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Impact Of Risk Factors; Prime Cost Sums And Provisional Sums On Project Cost Performance

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Abstract: *This research carried out literature scan on the impact of risk factors, consequential costs and their management on project cost performance. It specifically evaluated the impacts of prime cost sums and provisional sums' risks on cost performance of hospital projects in Taraba State in the past fifteen years. To this end, primary data was drawn from bills of quantities and associated documents of the hospital projects implemented by the Ministry of Works and Housing in Taraba State. The obtained data was analysed using linear regression, t-statistics, F-ratio and scatter graphs. Findings from literature identified the following risk variables as having significant impact on cost performance: Project size, project location, project complexity, level of variations, prime cost sums and provisional sums, estimator bias, market conditions, level of competition, fraudulent practices, construction techniques, economic and political factors, construction accidents, health and safety factors. While findings and conclusion from the hospital projects corroborated literature and posited P.C. sums, provisional sums and builder's work as high explanatory risk variables having high negative cost performance and which must be critically reviewed and managed in projects to reduce their potential to cause high cost over-runs.*

Keywords: *Risk factors, Consequential costs, Cost performance, Evaluation, Projects.*

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I. INTRODUCTION

The basic objectives in construction projects are to complete within budget, schedule and specified quality. In Nigeria construction industry, project cost and time overruns have become common experiences. These erroneously put the competence and integrity of construction professionals who plan, predict, budget and manage costs of the projects in great doubt. To an average Nigerian, fouls play is usually suspected given the size or billions of naira cost overruns beyond what can be attributed to genuine project risks. Risk is a measurable uncertainty or loss. Genuine risk is the chance of an event happening which has measurable financial consequences on the project. All investments, tasks or projects face elements of risk. Project risks encompass: Project size, location, complexity, haste, excessive prime cost sums and provisional sums, estimators bias, changing market condition, level of competition, fraudulent practices, health and safety, foreign exchange fluctuations, economic/financial/political factors and construction risks (Ajator, 2012, 2014; Onyeador and Ukwuoma, 2006; Smith, 1999).

Construction related risks factors include, geological conditions landslide/unexpected site conditions, weather, accessibility, client, contractor and sub-contractor-generated risks. Plant/equipment accidents and disputes. Political risk factors include strikes, power/project promoters' influences, labour restrictions/ civil disorder, change in Government, joint ventures risks, bilateral Government relations, tariff/taxation, high donor/lender charges and politics-induced exchange fluctuations.

Risk can emanate from changes in requirements of clients, poor estimates, design errors; omissions under/overdesigns, discrepancies, divergences, poor documentation, poor co-ordinations, undefined roles and responsibilities and insufficient professionals' technical and operative skills (Ajator, 2014; Miller & Lessard 2001; Morris & Hough 1987). In complex construction projects uncertainties may rear in diverse forms apart from force majeure. There are diverse parochial objectives or interests of project participants which threaten the tripartite project objective of completing within cost, time and quality.

Project risks (costs) over and above those carefully identified, planned, projected and provided for at project packaging and estimating may rear as consequential costs **(CCS)**. These are additional costs arising from changes to the contract. Cost performance is a situation where a project is completed within the planned costs for it, that would add value to the economy. Cost performance of a project is thus a function of quality of cost

estimate **(QCE)** plus size of consequential costs **(SCC)**, plus quality of Cost/Risk Management **(QCRM)** exercised in project delivery. (see model I).
Cost Performance **CP = QCE + SCC + QCRM**. **……………………………..……………(1)**
Cost performance is therefore viewed as a measure of extent of control of cost growth. High Quality cost estimate and quality contract/risk management seek to reduce consequential costs, thereby resulting in high project cost performance. It is a situation where design quality/management is appropriate, motivational (inducement) bias and cognitive (adjustment) bias of the estimator are controlled and efficient cost and risk management implemented.
In contract practice, project final completion cost **(FCC)** equals Contract Sum **(CS)** plus consequential costs **(CCS)** ie Final Completion Cost **(FCC) = CS + CCS ……………… (2)**
But Contract Sum **(CS)** is Prime Cost **(PC)** plus markup **(MU)** plus contingencies **(C)**. Final Completion Cost **(FCC)** = (Prime Cost + Markup + Contingencies) + Consequential Costs ie **FCC = (PC + MU + C) + CCS ……………………………………………….……………(3)**
High cost performance therefore depict situations where consequential costs **(CCS)** arising from project delivery is reduced to the barest minimum or possibly eliminated **(CCS → O)**. It is where contingencies' **(C)** allocation in project, virtually takes care of all consequential costs **(CCS → O)** such that final completion cost **(FCC)** equates with the original Contract Sum **(CS)**. See models (3) and (4).
FCC = PC + MU + C + O = Contract Sum …………………………….……..…… (4)
This is a rare fit in most project delivery especially in Nigeria. Efficient contract/cost management and effective risk management where professionally applied, would drastically reduce consequential costs.
The objective of this research is to attempt to identify and characterize various construction project risk factors through incisive literature scan. To establish the impact of key risk factors, such as builder's work, prime cost sums and provisional sums on cost performance of Taraba hospital projects over the years. And advice Government and construction stakeholders on the necessary risk response and management strategies to be put in place to forestall project non-performance arising from high consequential costs.

II. LITERATURE:

The works of many previous researchers attempted to identify and document internal and external risk factors and their consequential costs on projects. This review exposes these perspectives, their strength and weaknesses to enable project participants to maximize the result of positive events and minimize the consequence of the adverse effect.

Construction projects risks may relate to external, commercial, design, construction and operational factors impacting cost, time and quality in varying degrees. The time and quality impacts consequently translate to cost impact as the ultimate denominator.

Morris and Hough (1987) examined the records of some 4000 different World Bank funded projects between 1974 and 1988 and concluded that 63% of projects had experienced significant cost overruns. In similar report, Kaming, Olomolaiye, Holt and Harris (1997) presented high rate of time and cost overrun in high rise projects in Indonesia.

Poor cost performance of construction projects in various developing countries were exposed in the listed studies (Okpala & Aniekwu, 1998; Elinwa & Buba, 1993; Mansfield, et al, 1994; Assaf et al, 1995; Kim & Bajaj 2000), among many others. Also the works of (Ajator, 2014; Ugwu, 2013; Aje, 2013; and Giwa, 1988) not only identified two most common and frequently recurring problems in Nigeria contract execution as (i) cost overruns or excess of final completion cost over contract sum and (2) time and schedule slippages arising from inherent/external project risks but proffered various management strategies. Ajator (2014) specifically developed an integrated framework for financial engineering and project risk management and recommended it for adoption by quantity surveyors, cost engineers and project practitioners in managing heavy engineering and infrastructure project financing and construction risk (see figure I).

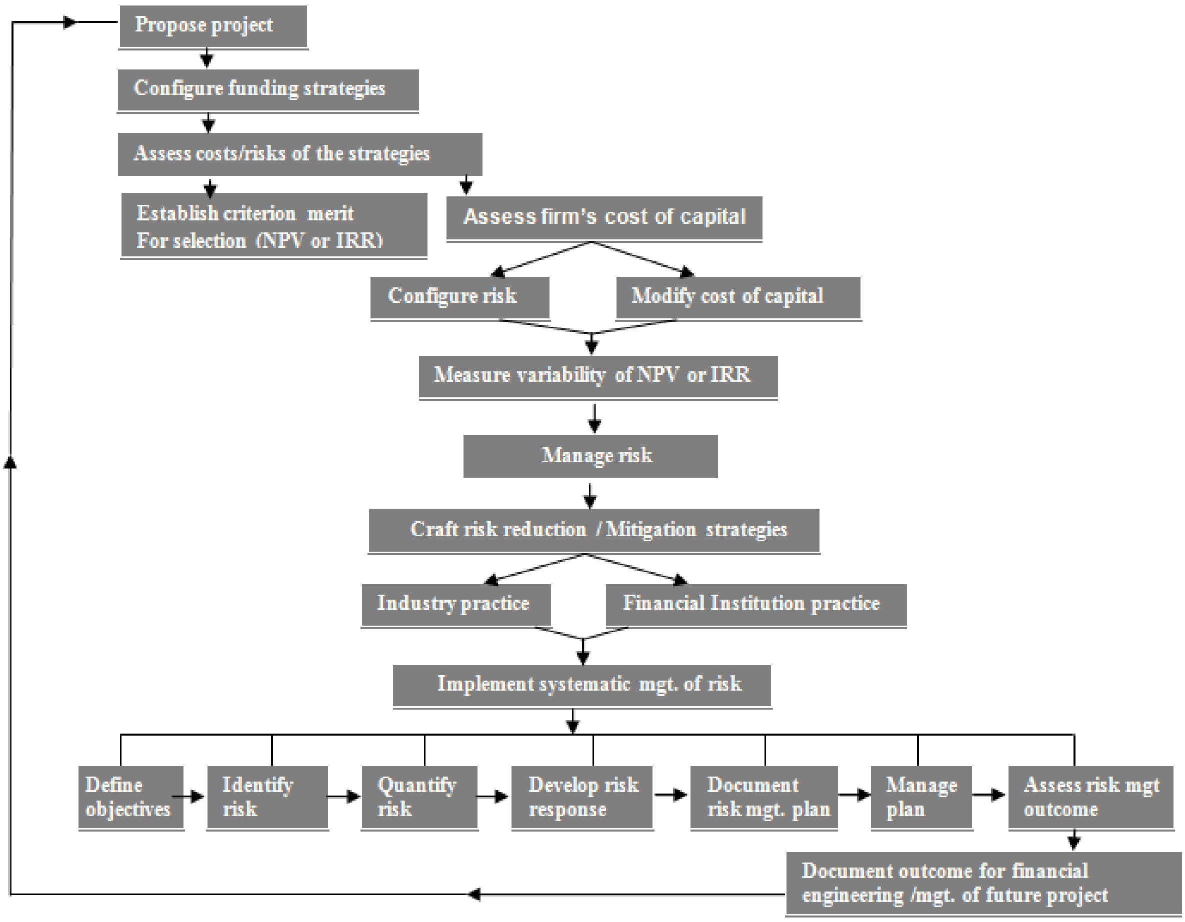

Figure I: Integrated Framework for Financial engineering and Project risk Management.
Source: Ajator's Research 2014.

Concepts of Cost, Cost Estimate, Risk Factors, PC sums/provisional sums, Consequential Costs.
A review of construction contracts produces a variety of definition of cost.

Cost may be viewed as what is paid for a project. What is paid for the various factor and services input in a project:- cost of material, labour, plant, equipment, subcontract/supply, supervision, entrepreneurial skill or opportunity foregone cost, contract procurement cost, project procurement cost, total project or life cycle cost (Ajator, 2012b; Cao, Wang & Tiong, 2008).

These costs are prone to risks of overrunning their target provisions by way of consequential costs, especially where the target costs were not originally assessed in detail and value-analyzed. Hence for most construction contracts, costs covered include the contract price, additional contract amount arising from variations, remeasured/other costs, increases from prime cost sum and provisional sums. These consequential costs arising as additional contract amount, remeasured/other costs, constitute incurred costs to deal with risk and uncertainties during construction and commissioning periods. In total cost management the above costs among others have to be properly estimated, risk-adjusted, budgeted and strategically (proactively) controlled to achieve the desired cost performance.

Cost Estimate: Cost estimate is the product of costing which presents a cost model for measuring cost performance; hence defective cost model will ultimately impede cost performance of construction projects (Ajator & Onyeador, 2009).

Cost Data: Cost data are researched updatable cost atoms. The smallest division of cost e.g. labour, materials plant/equipment costs and output cost constants etc. To minimize risks, the quantity surveyor has to gather, screen and factor the cost data in full consideration of the background from which they originate (BCIS and BMI, 1999; Flanagan & Marsh, 1994; CIBW 80 Report, 1996; Ajator and Onyeador, 2009) and pose Salient questions that serve as drivers for data integrity.
Risk Factors: These are those elements of risks that may give rise to consequential costs.

Ajator (2013) grouped the general risk factors earlier exposed in the introduction into five basic domains-technological, social, physical, economic and political. They impact organizations' (agency or private) projects leading to consequential costs depending on actions or inactions of the project managers. They may present as internal and external risk factors. Internal risk factors are within the control of organization eg its human, physical, financial, technological and managerial values and ethics. While external risks are outside the organizations control. Labour, material, plant/equipment quality, availability, reliability and management efficiency are internal risks. Also opting for a contract without adequate human financial technical and technological resources or pricing competitive project at breakeven margin, or implementing too many projects concurrently without adequate carrying capacity or lack of professional skill for a listed project are internal organization's risks while external risks are macro-economic, political, competition, environmental, multiple clients/joint venture project risks. There is therefore the need for application of strength weakness and opportunity threat (SWOT) strategies in project planning, execution and management to reduce consequential costs. Both internal, external and operational environment of construction organization have significant impacts on management/cost performance of project. Act of God risk factors include: heavy floods, landslide, fire, earthquakes, hurricanes. They have low probability of occurrence, yet with huge negative impact on project when they occur (Ajator, 2000a, 2000b).

In a similar vein, Dey (2002) in measuring the likelihood of risks in a project, compartmentalized risk factors into five categories; Technical risk (0.479), Financial and Economic risk (0.228), organizational risk (0.146), Acts of God (0.064) and clearance risk (0.083). And stated the likelihood of occurrence of the risk sub factors in each category (see table I). He recorded the most likely occurring risk factor as the technical risk, with risk subfactors as; scope change, technology selection, implementation methodology, equipment risk, materials risk, engineering and design change.

Prime Cost Sums/Provisional Sums as Technical risk Factors:

Improper provisions and administration of Prime cost sums and provisional sums have presented great risks to project cost performance. Prime costs sums are sums included in the contract for specialist works and specialist supplies by nominated sub contractors/suppliers or statutory bodies, upon which the main contractor builds-in his profits respectively.

Provisional sums are sums included for works/conditions not fully defined or foreseen at estimate stage and which are subject to design /implementation changes. Most contract conditions empower the lead consultant to direct the expenditure of prime cost sums and provisional sums including their nominations within the contract provisions. Abuse of this provisions through improper/excessive nominations or incomplete contract packaging especially for difficult sites, relying on provisional mechanisms, present high risk potentials for scopecrip, excessive cost overruns and project failure (Ajator, et al 2015; BESMM4, 2015; Mac-Barango et al, 2016).

Builder's works are contract works executed by main contractor other than those outsourced to nominated subcontractors/suppliers/statutory bodies. Their disproportionate increase create risks of vitiating the contract, hence are better handled as addendum contract. Thus the agreed contract sum is a dependent risk variable, impacted by quality/detail of cost estimate, contract management, variation/change orders, economic conditions and policy shifts (Ajator 2015).

Table 1: Likelihood of Risk in a Project

Factors	**likelihood**	**Sub-factors**	**Likelihood**	
			LP	**GP**
Technical Risk	0.479	Scope change	0.36	0.172
		Technology selection	0.124	0.059
		Implementation methodology	0.13	0.062
		Equipment risk	0.073	0.035
		Materials risk	0.08	0.038
		Engineering and design change	0.233	0.112
Financial & Economical Risk	0.228	Inflation risk	0.152	0.035
		Fund risk	0.383	0.087
		Changes in local law	0.105	0.024
		Changes in Govt. Policy	0.105	0.024
		Improper estimate	0.255	0.058
Organizational Risk	0.146	Capability of owner's project group	0.106	0.015
		Contractor's capability	0.283	0.041
		Vendor's Capability	0.448	0.065
		Consultant's Capability	0.163	0.024

Acts of God	0.064	Calamity Normal Calamity abnormal	0.44 0.56	0.028 0.036
Clearance risk	0.083	Environmental clearance Land acquisition Explosive clearance Other clearances	0.026 0.461 0.133 0.142	0.022 0.038 0.011 0.012
LP – Local percentage ***CP – Global percentage***				

Source: Dey (2002).

Akinci and Fisher (1998) report, showed that contractors ascribed high importance index to construction related risk factors. Geological conditions, site accessibility and weather conditions have importance index of 62 whereas site location, non/delay payments and subcontractor with its supervision and management problems have importance index of 70, 74, 74 and 70 respectively.

Many other researchers have further categorized risk factors. Miller & Lessard grouped risk into Market risk; demand, financial, supply; competition risk; technical, construction, operational and instructional risks; regulatory, social acceptability and sovereign risks.

Abrahamson (1998) arranged risk factors under subheads: Physical works, delay/disputes, direction and supervision, damage and injury to persons/properties, external factors, payments, law and arbitration.

Finerty (1996) categorized risk under:- Supply, technological competition, economic, financial, currency, political, environmental and force majeure. Chapman and Ward (2002) considered risk associated with: estimate variability, uncertainty of basis of estimate, uncertainty of design/logistics, uncertainty of objectives and priorities, uncertainty of mutual relationship of project parties.

Cohen & Palmer (2004) reviewed construction project risk sources to include project scope crip, design errors/ omissions, undefined roles/ responsibilities, unskilled staff/multi subcontractors and use of inexperienced contractor. The above categorizations present risks as something negative and which threaten project success and heighten consequential costs.

Consequential Costs:

Factors causing consequential costs, e.g. influence of contract provisions on consequential costs:

Consequential costs may be viewed as those costs over and above the costs defined as the contract price payable to the contractor for execution and completion of the works including remedying defects as provided in the contract. In addition to force majeure/uncertainties, they arise from the operation of detailed and implied conditions of contract.

It is an agreed term in most contracts for implementation of variations/change orders. There is also stipulated mechanism for pricing variations. But excessive variations or change orders from clients, design consultants, specialist prime cost and provisional works, macro variables and weak pricing mechanisms introduce huge consequential costs. Most of these costs are not recovered by the project contractor. The huge under-valuation/under-recovery often lead to dispute and constitute serious risk of delays on the progress of the project. Ajator, Okoye and Agbonome (2014) reviewing the JCT. 1963 and its updates outlined similar unrecoverable consequential costs that threaten project success:

- The joint contract tribunal JCT condition of contract allows for fluctuation claims (in fluctuation-term contracts) but excludes claims in respect of labour “price-hike” not arising from national/local wage negotiations. As Government’s increase in wage rates comes once in many years, contractors pay more than they recover in fluctuation claims especially in inflation-prone developing economies like Nigeria.
- Inflation rate may well be in excess of “firm-price” risk adjustment factor (for competitive firm-price contracts) thereby presenting unrecovered costs.
- Excessive variation instructions introduce inevitable loss/expense not fully recovered under the contract pricing formula (see clause 11(6) and clause 24) of the JCT.
- Accelerated retention provision holds back sizeable proportion of monies due to contractor till practical completion and completion of defects periods respectively, without interest recoupment on them.
- Inaccurate valuation for interim certificates following the concept of “payment-on-account”, introduce hidden retention, increasing contractor’s costs.
- Violation of assignment/subletting provisions by client clause 17 (1) and Architect under clause 11(3) instruction for expenditure of prime cost and provisional sums, reduce contract profit and increase consequential costs through increased co-ordination costs and huge attendance costs.
- Delay or non-payment of certificates cause capital lock-up and disincentive, lower productivity and increase finance costs.

These consequential costs arising from contract provisions alone are preventable risks which proper implementation of contract and risk management practices, will solve. Cao, et al (2008) aligning with the foregoing expositions/conditions of JCT, illustrated types of consequential costs and the events that may trigger them and the related contract clauses from China Condition of Contract CCC99 (see table 2). They also charted other factors causing consequential costs and their managing measures as depicted in table 3.

Table 2: CCC99 Clauses That May Incur Consequential Cost to Client.

Clause	Event	Consequential Cost
3.3	Works required other than local specification	Proposal for special construction process
6.2	Error in the engineer's instruction	The correction cost and cost for extension of time
6.3	The engineer fails to provide instruction on time	The cost and delay incurred
7.3	Emergency in complying with statutory requirement	Additional contract amount shall be borne by the client, if due to his responsibility.
8.1(1)-(9)	The client's obligations	Site preliminary development cost
8.2	Appoint the contractor to undertake extra works excluded in the contract.	Service commission cost and delay incurred
8.3	The client fails to fulfill his obligations	The cost and delay incurred
9(1)-(9)	Contractor's obligation but some costs to be borne by the client due to the latter's faults	The client bears the costs accordingly.
11.2	The client fails to give the contractor possession of site on time.	The cost and delay incurred.
12	Suspension caused by default of the client	Default cost and delay
14.3	Accelerating completion prior to the time prescribed in the contract.	Acceleration fee
16.3	Required by the engineer, opening up of work or testing of material or goods found to be in accordance with the contract.	The cost and delay incurred
19.5	Failure of commissioning test due to: (a) default of design; (b) defects of equipment purchased by the client	(a) Design cost (b) Replacement cost and extension of time
19.5(4)	Divergence between contract documents and actual works.	Extra cost for commissioning test
21	Security and protective work	Cost for security work
27.3	Material and goods storage	Storage fee
27.4(3)	Defects of goods purchased by the client	Goods replacement and extension of time
27.4(6)	The client fails to deliver goods on time	The cost and delay incurred
27.5	Test for material/equipment supplied by the client	Test fee
29.1/30/31.5	Design variation	Variation cost
39.3	Force Majeure	Repay to the contractor any costs of the execution of works.
40.1	Failure to pay insurance premium for the client's workman and third party	Insurance premium
40.2	Failure to pay insurance premium for equipment or material	Insurance premium
40.3	Appoint the contractor to arrange insurance	Service commission
42.1	Patent right	Patent right cost
43.1	Loss and/or expense in regards to antiquities	Cost for antiquities protection
43.2	Underground obstacles	Underground obstacles settlement cost
44.6	All parties are released from performance for various reasons.	Sum payable by the client to contractor in respect to the work executed.

Source: Cao, et al (2008).

Table 3: Other Factors Causing Consequential Cost and Their Managing Measures.

Factors	Consequential Costs	Managing Measures
Loose contract management	Misunderstanding the scope of work can cause additional cost	Avoid such loose commitments; use standard form of contract and legal terms
Changes in law	Inflation, taxation increase, currency exchange rate	Detailed clauses should be highlighted in the contract agreement e.g. how to share the risk of change in current law.
Reliance on Guanxi (Relationship)	Business development cost	Estimate certain percentage of this cost as part of contingency cost.
Cultural difference and language deficiency	Investment cost increase and translation cost	Use local engineers familiar with Chinese regulation and local situations
Corruption and operating cost	Extra cost for operation business	Clause for preventing corruption could be drafted out in the contract.
Various polices in different territory	Business development costs in various territory of China	Feasibility study must be carried out to identify the complexity in different places of China.
Non-convertible Chinese currency	Devaluation of Chinese RMB	Obtain government's guarantees on exchange rate and convertibility. E.g. fixed rate is the most effective measure for mitigating the risk.
Inflation	Material price fluctuation	List the principal materials with unit rates. For a long project period, both parties can negotiate for relevant material prices to be fixed.

Source: Cao et al (2008).

Other factors causing consequential cost

In addition to the clauses highlighted by Cao, et al (2008), Ajator, et al (2015), and issues pinpointed in Ajator (2014) there exist other factors capable of causing consequential cost:

- **Loose Contract Agreement**
  Most contracts are let in a hurry without detailed agreement. Some are let with incomplete execution of agreement leaving future issues to be mutually negotiated on trust. For instance non-documentation/execution of consultancy agreement which define terms, responsibilities and benefits (or fees) of the parties do create problems in the management of contracts, increasing consequential cost. Just in the same way, non-definition of cost ceiling, percentage/adjustable profits and loss sharing incentives in cost-plus contract do. Hence all issues must be comprehensively and strategically analysed, with proactive measures defined for handling them. Consultancy agreement must be executed and should clearly define scope, responsibilities and specific fees from start. Issues requiring client's decision/authorization/approval and their stages must be known and approval sought in good time, and not delayed to the prejudice of progress of work. Ajator (2000) opined that the consequent delay causes consequential costs, through disruption of programmes, force extension of time and payment of cost of extension for loss and expenses suffered by the contractor, increases consultants' costs for supervising beyond target completion date and fuel general cost escalation due to inflation.
- **Changes in Law:-** Too frequent policy revisions and conflicting government policies create consequential costs.
- **Corruption and Operating Cost:** corruption is one of the major bane of construction projects resulting in very high consequential cost and loss of value-adding of our development programme. It undermines fair play, leads to substantial increase in costs and budget overruns. Contractors incur huge costs or loses due to theft of materials/components on site. Clauses must be detailed in the contract for dealing with bribery and gratification and must be spiritedly enforced.
  There is need for efficient implementation of variation control and management principles.
  Cao, et al (2008) aligning with (Ajator, et al 2015) suggested five action steps necessary for effective variation control (see table 4), to include use of: Detailed tender document, variation order and variation control, valuation of variation and its control, Exclusion of the rules (clauses) of valuation and variation cost control. For instance to control valuation of variation, the variation work must be valued according to the principle/pricing rules of the condition of contract in use.

Factors giving rise to huge variations must be controlled such as:

- Excessive lump sum/provisional sum adjustments in contract bills must be avoided.
- Preliminaries bill must be priced in detail (full).
- Use day work method and star rate method where nature of variation work so demands.

To control variation cost:

- Check the tenders carefully
- Anticipate the variations in advance
- Get early knowledge of likely instructions.
- Negotiate with the contractor.
- Avoid protracted claims-agreement delays.

Table 4: Variation Control Strategies and Details

Variation Control Strategies	Details
Detailed tender document	• Ask the contractor to provide a list of principal materials. • State clearly in the contract the obligations of each parties' obligations for the variation work and cost.
Variation order and variation control	• Analyze and categorize properly the variations • Follow proper format and procedure e.g.: ○ Channel for instructions and variation orders ○ Authorize persons/parties for issuing them ○ In standard writing form with serial number
Valuation of variation and its control	• Value variations according to CCC999 • Consider other factors affecting the valuation of work: ○ A percentage or lump sum adjustments in the contract bills ○ All preliminary items priced in the contract bills ○ Valuation of variation by day-work
Exclusion of the rules (Clauses) of valuation	• Sign separate agreements for variations under different circumstance e.g. ○ Where the client requires as a necessity a fixed cost prior to execution. ○ Where no rates exist in the contract document. ○ Where an unrealistic and high figure exist in the contract.
Variation Cost Control	• Check the tenders carefully • Anticipate the variations in advance • Get early knowledge of instructions • Negotiate with the contractor

Source: Cao, et al (2008).

Consequential Cost Management Framework:

As exposed in the foregoing there is implicit need for proactive management of consequential costs to avert their swell of construction cost or budget overrun. To this effect (Ajator, 2004, 2015), managing consequential cost must start with such "front-end" development risk factors:

- Multiple client projects with slow decision making process.
- Procurement of incompetent consultants and use of inappropriate contract.
- Unduly short construction programme that increase design errors.
- Obsolete design concepts in this era of dynamic technology
- Misread of brief or user requirement.
- Lack of co-ordination between client(s) and design team.
- Imperfect design information without value-alternative review.
- Biased disposition of design team.
- Frequent change of project consultants.
- Poor design expertise, incomplete designing or over designing.
- Procurement of mediocre contractor/poor placement of contract, through management of contract provisions at project process stage to commissioning and project closure.

Cao, et al (2008) proposed a consequential cost management framework that will help international investors, developers and design consultants to identify and manage consequential costs and consequently total project cost. (see figure 2).

The framework consists of five steps of consequential cost identification and management, each providing appropriate detailed measures and activities. It is our view that the framework is appropriate and adaptable for managing consequential costs of conventional public and non-conventional public private partnership projects.

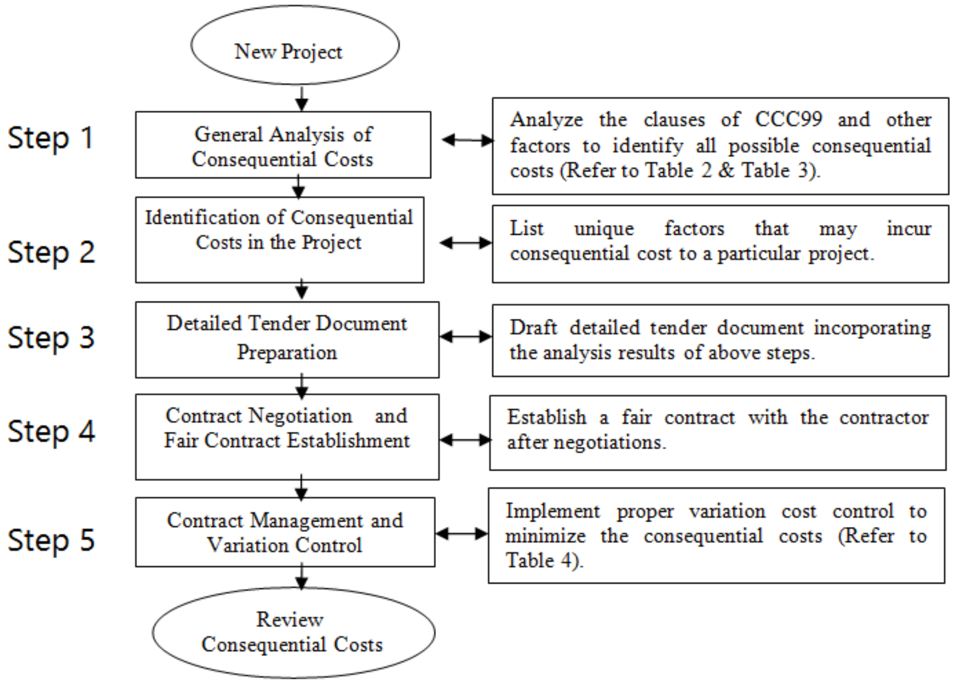

Figure 2 – Framework for Consequential Cost Management

Source: Adapted from Cao, et al (2008).

III. METHODOLOGY

The research is designed to identify and characterize various construction project risk factors using incisive literature search, experiential contract practice skills and discussions with practicing quantity surveyors, construction cost estimators, design and engineering consultants.

It further sought to establish the impact of some risk factors such as prime cost sums, provisional sums and builder's work on cost performance of Taraba hospital project over the years. And advice Government and construction stakeholders on the necessary risk response and management strategies that would avert poor cost performance arising from high consequential costs. To this effect, the research design crafted four risk factors or variables of prime cost sums, provisional sums, builder's work and contract sum as the data needs for the study. Bills of quantities and associated documents of thirty completed cottage hospital projects in Taraba state were evaluated and cost data extracted on the selected risk variables (see table 4.1) Also relative cost statistics i.e. cost data over floor area are charted in Table 4.2.

The Null (Ho) hypotheses are that changing the prime cost sums or the provisional sums or the builder's works will not significantly increase the contract sum. The Alternative (H1) hypotheses are that changing the prime cost sums or the provisional sums or the builder's work will significantly increase contract sum. The extent of variability of prime cost sums in the thirty hospital projects was measured. This was repeated for the other risk variables, provisional sums, builder's work and contract sum to establish their beta or cost changes and measure their regression with the contract sum, i.e. measure whether the changes in size of each of the selected risk factors, have significant impact on the contract sum of the hospital projects. Regression metric analysis. T-test of significance and F-test were implemented and statistical package for social sciences (SPSS) model was used as the instrument for data analysis.

The decision rule employed was to reject Null (Ho) hypothesis if t-tabulated (t.025)< t-calculated, and F-calculated > F-tabulated. Where that is the case the relationship between each of the variables and contract sum is statistically significant. Coefficient of regression R and coefficient of determination R^2 were used to measure whether the relationship between the risk variables are high, positive (+ve) or negative (-ve) and the extent of change in the contract sum or dependent variable that is explained by change in prime cost sum, provisional sum and builder's work respectively. Also descriptive analysis in the form of trend/line graphs for the risk variables and their cost charts, minimum, maximum and standard deviation were also employed. The report is presented in the section below;

IV. DATA PRESENTATION AND ANALYSIS

Table 4.1: Analyzed Risk Factors/Cost Variables of Taraba Cottage Hospital Projects.

BILLS OF QUANTITIES	FLOOR AREA (M^2)	PRIME COST SUM (₦)	PROVISIONAL SUM (₦)	PMCOST+ PROVSUM (₦)	BUILDER'S WORK (₦)	CONTRACT SUM (₦)
BILL NO. 1	489	1397711	800,000	2197.71095	92,573,792	94771502
BILL NO. 2	300	564000	160,000	724,000	13,345,881.00	14069881.00
BILL NO. 3	160	350800	100,000	450,800	7,776,065.00	8226865.00
BILL NO. 4	206	307000	35,000	342,000	4838,145	5180145.00
BILL NO. 5	214	216000	75,000	291,000	7705112,00	7996112.00
BILL NO. 6	307	286850	25,000	311,850	7310,501.00	7622351.00
BILL NO. 7	213	263000	20,000	283,000	5529919.00	5812919.00
BILL NO. 8	67	115000	40,000	155,000	8335991.00	8490991.00
BILL NO. 9	273	260000	0.000	260,000	4911679	5171679.00
BILL NO. 10	240	1295500	395000	1690500	46695251.47	48385751.47
BILL NO. 11	290	1200000	550,000	1750,000	55112900.36	56862900.36
BILL NO. 12	438	1300000	750,000	2050,000	83270,450	85320450.00
BILL NO. 13	145	390000	220,000	610,000	27800150	28410150.00
BILL NO. 14	220	670000	275,000	1045,000	41615225	42660225.00
BILL NO. 15	390	1120000	670,000	1770,000	74070400	75840400.00
BILL NO. 16	50	140000	650,000	240,000	9260000.00	9500000.00
BILL NO. 17	100	200000	100,000	320,000	14430125	14750125.00
BILL NO. 18	135	250000	120,000	350,000	17140991.00	17490991.00
BILL NO. 19	70	325000	100,0000	425,000	12671437.86	13096437.86
BILL NO. 20	110	425000	100,000	635,000	2169511250	22330112.50
BILL NO. 21	310	1000000	210,000	1,625,000	58099315.00	59724315.00
BILL NO. 22	200	600000	625,000	1095,000	37825200.00	38920200.00
BILL NO. 23	250	1100000	495,000	1,950,000	45250000.00	47200000.00
BILL NO. 24	122	750000	850,000	1,045,000	23340751.50	24385751.50
BILL NO. 25	115	450000	295,000	1,650,000	8879360.00	10529360.00
BILL NO. 26	55	150000	1200,0000	250,000	8119076.00	8369076.00
BILL NO. 27	225	850000	100,000	2,350,000	18180500.00	20530500.00
BILL NO. 28	120	250000	1500.000	500,000	16900500	17400500.00
BILL NO. 29	160	1200000	750,000	1950,000	27800200.00	29750200.00
BILL NO. 30	68	250000	95,000	345,000	11773930.00	12118930.00
Total	**6,042**	**17675860.5**	**10985000**	**28660860.9**	**812257960.7**	**840.918,821.64**

Source: Ajator and Ogika (2016)

Table 4.2: Cost Variables Relative to the Floor Areas of the Hospital Projects.

BILLS OF QUANTITIES	Prime Cost Sum/Floor Area $\frac{Pcsum}{m^2}$	Provisional Sum/Floor Area $\frac{provsum}{m^2}$	Builder's Sum/Floor Area $\frac{bldwrk}{m^2}$	Contract Sum/Floor Area $\frac{contsum}{m^2}$	PMCOST + PROVSUM
BILL NO. 1	2858.300	1635.990	189312.5	193806.8	4494.290
BILL NO. 2	1880.00	533.3300	44486.27	46899.60	2413.330
BILL NO. 3	2192.500	625.0000	48600.41	51471.91	2817.500
BILL NO. 4	1490.290	169.9000	23486.14	5146.33	1660.190
BILL NO. 5	1009.350	350.4700	36005.20	37365.00	1359.820
BILL NO. 6	934.3600	81.43000	23812.71	24828.50	1015.790
BILL NO. 7	1234.740	93.90000	25962.06	27290.70	1328.640
BILL NO. 8	1716.420	597.0100	124417.8	126731.2	2313.430
BILL NO. 9	952.3800	0.000000	17991.50	18943.88	952.3800
BILL NO. 10	5397.910	1645.830	194563.5	201607.3	7043.740
BILL NO. 11	4137.930	1896.550	190044.5	196079.0	6034.480
BILL NO. 12	2968.040	1712.330	190115.2	194795.5	4680.370
BILL NO. 13	2689.660	1517.240	191725.2	195932.1	4206.900
BILL NO. 14	3045.450	1704.550	189160.1	193910.1	4750.000
BILL NO. 15	2871.790	1666.670	189924.1	194462.6	4538.460
BILL NO. 16	2800.000	2000.000	18520.00	190000.0	4800.000
BILL NO. 17	2000.000	1200.000	144301.2	147501.2	3200.000

BILL NO. 18	1851.850	740.7400	126970.3	129562.9	2592.590
BILL NO. 19	4642.860	1428.570	181020.5	187092.0	6071.430
BILL NO. 20	3863.640	1909.090	197228.3	203001.0	5772.730
BILL NO. 21	3225.810	2016.130	187417.1	192659.1	5241.940
BILL NO. 22	3000.000	2475.000	189126.0	194601.0	5475.000
BILL NO. 23	4400.000	3400.000	181000.0	188800.0	7800.000
BILL NO. 24	6147.540	2418.030	191317.6	199883.2	8565.570
BILL NO. 25	3913.040	1043.480	77211.83	91559.65	4956.520
BILL NO. 26	1000.000	1818.180	147619.6	152165.0	2818.180
BILL NO. 27	3777.780	6666.670	80.80200	91246.67	10444.45
BILL NO. 28	2083.330	2083.330	140.8370	145004.2	4166.660
BILL NO. 29	7500.000	4687.500	173751.2	185938.8	12187.50
BILL NO. 30	3676.470	1397.060	173146.0	178219.6	5073.530

Source: Ajator and Ogika (2016).

Trend Chart of Changes in prime cost sums of the 30 hospital projects

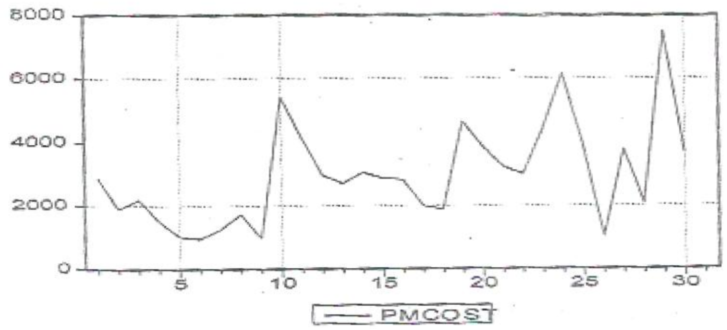

Figure 4.1: Movement and Trend of prime Cost Sum/Floor Area.

Trend Chart of Changes in Provisional Sums of the 30 Hospital Projects

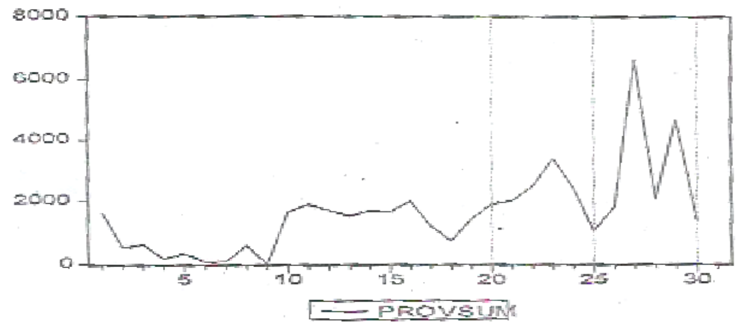

Figure 4.2: Trend and Movement Line Graph Analysis of provisional Sum

Trend Chart of Changes in Builder's work of the 30 Hospital projects

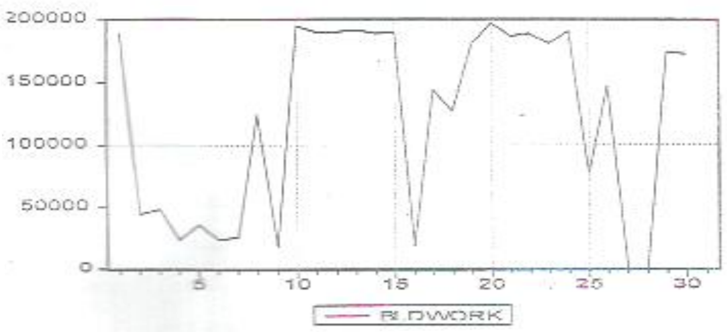

Figure 4.3: Trend and Movement Line Graph Analysis of Builder's Work.

Trend Chart of changes in contract sum of the 30 Hospital projects

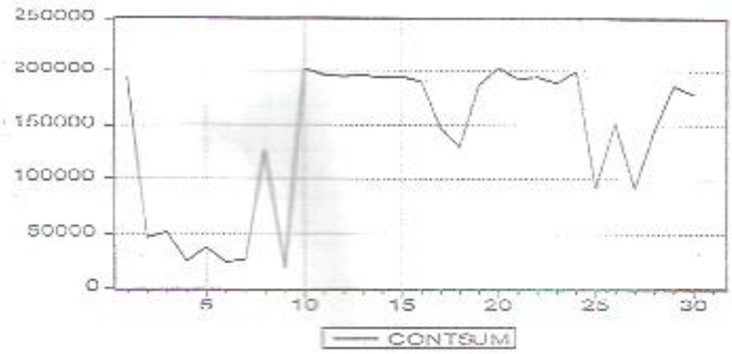

Figure 4.4: Trend and Movement Line Graph Analysis of Contract Sum.

SPSS Computation Results

Table 4.3: Model Summary[b]

Model	R	R Square	Adjusted R-Square	Std. Error of the Estimate
1	.887[a]	.787	.762	32895.52759

a. Predictors: (Constant), Builder's Work, Provisional Sum, Prime Cost Sum.
b. Dependent variable: Contract Sum

Table 4.4 T- Statistic Result

VARIABLES	t-computed (tcal)	t-tabulated (ta/2)	Test Result
Prime Cost Sum	0.216	2.064	Insignificant
Provisional Sum	2.330	2.064	Significant
Builders Work	6.869	2.064	Significant

Source: E-views Regression Result

Table 4.5 ANOVA[b]

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	1.0E+011	3	3.459E+010	31.966	.000[a]
Residual	2.8E+010	26	1082115736		
Total	1.3E+011	29			

a. Predictors: (Constant), Builder's Work, provisional Sum, Prime Cost Sum
b. Dependent variable: Contract Sum

Table 4.6 Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	30620.959	13646.913		2.244	.034
Prime Cost Sum	1.287	5.968	.030	.216	.831
Provisional Sum	13.577	5.827	.279	2.330	.028
Builder's Work	.682	.099	.766	6.869	.000

a. Dependent variable: Contract Sum

Table: 4.7 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Prime Cost Sum	30	934.36	7500.00	2975.3813	1589.20803
Provisional Sum	30	.00	6666.67	1650.4660	1386.53878
Builder's Work	30	80.80	197228.30	122281.9	75737.21564
Contact Sum	30	18943.88	203001.00	140216.8	67442.79401
(Valid N listwise)	30				

Source: Researcher's Computation Using SPSS

V. ANALYSIS, FINDINGS AND DISCUSSION

The graphs of the cost variables, prime cost sums, provisional sums, Builder's work and contract sum as depicted in figures 4.1 to 4.4 show reasonable level of volatility which in deed is an expected pattern in risk variables. They portray likelihood of such volatility to affect cost performance of the projects. The analyzed results show the existence of positive relationship between the dependent variable contract sum and the independent risk variables (see tables 4.3 and 4.6). The standardized beta coefficient is 0.03 for prime cost sums, 0.279 for provisional sums and 0.766 for builder's work, with total regression frame co-efficient of 0.887 (SPSS Computation results tables 4.3 and 4.6). This evidence thus suggests that increasing the value of risk variables will inevitably lead to increase in contract sum.

Also, the regression output (table 4.3) showed R-square (co-efficient of determination) of 0.787. This entails that 78.7% variations in contract sum is attributable to changes in prime cost sum, provisional sum and the builder's work. This alludes to high explanatory power of the independent variables, and the dependence of contract sum on the risk factors.

The T- Statistic result (table 4.4) portrays that T- tabulated value for prime cost sum is 2.064, while T-computed is 0. 216. This leads to the acceptance of null hypothesis of insignificant relationship between changes in contract sum and prime cost sums, contrary to general expectations. Also for provisional sum, T- Tabulated is 2.064, while T computed is 2. 330. This depicts a statistically significant relationship, meaning that increasing provisional sums' work in the project creates unresolved risk issues that will ultimately swell consequential costs.

The result is similar for new builder's work with T-tabulated of 2.064 and T-computed of 6.869.

Possible argument in favour of insignificant relationship between prime cost sum and contract sum is that the prime cost sums are detailed quotation/costs of specialist works and supplies built into the contract sum (unlike provisional sums) and as such its value modification will not result in high consequential costs that will negatively impact cost performance.

The F- statistics metric, analysis of variance (ANOVA), which measured the statistical significance of the entire regression plane (see tables 4.5) showed a computed F* statistics of 31.966 with corresponding probability value of 0.000. This alludes that prime cost sum, provisional sum and Builder's work jointly has significant effect on contract sum of the hospital projects. The descriptive statistic analyzed to portray the statistical properties of the variables (see table 4.7) showed 30 variable observations with minimum value distributions for prime cost sum, provisional sum, Builder's work and contract sum of 934.36, 0.00, 80.80, 18943.88, respectively. Maximum value distributions, prime cost sum, provisional sum, Builder's work and contract sum, 7500.00, 6666.67, 197228.3, 203001.00 respectively. Also the mean value distributions for these variables are 2975.3813, 1650.4660, 122281.9, and 140216.8 respectively. While the standard deviation distribution are 1589.20803, 1386. 5387, 75737.21564 and 67442.79401 respectively.

The Builder's work risk factor 75737.21664 exhibited the highest dispersion in cost performance hence such huge change orders should best be constituted under a new contract, to minimize friction and risk of under performance.

VI. CONCLUSIONS

Risk is indeed a strong variable that significantly influences cost decisions.

The study concluded that risk factors of increase in provisional sums, Builder's work and to a minimal extent prime cost sums have high potential for increasing consequential costs thereby heightening final completion costs and resulting in low cost performance.

It recommends for contract practitioners and managers to increase their skill in project risk assessment, measurement and management. And at all times to make risk- analyzed cost decisions that will help reduce consequential costs and stem cost growth. The high explanatory risk factors/variables of prime cost sums, provisional sums and builder's work must be critically reviewed and managed to reduce their potential to cause high cost over-runs.

Contract mangers and cost estimators must improve their risk analytic skill by application of risk estimating softwares to reduce motivational and cognitive estimating biases and other exposed front-end development risk factors that swell consequential costs and predispose project to poor cost performance.

Further in-depth studies of impact of other risk factors on cost performance, such as variations, fluctuations and contingencies in rural, urban and spatially - difficult sites should be undertaken as a way of comprehensively stemming the impact of risk factors on project cost performance.

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