 6 | 3.67 | 8 | 3.41 | 9 | 3.26 | 13 | 4.299 | .006* |
| Failure of Subcontractors | 0.75 | 30 | 1.07 | 29 | 0.65 | 30 | 3.17 | 14 | 4.150 | .007* |
| Geotechnical Issues | 0.83 | 29 | 0.78 | 30 | 0.73 | 29 | 3.13 | 15 | .755 | .521 |
| High Cost of Materials | 4.12 | 3 | 4.00 | 3 | 3.97 | 4 | 3.13 | 16 | 3.549 | .016* |
| Inclement Weather | 3.27 | 10 | 3.33 | 9 | 2.95 | 14 | 2.78 | 17 | .969 | .409 |
| Increased Duration of the Project | 4.46 | 1 | 4.64 | 1 | 4.46 | 2 | 2.52 | 18 | .953 | .417 |
| Inflation | 3.23 | 11 | 3.22 | 11 | 3.05 | 12 | 2.48 | 19 | 2.010 | .115 |
| Long Period of Honouring Certificates by Client | 2.73 | 19 | 2.80 | 19 | 2.54 | 21 | 2.30 | 20 | 1.815 | .147 |
| Over Measurements | 3.29 | 9 | 3.09 | 15 | 3.03 | 13 | 2.26 | 21 | 3.521 | .017* |
| Poor communication Amongst Parties | 3.21 | 12 | 3.11 | 14 | 3.30 | 10 | 2.00 | 22 | .633 | .595 |
| Poor Design | 1.37 | 26 | 1.49 | 25 | 1.35 | 27 | 1.61 | 23 | 1.329 | .267 |
| Problem with Foundation | 1.46 | 25 | 1.38 | 26 | 1.16 | 28 | 1.39 | 24 | 1.170 | .323 |
| Replacement of Defective Works | 3.73 | 7 | 3.76 | 6 | 3.89 | 5 | 1.39 | 25 | 1.745 | .160 |
| Shortage of Key Plant Items | 3.85 | 4 | 3.80 | 5 | 3.86 | 6 | 1.26 | 26 | 3.081 | .029* |
| Shortage of Key Skilled Labour | 2.88 | 18 | 2.89 | 18 | 2.95 | 15 | 1.13 | 27 | 1.326 | .268 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Strikes, Internal and External Military Actions | 2.67 | 20 | 2.49 | 21 | 2.22 | 23 | 1.04 | 28 | 3.850 | .011 |
| Under Measurements | 2.31 | 23 | 2.38 | 22 | 2.35 | 22 | 1.00 | 29 | .438 | .726 |
| Under-estimating Project complexity | 2.94 | 17 | 2.91 | 16 | 3.51 | 7 | 0.96 | 30 | 4.786 | .003* |
| Variations | 3.56 | 8 | 3.87 | 4 | 4.35 | 3 | 0.52 | 31 | 8.353 | .000* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.25: Occurence of Risk Factors in cash-out Forecasts across Annual Turnover of Organisations.

| | **Below 100m** | | **101-200m** | | **201-300m** | | **301-400m** | | **401-500m** | | **Above 500m** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Archaeological Remains | 0.17 | 31 | 0.42 | 31 | 0.00 | 31 | 0.00 | 29 | 0.38 | 29 | 0.00 | 28 | 2.554 | .070 |
| Bad Relationship Between Main and Sub Contractor | 2.83 | 16 | 1.70 | 24 | 2.90 | 18 | 2.91 | 19 | 2.50 | 20 | 2.00 | 22 | 29.358 | .090 |
| Change in Currency Exchange Rates | 4.17 | 2 | 4.16 | 1 | 4.81 | 2 | 4.00 | 4 | 3.94 | 5 | 5.00 | 1 | 9.123 | .066 |
| Change Orders | 2.72 | 18 | 2.40 | 17 | 3.71 | 9 | 0.00 | 30 | 0.25 | 30 | 1.00 | 23 | 40.802 | .071 |
| Changes to Initial Design | 2.33 | 21 | 2.58 | 14 | 2.19 | 19 | 4.00 | 5 | 3.94 | 6 | 5.00 | 2 | 43.112 | .081 |
| Charging of "Land Dues" by Locals (illegally) | 1.06 | 26 | 2.30 | 20 | 1.81 | 26 | 4.94 | 2 | 4.38 | 2 | 5.00 | 3 | 89.176 | .067 |
| Civil Disturbance | 2.67 | 19 | 3.19 | 11 | 4.61 | 3 | 0.00 | 31 | 0.25 | 31 | 1.00 | 24 | 47.213 | .071 |
| Client's Insolvency | 1.17 | 25 | 1.42 | 26 | 1.90 | 24 | 0.97 | 26 | 1.00 | 27 | 0.00 | 29 | 53.330 | .771 |
| Compliance With New Regulations | 1.00 | 28 | 1.28 | 28 | 1.90 | 25 | 0.94 | 27 | 1.19 | 26 | 0.00 | 30 | 34.673 | .401 |
| Contractor/Owner Dispute | 3.00 | 15 | 2.35 | 18 | 3.00 | 14 | 3.89 | 11 | 2.94 | 18 | 3.00 | 14 | 29.860 | .511 |
| Delay in Agreeing Variation/Day Works | 3.22 | 14 | 3.00 | 13 | 2.10 | 21 | 3.89 | 12 | 3.06 | 15 | 3.00 | 15 | 130.833 | .612 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Delay in Payment from Client | 3.94 | 5 | 3.86 | 5 | 3.10 | 11 | 3.11 | 15 | 4.13 | 4 | 5.00 | 4 | 97.419 | .821 |
| Delay in Settling Claims | 4.00 | 4 | 3.86 | 4 | 3.10 | 10 | 3.11 | 14 | 4.13 | 3 | 4.00 | 7 | 56.863 | .441 |
| Failure of Subcontractors | 0.33 | 30 | 0.79 | 30 | 0.10 | 30 | 1.86 | 24 | 1.31 | 25 | 1.00 | 25 | 24.465 | .541 |
| Geotechnical Issues | 1.06 | 27 | 0.91 | 29 | 0.90 | 29 | 0.94 | 28 | 0.63 | 28 | 0.00 | 31 | 3.929 | .332 |
| High Cost of Materials | 3.72 | 6 | 4.12 | 3 | 4.00 | 5 | 4.00 | 6 | 3.81 | 9 | 4.00 | 8 | 1.481 | .199 |
| Inclement Weather | 3.33 | 10 | 2.51 | 15 | 2.19 | 20 | 4.00 | 7 | 3.63 | 11 | 5.00 | 6 | 56.732 | .188 |
| Increased Duration ofthe Project | 4.56 | 1 | 4.14 | 2 | 4.10 | 4 | 5.00 | 1 | 4.75 | 1 | 5.00 | 5 | 18.372 | .321 |
| Inflation | 3.33 | 13 | 3.42 | 7 | 3.00 | 15 | 3.03 | 16 | 3.13 | 14 | 3.00 | 16 | 9.085 | .412 |
| Long Period of Honouring Certificates by Client | 2.33 | 20 | 3.28 | 8 | 3.10 | 13 | 2.83 | 21 | 1.44 | 24 | 1.00 | 27 | 59.865 | .477 |
| Over Measurements | 3.56 | 9 | 3.14 | 12 | 3.00 | 16 | 3.03 | 17 | 2.88 | 19 | 3.00 | 17 | 2.538 | .091 |
| Poor communication Amongst Parties | 2.78 | 17 | 2.49 | 16 | 3.00 | 17 | 4.00 | 8 | 3.94 | 7 | 4.00 | 9 | 17.366 | .088 |
| Poor Design | 1.00 | 29 | 1.30 | 27 | 1.00 | 27 | 1.97 | 23 | 2.31 | 21 | 1.00 | 26 | 60.593 | .177 |
| Problem with | 1.33 | 24 | 1.63 | 25 | 1.00 | 28 | 1.06 | 25 | 1.44 | 23 | 2.00 | 21 | 6.605 | .071 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Foundation | | | | | | | | | | | | | | |
| Replacement of Defective Works | 4.06 | 3 | 3.19 | 10 | 4.00 | 6 | 3.97 | 10 | 3.56 | 12 | 4.00 | 10 | 8.755 | .912 |
| Shortage of Key Plant Items | 3.67 | 8 | 3.42 | 6 | 4.00 | 7 | 4.00 | 9 | 3.69 | 10 | 4.00 | 11 | 4.962 | .911 |
| Shortage of Key Skilled Labour | 3.67 | 7 | 2.07 | 22 | 3.10 | 12 | 3.03 | 18 | 3.00 | 16 | 3.00 | 18 | 16.975 | .819 |
| Strikes, Internal and External Military Actions | 2.17 | 23 | 2.21 | 21 | 2.10 | 22 | 2.91 | 20 | 2.25 | 22 | 3.00 | 19 | 5.493 | .677 |
| Under Measurements | 3.33 | 11 | 2.00 | 23 | 2.00 | 23 | 2.09 | 22 | 3.00 | 17 | 3.00 | 20 | 85.139 | .0555 |
| Under-estimating Project complexity | 2.33 | 22 | 2.33 | 19 | 3.90 | 8 | 3.20 | 13 | 3.81 | 8 | 4.00 | 12 | 43.980 | .071 |
| Variations | 3.33 | 12 | 3.28 | 9 | 4.90 | 1 | 4.09 | 3 | 3.44 | 13 | 4.00 | 13 | 43.858 | .067 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.26: Occurence of Risk Factors in cash-out Forecasts and Projects' Client

| Risk Factors | Federal Government Mean | Federal Government Rank | State Government Mean | State Government Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|
| Archaeological Remains | 0.17 | 31 | 0.13 | 31 | 13.180 | .000* |
| Bad Relationship Between Main and Sub Contractor | 2.52 | 20 | 2.37 | 22 | 3.100 | .029* |
| Change in Currency Exchange Rates | 4.23 | 2 | 4.41 | 2 | .863 | .462 |
| Change Orders | 1.64 | 24 | 2.04 | 24 | .943 | .422 |
| Changes to Initial Design | 3.23 | 11 | 3.01 | 15 | 1.228 | .301 |
| Charging of "Land Dues" by Locals (illegally) | 2.96 | 18 | 3.30 | 9 | 1.593 | .193 |
| Civil Disturbance | 1.82 | 23 | 2.65 | 19 | 1.965 | .122 |
| Client's Insolvency | 1.13 | 27 | 1.32 | 26 | 1.290 | .280 |
| Compliance With New Regulations | 1.12 | 28 | 1.21 | 28 | 2.772 | .043* |
| Contractor/Owner Dispute | 3.11 | 15 | 2.94 | 17 | 3.354 | .021* |
| Delay in Agreeing Variation/Day Works | 3.07 | 16 | 3.01 | 16 | .822 | .484 |
| Delay in Payment from Client | 3.71 | 7 | 3.62 | 7 | 1.770 | .155 |
| Delay in Settling Claims | 3.61 | 8 | 3.56 | 8 | .700 | .553 |
| Failure of Subcontractors | 0.96 | 29 | 0.86 | 29 | .477 | .698 |
| Geotechnical Issues | 0.80 | 30 | 0.83 | 30 | 6.282 | .000* |
| High Cost of Materials | 3.94 | 4 | 4.04 | 3 | .853 | .467 |
| Inclement Weather | 3.33 | 10 | 3.06 | 14 | .987 | .400 |
| Increased Duration of the Project | 4.63 | 1 | 4.42 | 1 | 14.488 | .000* |

| | | | | | | |
|---|---|---|---|---|---|---|
| Inflation | 3.16 | 13 | 3.20 | 10 | .352 | .788 |
| Long Period of Honouring Certificates by Client | 2.48 | 21 | 2.80 | 18 | 2.244 | .085 |
| Over Measurements | 3.04 | 17 | 3.17 | 11 | .537 | .658 |
| Poor communication Amongst Parties | 3.43 | 9 | 3.07 | 12 | 4.873 | .003* |
| Poor Design | 1.47 | 25 | 1.38 | 25 | .629 | .597 |
| Problem with Foundation | 1.36 | 26 | 1.28 | 27 | 6.375 | .000* |
| Replacement of Defective Works | 3.76 | 6 | 3.75 | 6 | 2.442 | .066 |
| Shortage of Key Plant Items | 3.78 | 5 | 3.77 | 4 | .558 | .644 |
| Shortage of Key Skilled Labour | 3.12 | 14 | 2.58 | 20 | 7.964 | .000* |
| Strikes, Internal and External Military Actions | 2.29 | 22 | 2.54 | 21 | 1.355 | .259 |
| Under Measurements | 2.52 | 19 | 2.21 | 23 | 5.803 | .001* |
| Under-estimating Project complexity | 3.19 | 12 | 3.07 | 13 | .251 | .861 |
| Variations | 3.96 | 3 | 3.76 | 5 | .990 | .399 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.27: Impact of Risk Factors on cash-out Forecasts across Project Types

| | **Commercial** | | **Hospital** | | **Residential** | | **Public/Community** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Archaeological Remains | 0.10 | 1 | 0.08 | 31 | 0.00 | 31 | 0.17 | 31 | 0.379 | 0.768 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bad Relationship Between Main and Sub Contractor | 2.43 | 24 | 2.04 | 24 | 2.00 | 23 | 2.38 | 22 | 2.395 | 0.071 |
| Change in Currency Exchange Rates | 4.10 | 2 | 4.46 | 1 | 4.71 | 1 | 4.44 | 1 | 3.369 | 0.020* |
| Change Orders | 1.29 | 5 | 2.54 | 21 | 2.86 | 16 | 2.03 | 24 | 4.108 | 0.008* |
| Changes to Initial Design | 3.33 | 3 | 2.88 | 15 | 2.57 | 18 | 3.11 | 15 | 1.431 | 0.236 |
| Charging of "Land Dues" by Locals (illegally) | 3.27 | 4 | 2.46 | 22 | 2.86 | 15 | 3.19 | 13 | 1.403 | 0.244 |
| Civil Disturbance | 1.40 | 6 | 3.13 | 9 | 3.57 | 8 | 2.49 | 21 | 5.782 | 0.001* |
| Client's Insolvency | 1.00 | 7 | 1.04 | 27 | 1.71 | 25 | 1.35 | 26 | 5.475 | 0.001* |
| Compliance With New Regulations | 0.97 | 8 | 0.96 | 28 | 1.29 | 26 | 1.02 | 29 | 1.000 | 0.395 |
| Contractor/Owner Dispute | 2.84 | 9 | 2.67 | 18 | 3.00 | 11 | 3.30 | 11 | 6.281 | 0.000* |
| Delay in Agreeing Variation/Day Works | 3.25 | 10 | 3.00 | 13 | 3.14 | 10 | 3.35 | 10 | 3.608 | 0.015* |
| Delay in Payment from Client | 3.97 | 12 | 4.08 | 3 | 4.00 | 4 | 3.76 | 6 | 2.672 | 0.049* |
| Delay in Settling Claims | 3.79 | 11 | 3.92 | 4 | 4.00 | 3 | 3.67 | 7 | 2.529 | 0.059 |
| Failure of Subcontractors | 1.08 | 14 | 0.75 | 30 | 0.43 | 30 | 0.98 | 30 | 1.267 | 0.288 |
| Geotechnical Issues | 0.62 | 15 | 0.88 | 29 | 0.71 | 29 | 1.06 | 28 | 2.986 | 0.033* |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| High Cost of Materials | 4.00 | 16 | 3.83 | 5 | 4.00 | 5 | 4.22 | 3 | 6.613 | 0.000* |
| Inclement Weather | 3.56 | 17 | 2.92 | 14 | 2.43 | 21 | 2.95 | 17 | 4.478 | 0.005* |
| Increased Duration of the Project | 4.67 | 13 | 4.25 | 2 | 4.29 | 2 | 4.37 | 2 | 3.016 | 0.032* |
| Inflation | 3.17 | 18 | 3.04 | 11 | 3.00 | 12 | 3.24 | 12 | 1.935 | 0.126 |
| Long Period of Honouring Certificates by Client | 2.48 | 29 | 2.63 | 20 | 2.43 | 20 | 2.84 | 19 | 1.769 | 0.156 |
| Over Measurements | 3.08 | 19 | 3.04 | 12 | 3.00 | 13 | 3.17 | 14 | 0.364 | 0.779 |
| Poor communication Amongst Parties | 2.94 | 20 | 2.83 | 16 | 3.29 | 9 | 3.65 | 8 | 6.381 | 0.000* |
| Poor Design | 1.52 | 21 | 1.50 | 26 | 1.29 | 27 | 1.49 | 25 | 0.238 | 0.869 |
| Problem with Foundation | 1.38 | 22 | 1.92 | 25 | 1.00 | 28 | 1.24 | 27 | 5.195 | 0.002* |
| Replacement of Defective Works | 3.71 | 23 | 3.29 | 7 | 4.00 | 6 | 3.78 | 5 | 2.534 | 0.059 |
| Shortage of Key Plant Items | 3.73 | 25 | 3.71 | 6 | 4.00 | 7 | 3.95 | 4 | 3.368 | 0.020* |
| Shortage of Key Skilled Labour | 2.84 | 26 | 2.79 | 17 | 3.00 | 14 | 2.97 | 16 | 0.492 | 0.688 |
| Strikes, Internal and External Military Actions | 2.44 | 27 | 2.63 | 19 | 1.86 | 24 | 2.56 | 20 | 1.727 | 0.164 |
| Under Measurements | 2.76 | 28 | 2.42 | 23 | 2.29 | 22 | 2.16 | 23 | 10.438 | 0.000* |
| Under-estimating | 2.98 | 30 | 3.08 | 10 | 2.57 | 17 | 2.94 | 18 | 0.744 | 0.527 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Project complexity | | | | | | | | | | |
| Variations | 3.48 | 31 | 3.21 | 8 | 2.57 | 19 | 3.37 | 9 | 2.712 | 0.047* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.28: Impact of Risk Factors on cash-out Forecasts across Project Duration

| | **Less than 12 months** | | **13-24 Months** | | **Above 24 Months** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | F STAT | (P.Values) |
| Archaeological Remains | 0.20 | 31 | 0.08 | 31 | 0.15 | 31 | 1.079 | .360 |
| Bad Relationship Between Main and Sub Contractor | 2.40 | 22 | 2.30 | 23 | 2.35 | 22 | .376 | .771 |
| Change in Currency Exchange Rates | 4.20 | 1 | 4.35 | 2 | 4.31 | 2 | 1.072 | .363 |
| Change Orders | 2.00 | 24 | 2.12 | 24 | 1.51 | 25 | 1.663 | .177 |
| Changes to Initial Design | 2.80 | 14 | 2.98 | 14 | 3.42 | 10 | 2.863 | .039* |
| Charging of "Land Dues" by Locals (illegally) | 2.00 | 23 | 2.86 | 17 | 3.52 | 8 | 3.101 | .029* |
| Civil Disturbance | 2.40 | 21 | 2.50 | 20 | 1.82 | 23 | 1.502 | .216 |
| Client's Insolvency | 0.80 | 30 | 1.17 | 27 | 1.23 | 26 | 1.857 | .139 |
| Compliance With New Regulations | 1.00 | 28 | 0.99 | 28 | 1.00 | 29 | 1.475 | .224 |
| Contractor/Owner Dispute | 2.80 | 15 | 2.87 | 15 | 3.22 | 14 | 3.355 | .021* |
| Delay in Agreeing Variation/Day Works | 3.00 | 10 | 3.24 | 9 | 3.28 | 13 | .658 | .579 |
| Delay in Payment from Client | 4.20 | 2 | 3.91 | 4 | 3.88 | 5 | .537 | .658 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Delay in Settling Claims | 3.80 | 5 | 3.77 | 6 | 3.78 | 6 | .942 | .422 |
| Failure of Subcontractors | 1.00 | 29 | 0.84 | 29 | 1.09 | 28 | 2.143 | .097 |
| Geotechnical Issues | 1.20 | 27 | 0.84 | 30 | 0.78 | 30 | 2.568 | .057 |
| High Cost of Materials | 4.20 | 4 | 4.06 | 3 | 4.06 | 3 | .187 | .905 |
| Inclement Weather | 2.80 | 16 | 3.07 | 12 | 3.37 | 11 | 3.517 | .017* |
| Increased Duration of the Project | 4.20 | 3 | 4.48 | 1 | 4.49 | 1 | 1.662 | .178 |
| Inflation | 3.20 | 9 | 3.20 | 10 | 3.14 | 15 | .344 | .793 |
| Long Period of Honouring Certificates by Client | 2.60 | 20 | 2.83 | 18 | 2.40 | 21 | 2.701 | .048* |
| Over Measurements | 3.00 | 11 | 3.17 | 11 | 3.06 | 17 | 3.759 | .012* |
| Poor communication Amongst Parties | 3.00 | 12 | 3.07 | 13 | 3.46 | 9 | 2.166 | .094 |
| Poor Design | 1.40 | 26 | 1.40 | 26 | 1.62 | 24 | 2.863 | .039 |
| Problem with Foundation | 1.60 | 25 | 1.49 | 25 | 1.22 | 27 | 3.063 | .030* |
| Replacement of Defective Works | 3.40 | 7 | 3.67 | 7 | 3.77 | 7 | 4.224 | .007* |
| Shortage of Key Plant Items | 3.80 | 6 | 3.78 | 5 | 3.91 | 4 | 2.019 | .114 |
| Shortage of Key Skilled Labour | 2.80 | 17 | 2.81 | 19 | 3.03 | 18 | 3.286 | .022* |
| Strikes, Internal and External Military Actions | 3.00 | 13 | 2.50 | 21 | 2.43 | 20 | .838 | .475 |
| Under Measurements | 2.60 | 19 | 2.41 | 22 | 2.48 | 19 | .463 | .709 |
| Under-estimating Project complexity | 2.80 | 18 | 2.87 | 16 | 3.09 | 16 | .967 | .410 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Variations | 3.40 | 8 | 3.35 | 8 | 3.35 | 12 | .061 | .980 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.29: Impact of Risk Factors on cash-out Forecasts across Project Values

| Risk Factors | Less than 50 million Naira Mean | Rank | 50-100 million Naira Mean | Rank | 101-200 million Naira Mean | Rank | Above 200 million Naira Mean | Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|---|---|---|---|
| Archaeological Remains | 0.08 | 31 | 0.20 | 31 | 0.05 | 31 | 4.33 | 1 | .649 | .585 |
| Bad Relationship Between Main and Sub Contractor | 2.23 | 23 | 2.44 | 22 | 2.27 | 22 | 4.17 | 2 | .980 | .404 |
| Change in Currency Exchange Rates | 4.40 | 2 | 4.16 | 2 | 4.49 | 1 | 4.04 | 3 | 1.776 | .154 |
| Change Orders | 2.10 | 24 | 1.69 | 24 | 2.19 | 24 | 3.91 | 4 | 2.296 | .080 |
| Changes to Initial Design | 3.21 | 13 | 3.29 | 11 | 2.86 | 18 | 3.69 | 5 | .906 | .440 |
| Charging of "Land Dues" by Locals (illegally) | 2.98 | 15 | 3.16 | 13 | 2.89 | 17 | 3.56 | 6 | .819 | .485 |
| Civil Disturbance | 2.60 | 21 | 1.91 | 23 | 2.65 | 19 | 3.56 | 7 | 3.160 | .026* |
| Client's Insolvency | 1.19 | 27 | 1.18 | 27 | 1.38 | 26 | 3.52 | 8 | 3.653 | .014* |
| Compliance With New Regulations | 0.96 | 28 | 1.04 | 28 | 1.00 | 28 | 3.43 | 9 | .236 | .871 |
| Contractor/Owner Dispute | 2.98 | 16 | 2.96 | 16 | 3.03 | 10 | 3.39 | 10 | .293 | .830 |
| Delay in Agreeing Variation/Day Works | 3.23 | 12 | 3.31 | 9 | 3.16 | 9 | 3.39 | 10 | .841 | .473 |
| Delay in Payment from Client | 3.87 | 4 | 3.89 | 4 | 3.97 | 4 | 3.30 | 12 | .286 | .835 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Delay in Settling Claims | 3.81 | 6 | 3.76 | 6 | 3.86 | 5 | 3.13 | 13 | 2.176 | .093 |
| Failure of Subcontractors | 0.83 | 29 | 1.04 | 29 | 0.81 | 29 | 3.13 | 13 | 1.780 | .153 |
| Geotechnical Issues | 0.83 | 30 | 0.78 | 30 | 0.73 | 30 | 3.13 | 13 | 1.458 | .228 |
| High Cost of Materials | 4.10 | 3 | 4.09 | 3 | 4.00 | 3 | 3.04 | 16 | .457 | .713 |
| Inclement Weather | 3.27 | 10 | 3.31 | 10 | 2.92 | 16 | 2.82 | 17 | .971 | .408 |
| Increased Duration of the Project | 4.46 | 1 | 4.58 | 1 | 4.43 | 2 | 2.73 | 18 | .770 | .512 |
| Inflation | 3.25 | 11 | 3.22 | 12 | 3.03 | 11 | 2.69 | 19 | 2.753 | .045* |
| Long Period of Honouring Certificates by Client | 2.67 | 19 | 2.80 | 19 | 2.59 | 20 | 2.43 | 20 | 1.247 | .295 |
| Over Measurements | 3.31 | 9 | 3.13 | 14 | 2.97 | 14 | 2.43 | 20 | 3.426 | .019* |
| Poor communication Amongst Parties | 3.15 | 14 | 3.11 | 15 | 3.27 | 8 | 2.34 | 22 | .834 | .477 |
| Poor Design | 1.40 | 26 | 1.53 | 25 | 1.41 | 25 | 1.78 | 23 | 1.845 | .141 |
| Problem with Foundation | 1.40 | 25 | 1.42 | 26 | 1.22 | 27 | 1.56 | 24 | .984 | .402 |
| Replacement of Defective Works | 3.71 | 7 | 3.69 | 7 | 3.81 | 7 | 1.34 | 25 | 1.014 | .388 |
| Shortage of Key Plant Items | 3.87 | 5 | 3.82 | 5 | 3.86 | 6 | 1.17 | 26 | .795 | .498 |
| Shortage of Key Skilled Labour | 2.90 | 17 | 2.87 | 17 | 3.00 | 12 | 1.13 | 27 | .582 | .628 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Strikes, Internal and External Military Actions | 2.65 | 20 | 2.51 | 20 | 2.27 | 23 | 1.04 | 28 | 1.546 | .205 |
| Under Measurements | 2.35 | 22 | 2.49 | 21 | 2.38 | 21 | 1.00 | 29 | 1.688 | .172 |
| Under-estimating Project complexity | 2.87 | 18 | 2.84 | 18 | 2.97 | 15 | .82 | 30 | 2.773 | .043* |
| Variations | 3.38 | 8 | 3.58 | 8 | 3.00 | 13 | .17 | 31 | 3.329 | .021* |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.30: Impact of Risk Factors on cash-out Forecasts across Organisations' Annual Turnover

| | **North East** | | **North Central** | | **North West** | | **South West** | | **South East** | | **South South** | | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk Factors | Mean | Rank | Mean | Rank | Mean | Rank | Mean | Rank | | | | | F STAT | (P.Values) |
| Archaeological Remains | 0.17 | 31 | 0.14 | 31 | 0.00 | 31 | 0.00 | 29 | .63 | 29 | 0.0000 | 28 | 3.678 | .084 |
| Bad Relationship Between Main and Sub Contractor | 2.94 | 17 | 1.98 | 24 | 2.00 | 22 | 2.91 | 19 | 2.25 | 21 | 2.0000 | 22 | 17.703 | .082 |
| Change in Currency Exchange Rates | 4.33 | 2 | 4.16 | 2 | 4.81 | 1 | 4.00 | 4 | 3.88 | 7 | 5.0000 | 1 | 9.271 | .067 |
| Change Orders | 3.00 | 15 | 2.40 | 18 | 3.71 | 9 | 0.00 | 30 | .25 | 30 | 1.0000 | 23 | 41.020 | .009 |
| Changes to Initial Design | 2.33 | 21 | 2.58 | 15 | 2.19 | 18 | 4.00 | 5 | 3.88 | 6 | 5.0000 | 2 | 42.276 | .042 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Charging of "Land Dues" by Locals (illegally) | 1.00 | 27 | 2.30 | 20 | 1.81 | 25 | 4.94 | 2 | 4.38 | 1 | 5.0000 | 3 | 90.957 | .327 |
| Civil Disturbance | 2.61 | 19 | 3.19 | 11 | 4.61 | 2 | 0.00 | 31 | .25 | 31 | 1.0000 | 24 | 46.777 | .082 |
| Client's Insolvency | 1.00 | 28 | 1.28 | 27 | 1.90 | 24 | 1.00 | 26 | 1.13 | 27 | 0.0000 | 29 | 42.214 | .077 |
| Compliance With New Regulations | 1.17 | 25 | 1.14 | 28 | 1.00 | 26 | 0.97 | 27 | 1.38 | 25 | 0.0000 | 30 | 28.938 | .126 |
| Contractor/Owner Dispute | 3.00 | 16 | 2.21 | 22 | 3.00 | 12 | 3.89 | 11 | 3.25 | 13 | 3.0000 | 14 | 46.863 | .621 |
| Delay in Agreeing Variation/Day Works | 3.33 | 13 | 3.00 | 13 | 3.00 | 13 | 3.89 | 12 | 3.13 | 16 | 3.0000 | 15 | 45.482 | .327 |
| Delay in Payment from Client | 4.06 | 3 | 4.00 | 4 | 4.00 | 5 | 3.11 | 15 | 4.06 | 4 | 5.0000 | 4 | 163.276 | .541 |
| Delay in Settling Claims | 4.00 | 5 | 3.86 | 5 | 4.00 | 4 | 3.11 | 14 | 4.06 | 3 | 4.0000 | 7 | 44.497 | .451 |
| Failure of Subcontractors | 0.33 | 30 | 0.79 | 30 | 0.10 | 30 | 1.86 | 24 | 1.81 | 23 | 1.0000 | 25 | 23.241 | .617 |
| Geotechnical Issues | 1.06 | 26 | 0.91 | 29 | 0.90 | 29 | 0.94 | 28 | .81 | 28 | 0.0000 | 31 | 3.327 | .077 |
| High Cost of Materials | 4.00 | 6 | 4.26 | 1 | 4.00 | 6 | 4.00 | 6 | 3.94 | 5 | 4.0000 | 8 | 2.692 | .063 |
| Inclement Weather | 3.33 | 12 | 2.37 | 19 | 2.19 | 19 | 4.00 | 7 | 3.56 | 9 | 5.0000 | 6 | 44.497 | .078 |
| Increased Duration of the Project | 4.67 | 1 | 4.14 | 3 | 4.10 | 3 | 5.00 | 1 | 4.19 | 2 | 5.0000 | 5 | 13.272 | .709 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inflation | 3.33 | 14 | 3.42 | 7 | 3.00 | 14 | 3.03 | 16 | 3.13 | 14 | 3.0000 | 16 | 8.138 | .711 |
| Long Period of Honouring Certificates by Client | 2.33 | 20 | 3.28 | 8 | 3.10 | 11 | 2.83 | 21 | 1.44 | 24 | 1.0000 | 27 | 54.904 | .871 |
| Over Measurements | 3.72 | 7 | 3.14 | 12 | 3.00 | 15 | 3.03 | 17 | 2.81 | 19 | 3.0000 | 17 | 4.224 | .901 |
| Poor communication Amongst Parties | 2.83 | 18 | 2.49 | 16 | 3.00 | 16 | 4.00 | 8 | 3.69 | 8 | 4.0000 | 9 | 14.897 | .090 |
| Poor Design | 1.00 | 29 | 1.44 | 26 | 1.00 | 27 | 1.97 | 23 | 2.56 | 20 | 1.0000 | 26 | 35.490 | .070 |
| Problem with Foundation | 1.33 | 24 | 1.77 | 25 | 1.00 | 28 | 1.06 | 25 | 1.38 | 26 | 2.0000 | 21 | 7.612 | .072 |
| Replacement of Defective Works | 4.06 | 4 | 3.19 | 10 | 4.00 | 7 | 3.97 | 10 | 3.13 | 17 | 4.0000 | 10 | 9.616 | .068 |
| Shortage of Key Plant Items | 3.61 | 10 | 3.70 | 6 | 4.00 | 8 | 4.00 | 9 | 3.56 | 10 | 4.0000 | 11 | 5.230 | .611 |
| Shortage of Key Skilled Labour | 3.61 | 8 | 2.21 | 21 | 3.10 | 10 | 3.03 | 18 | 3.13 | 15 | 3.0000 | 18 | 17.184 | .781 |
| Strikes, Internal and External Military Actions | 2.06 | 23 | 2.63 | 14 | 2.10 | 21 | 2.91 | 20 | 2.00 | 22 | 3.0000 | 19 | 7.783 | .812 |
| Under Measurements | 3.61 | 9 | 2.14 | 23 | 2.00 | 23 | 2.09 | 22 | 3.13 | 18 | 3.0000 | 20 | 85.642 | .092 |
| Under-estimating Project complexity | 2.33 | 22 | 2.47 | 17 | 3.00 | 17 | 3.20 | 13 | 3.50 | 11 | 4.0000 | 12 | 18.540 | .877 |
| Variations | 3.50 | 11 | 3.28 | 9 | 2.19 | 20 | 4.09 | 3 | 3.44 | 12 | 4.0000 | 13 | 43.396 | .457 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.31: Impact of Risk Factors on cash-out Forecasts across Nature of Client

| Risk Factors | Federal Government Mean | Rank | State Government Mean | Rank | F F STAT | Sig. (P.Values) |
|---|---|---|---|---|---|---|
| Archaeological Remains | 0.14 | 31 | 0.10 | 31 | .132 | .941 |
| Bad Relationship Between Main and Sub Contractor | 2.45 | 21 | 2.24 | 23 | 3.340 | .021* |
| Change in Currency Exchange Rates | 4.27 | 2 | 4.39 | 1 | .532 | .661 |
| Change Orders | 1.70 | 24 | 2.04 | 24 | .757 | .520 |
| Changes to Initial Design | 3.23 | 12 | 3.01 | 14 | .616 | .606 |
| Charging of "Land Dues" by Locals (illegally) | 2.96 | 18 | 3.21 | 9 | .695 | .556 |
| Civil Disturbance | 1.81 | 23 | 2.66 | 19 | 2.321 | .077 |
| Client's Insolvency | 1.10 | 27 | 1.28 | 27 | 1.132 | .338 |
| Compliance With New Regulations | 1.00 | 29 | 1.00 | 28 | 0.000 | 1.000 |
| Contractor/Owner Dispute | 3.12 | 15 | 2.92 | 16 | 3.733 | .013* |
| Delay in Agreeing Variation/Day Works | 3.28 | 11 | 3.23 | 8 | .450 | .718 |
| Delay in Payment from Client | 3.94 | 4 | 3.86 | 4 | .298 | .827 |
| Delay in Settling Claims | 3.77 | 6 | 3.76 | 6 | .251 | .861 |
| Failure of Subcontractors | 1.02 | 28 | 0.89 | 30 | .225 | .879 |
| Geotechnical Issues | 0.80 | 30 | 0.93 | 29 | 1.297 | .277 |
| High Cost of Materials | 4.04 | 3 | 4.11 | 3 | 1.681 | .174 |
| Inclement Weather | 3.31 | 10 | 2.97 | 15 | 1.284 | .282 |
| Increased Duration of the Project | 4.59 | 1 | 4.31 | 2 | 2.166 | .094 |
| Inflation | 3.16 | 13 | 3.18 | 10 | 1.672 | .175 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Long Period of Honouring Certificates by Client | 2.51 | 20 | 2.82 | 18 | 5.006 | .002* |
| Over Measurements | 3.06 | 16 | 3.17 | 12 | .343 | .794 |
| Poor communication Amongst Parties | 3.42 | 9 | 3.06 | 13 | 4.608 | .004* |
| Poor Design | 1.53 | 25 | 1.42 | 25 | 4.883 | .003* |
| Problem with Foundation | 1.41 | 26 | 1.32 | 26 | 1.686 | .172 |
| Replacement of Defective Works | 3.67 | 7 | 3.72 | 7 | .548 | .650 |
| Shortage of Key Plant Items | 3.82 | 5 | 3.85 | 5 | .407 | .748 |
| Shortage of Key Skilled Labour | 3.14 | 14 | 2.63 | 21 | 9.432 | .000* |
| Strikes, Internal and External Military Actions | 2.36 | 22 | 2.63 | 20 | 1.706 | .168 |
| Under Measurements | 2.61 | 19 | 2.25 | 22 | 4.599 | .004* |
| Under-estimating Project complexity | 3.02 | 17 | 2.89 | 17 | .356 | .785 |
| Variations | 3.48 | 8 | 3.18 | 11 | 1.806 | .148 |

Source: field survey, 2014. Note- *= significant at 5% Level of significance.

Table 4.32: Variation Between Forecast and Actual cash-in

| Risk Factor | @30% | | @50% | | @70% | |
|---|---|---|---|---|---|---|
| | %Positive | %Negative | %Positive | %Negative | %Positive | %Negative |
| Accuracy of Estimates | 74.00 | 26.00 | 14.00 | 86.00 | 14.00 | 86.00 |
| Back/Front end Loading | 19.00 | 81.00 | 96.00 | 4.00 | 95.00 | 5.00 |
| Bad Relationship Between Contractor and Consulting Team | 22.00 | 78.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Bad Relationship Between Contractor and Owner | 44.00 | 56.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Bad Relationship Between Main and Sub Contractor | 23.00 | 77.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Bureaucracy in Processing Payments (giving bribe to "speed up" payment | 5.00 | 95.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Change in Government Officials | 5.00 | 95.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Change in Interest Rates | 39.00 | 61.00 | 60.00 | 40.00 | 60.00 | 40.00 |
| Change Orders | 57.00 | 53.00 | 48.00 | 52.00 | 48.00 | 52.00 |
| Changes in Activities' Start Time | 26.00 | 74.00 | 27.00 | 73.00 | 26.00 | 74.00 |
| Changes to Initial Design | 26.00 | 74.00 | 47.00 | 53.00 | 48.00 | 52.00 |
| Civil Disturbance | 53.00 | 47.00 | 26.00 | 74.00 | 47.00 | 53.00 |
| Client's Insolvency | 40.00 | 60.00 | 47.00 | 53.00 | 40.00 | 60.00 |
| Compliance With New Regulations | 28.00 | 72.00 | 28.00 | 72.00 | 48.00 | 52.00 |
| Contractual Specification of Minimum Amount Valuation | 24.00 | 76.00 | 24.00 | 76.00 | 24.00 | 76.00 |
| Delay in Paying Creditors | 56.00 | 44.00 | 56.00 | 44.00 | 50.00 | 50.00 |
| Delay in Payment from Client | 19.00 | 81.00 | 50.00 | 50.00 | 19.00 | 81.00 |
| Delay in Receiving Retention | 5.00 | 95.00 | 19.00 | 81.00 | 5.00 | 95.00 |
| Delay in Releasing Advance Payment | 32.00 | 68.00 | 5.00 | 95.00 | 32.00 | 68.00 |
| Discount on Materials Purchased | 52.00 | 48.00 | 32.00 | 68.00 | 52.00 | 48.00 |
| Dispute Between Contractor and Owner | 6.00 | 94.00 | 6.00 | 94.00 | 6.00 | 94.00 |
| Geotechnical Issues | 10.00 | 90.00 | 10.00 | 90.00 | 10.00 | 90.00 |
| | 84.00 | 16.00 | 85.00 | 15.00 | 11.00 | 89.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Inclement Weather | | | | | | |
| Incompetent Consulting Team | 37.00 | 63.00 | 37.00 | 63.00 | 10.00 | 90.00 |
| Increase in duration of the Project | 26.00 | 74.00 | 10.00 | 90.00 | 85.00 | 15.00 |
| Labour Strikes | 16.00 | 84.00 | 10.00 | 90.00 | 36.00 | 64.00 |
| Large Retention Percentage | 34.00 | 66.00 | 40.00 | 60.00 | 26.00 | 74.00 |
| Listed Buildings | 44.00 | 56.00 | 26.00 | 74.00 | 33.00 | 67.00 |
| Long Interval Between Two Certificates | 60.00 | 40.00 | 26.00 | 74.00 | 59.00 | 41.00 |
| Overheads | 22.00 | 78.00 | 16.00 | 84.00 | 23.00 | 77.00 |
| Period of Honouring Certificates | 36.00 | 64.00 | 34.00 | 66.00 | 36.00 | 64.00 |
| Problems with Foundation | 36.00 | 64.00 | 44.00 | 56.00 | 36.00 | 64.00 |
| Production Time Slippage | 18.00 | 82.00 | 18.00 | 82.00 | 18.00 | 82.00 |
| Receiving Advance Payment | 36.00 | 64.00 | 35.00 | 65.00 | 36.00 | 64.00 |
| Replacement of Defective Work | 5.00 | 95.00 | 5.00 | 95.00 | 5.00 | 95.00 |
| Subcontractor's Insolvency | 8.00 | 92.00 | 5.00 | 95.00 | 8.00 | 92.00 |
| Unavailability of credit facilities | 9.00 | 91.00 | 95.00 | 5.00 | 8.00 | 92.00 |
| Under Valuation | 63.00 | 37.00 | 8.00 | 92.00 | 57.00 | 43.00 |
| Variations | 15.00 | 85.00 | 57.00 | 43.00 | 57.00 | 43.00 |
| Withholding Tax | 15.00 | 85.00 | 14.00 | 86.00 | 14.00 | 86.00 |
| **Overall Mean Percentage** | 31.13 | **69.13** | 30.03 | **69.97** | 30.59 | **69.41** |

Source: field survey, 2014.

Table 4.33: Variation Between Forecast and Actual cash-out

| Risk Factors | Completion Stages 30% | | 50% | | 70% | |
|---|---|---|---|---|---|---|
| | %Positive | %Negative | %Positive | %Negative | %Positive | %Negative |
| Archaeological Remains | 32.00 | 68.00 | 61.00 | 39.00 | 100.00 | 0.00 |
| Change in Currency Exchange Rates | 32.00 | 68.00 | 61.00 | 39.00 | 100.00 | 0.00 |
| Changes to Initial Design | 28.00 | 72.00 | 44.00 | 56.00 | 100.00 | 0.00 |
| Charging of "Land Dues" by Locals (illegally) | 4.00 | 96.00 | 40.00 | 60.00 | 80.00 | 20.00 |
| Change Orders | 17.00 | 83.00 | 37.00 | 63.00 | 100.00 | 0.00 |
| Civil Disturbance | 32.00 | 68.00 | 42.00 | 58.00 | 100.00 | 0.00 |
| Client's Insolvency | 15.00 | 85.00 | 37.00 | 63.00 | 99.00 | 1.00 |
| Compliance With New Regulations | 15.00 | 85.00 | 49.00 | 51.00 | 96.00 | 4.00 |
| Contractor/Owner Dispute | 15.00 | 85.00 | 59.00 | 41.00 | 100.00 | 0.00 |
| Delay in Agreeing Variation/Day Works | 6.00 | 94.00 | 60.00 | 40.00 | 100.00 | 0.00 |
| Delay in Settling Claims | 6.00 | 94.00 | 60.00 | 40.00 | 100.00 | 0.00 |
| Delay in Payment from Client | 6.00 | 94.00 | 60.00 | 40.00 | 100.00 | 0.00 |
| Increased Duration of the Project | 7.00 | 93.00 | 60.00 | 40.00 | 100.00 | 0.00 |
| Failure of Subcontractors | 19.00 | 81.00 | 60.00 | 40.00 | 100.00 | 0.00 |
| Geotechnical Issues | 19.00 | 81.00 | 68.00 | 32.00 | 100.00 | 0.00 |
| High Cost of Materials | 30.00 | 70.00 | 73.00 | 27.00 | 100.00 | 0.00 |
| Inclement Weather | 40.00 | 60.00 | 70.00 | 30.00 | 100.00 | 0.00 |
| Inflation | 39.00 | 61.00 | 55.00 | 45.00 | 99.00 | 1.00 |
| Over Measurements | 25.00 | 75.00 | 42.00 | 48.00 | 55.00 | 45.00 |
| Poor communication Amongst Parties | 43.00 | 57.00 | 76.00 | 24.00 | 100.00 | 0.00 |
| Poor Design | 42.00 | 58.00 | 71.00 | 29.00 | 94.00 | 6.00 |
| Problem with Foundation | 43.00 | 57.00 | 77.00 | 23.00 | 100.00 | 0.00 |
| Replacement of Defective Works | 29.00 | 71.00 | 82.00 | 18.00 | 100.00 | 0.00 |
| Bad Relationship | 28.00 | 72.00 | 74.00 | 26.00 | 100.00 | 0.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Between Main and Sub Contractor | | | | | | |
| Shortage of Key Plant Items | 28.00 | 72.00 | 74.00 | 26.00 | 100.00 | 0.00 |
| Shortage of Key Skilled Labour | 29.00 | 71.00 | 73.00 | 27.00 | 100.00 | 0.00 |
| Strikes, Internal and External Military Actions | 29.00 | 71.00 | 74.00 | 26.00 | 100.00 | 0.00 |
| Under Measurements | 39.00 | 61.00 | 84.00 | 16.00 | 96.00 | 4.00 |
| Long Period of Honouring Certificates by Client | 1.00 | 99.00 | 3.00 | 97.00 | 54.00 | 46.00 |
| Under-estimating Project complexity | 85.00 | 14.00 | 80.00 | 20.00 | 100.00 | 0.00 |
| Variations | 12.00 | 87.00 | 57.00 | 43.00 | 100.00 | 0.00 |
| **OVERALL PERCENTAGE** | **25.65** | **74.29** | **60.10** | **39.58** | **95.90** | **4.10** |

Source: field survey, 2014.

# APPENDIX F: MODELS' ARCHITECTURE