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Effect of Construction Risks and Uncertainties on Time and Cost Strategies of Building Contracts in Nigeria

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ABSTRACT

The need to understand the concept of construction risks and uncertainties, their constituents and their impact on contract time and cost objectives of building contracts in Nigeria necessitated this research. The method of study was by critical exposition of existing related literature and a review of relevant empirical research findings. The findings of the study showed that construction risks impact negatively on project objectives particularly the time and cost benchmarks. Construction risks give rise to contractual claims arising from time and cost overruns, thus, defeating contract strategy. The study concluded that construction risks in projects arise from various sources including physical, environmental, design, logistics, financial, legal, political, construction, and operational. The study recommended that construction stakeholders must achieve desirable project performance through proactive control mechanisms aimed at averting risks and uncertainties in projects.

1.0 Introduction

Project success is most times assessed on the primary parameters of time, cost and functionality (Rogalska, Bozejko, and Hejducki, 2008). Poor project performance in terms of achieving these project objectives has remained the bane of most private and public projects in Nigeria.

The time parameter operates on the premise of the time – value of money as any delays in scheduled completion may erode planned profit expectancy, and may further damage customers' goodwill, especially for service oriented projects (Love, 2002). The cost parameter operates on the basis that funds set aside for the project must not be unduly overspent to avoid the reduction of business profit as a result of cost overrun (Ogunsemi, and Jagboro, 2006). There is also a need for strict budget compliance in order to control the amount of capital invested. The functionality parameter according to Elbeltagi, Hegazy and Eldosouky (2004) operates on the premise that facilities or infrastructures must be engineered and executed in a way that meets minimum requirements of the end user needs; also, construction facilities must function as expected otherwise it is of no use to any one. Time and Cost overrun according to Faber and Stewart (2003) has characterized several national, continental and intercontinental projects in recent times.

A host of factors are responsible for time and cost overruns of construction projects in Nigeria. The environment in which construction takes place is itself beclouded with risks and uncertainties (Demir et al 2002). The environment according to Kleindorfer and Wu (2003) is characterized by the following; large complicated schemes; long contract periods often exceeding six months; complex, incomplete and often conflicting contract documentation; incomplete designs at time of tender; participation of diverse parties; unpredictable weather, limited resources and varying site conditions; inflationary economy; relative political instability and inconsistency in policy trusts. All these give rise to risks and as such, constitute uncertainties in the attainment of predetermined project objectives.

Risks in construction projects manifest in many ways, varying over time and across activities. They essentially stem from uncertainty, which in turn is caused by lack of information (Dikmen, Birgonul, Anac, Tah and Aquad, 2008). The environment within which the decision making process takes place is often divided into three parts: - certainty, risk and uncertainty.

Certainty exits only when one can specify what will happen during the period of time covered by the decision. Unfortunately, this does not happen very often in the construction industry. There is a difference between risk and uncertainty. A decision is made under risk when the decision-maker assesses risk either intuitively or rationally (Huam, Thoo, Poon, Amran, Muhammad

and Lee, 2011). The probability of a particular event occurring is based upon historical data and experience. Uncertainty, by contrast is a situation in which there are no historic data or record relating to the situation being considered (Wiedemann, Thalmann, Grutsch and Schutz, 2006).

The difference between risk and uncertainty are somewhat close, and for convenience, the construction industry uses the term risk to encompass both risk and uncertainty. Risks and uncertainties according to Avramov (2002) threaten project performance in terms of time, cost and functionality. Many cost and time overruns are attributable to either unforeseen events or foreseen events which were not appropriately predicted, and as such, not truly accommodated by project parties or stakeholders (Zavadskas, Turskis and Tamosaitiene, 2010).

A triangular relationship exists between time, cost and functionality with each variable exerting influence on others in relation to the overall project success (Nelson, 2005). It is expected that significant improvement to the existing time and cost performance of the nation's projects will be achieved through a critical reappraisal, and proactive identification/management of a multifarious risks and uncertainties that challenge the achievement of predetermined project objectives of construction projects in Nigeria.

2.0 Theoretical Framework and Related Empirical Research:

The construction industry is one of the most exciting, risky, rewarding, dynamic, and challenging fields. Odeyinka (1987) posits that risk is inherent in any construction project, commencing from inception through its completion. They occur at both construction and operational phases of the contract (Adesanya, 1993).

Project performance is often measured by the extent to which predetermined parameters of time; cost, quality criteria are met. Perry and Hayes (1985) state that experience of many projects across the globe indicate poor performance in achieving time and cost targets. The estimated time and cost established at precontract stages are hardly met at post contract final accounts, completion, and handover/commissioning stages of the construction contract. There often times exists a difference between estimated contract duration and actual contract duration (Bover, Arellano and Bentolila, 2002). Similarly, the cost at award and cost at completion are often at variance (Elhag, Boussabaine and Ballal, 2005). All these imply an imperative for project time and cost monitoring and control especially during the post-contract stages. However, among all project objectives, the cost parameter ultimately reflects performance in all areas. A well-managed project incurs lower cost than one which is not (Choudhury, 2005).

Risk as a concept of project management has been defined by a plethora of

scholars including Knights, 1921; Dickson, 1978, and Odeyinka, 1987. Greene (1973), however, defines risk as 'the uncertainty that exists as to the occurrence of some events'.

Bussey (1978), Merrett and Sykes (1973) attempts distinguishing risks and uncertainties, and also, between pure risks and speculative risks. Conceptually, there seem to be a difference between risks and uncertainties. Operationally both terms are intrinsically related and interwoven; often difficult to isolate from one another. Both constitute major threat to the achievement of project objectives (contract strategy).

Perry and Hayes (1985) suggest the following as guides to the understanding of risks and uncertainties:

i. Risks and uncertainties are associated with specific events or activities which can be individually identified.
ii. A risk event implies that there is a range of outcomes of the events, and each outcome having a probability of occurrence.
iii. Some risks offer only the prospects of adverse consequences (loss), e.g. structural collapse of buildings, bankruptcy, act of God, war, etc.
iv. Many common construction risks offer the prospects of either loss or gain; depending on who it impacts. Some of the risks include plant and labour productivity, variation and inflation.

The significance of risks stem from the fact that the future is beset with uncertainties, both in terms of human behaviour and the characteristics of certain elements (Oyetoran, 1994). The preponderance of risks in construction projects especially its direct impact on time and cost strategy imply the imperatives of a renewed commitment to project control by both the design and construction teams through a strategic planning framework.

Global Studies of Time and Cost Overruns Risks and their Sources:

The challenge of time and cost overrun in construction projects is not locally situated. It is a global phenomenon that has assumed an international dimension. The domain of its seemingly ravaging effect cut across many countries and continents of the world.

Studies by Morris and Hough (1987) show a record of project overruns on a vast majority of projects including military installations, energy systems, information technology projects in various geographical entities, including the United States, United Kingdom and the third world countries. Their studies reveal a consistent and in some cases excessive overrun ranging from 40 - 500% over initial budget estimate. Other global construction research streams show a corroborating evidence of time and cost overruns in construction project delivery. Langford and Wong (1979) study on Slough Estates, London aimed at comparing the cost of providing buildings constructed for identical purposes for the same company in a variety of countries shows that Britain has a construction cost index of 100, France 98 , Germany 87, Belgium, 107,

Australia, 94, USA 74, and Canada 59. Similarly, the construction time, planning time, and total time horizon are respectively - Britain:57, 26, 96; France 30, 16, 56 ;Germany 29, 12, 56 ; Belgium 37, 6, 52; Australia 28, 3, 50; USA 23, 4.50, 38 , and Canada 21, 6, 27 (Table 1).

Table 1: Construction Cost, Time and Planning Time indices across countries of the Globe

	Britain	France	Germany	Belgium	Australia	USA	Canada
Construction Cost (index)	100	98	87	107	94	74	59
Construction Time (weeks)	57	30	29	37	28	23	21
Planning time (weeks)	26	16	12	6	3	4.5	6
Total Time Horizon (weeks)	96	56	56	52	50	38	27

Source: Langford and Wong (1979) "Towards Assessing Risks",

The disparity of time and cost indices are apparently due to various propensities of implementation risks associated with projects. Thus, the risk of time and cost overruns pervades construction projects across the globe irrespective of geographical location, project scope and size. As, such, the management of time and cost overrun risks in construction projects is not only of contemporary relevance but auspicious at this period of global recession and paucity of funds.

Studies by Charles and Andrew (1990) found out that a cost overrun rate of 1-11% is more likely to occur in large projects than the small ones. Their studies also reveal that contracts with award less than the Government estimate are more likely to have overrun rates above 5% with a chi-square value of 2.80. Also, research conducted by Akinwonmi (1991) on 10 selected Building Contracts in Nigeria revealed a time overrun ranging from 14 weeks – 240 weeks, and percentage time overrun ranging from 50% - 420%; and a cost overrun ranging from 8%-142%

Table 2: Percentage Overruns for Ten Selected Building Contracts in Nigeria

Project No	Contract Period		Overrun in Time	Percentage overrun in Time	Contract Sum		Overrun in Cost (₦ Million)	Percentage overrun in Cost
	Initial	Final			Initial (₦ Million)	Final (₦ Million)		
1	14 months	31 months	17 months	120	2.4	2.6	0.2	8
2	12 months	27 months	15 months	125	0.64	0.87	0.25	37
3	18 months	71 months	53 months	300	24	40	16	66
4	40 weeks	208 weeks	168 weeks	420	1.5	3.5	2.0	133
5	50 weeks	90 weeks	40 weeks	80	0.85	1.4	0.55	64
6	85 weeks	236 weeks	151 weeks	90	8	14	6	75
7	60 weeks	300 weeks	240 weeks	400	3.5	8.5	5.0	142
8	10 months	24 months	14 months	140	0.12	0.15	0.03	23
9	70 weeks	104 weeks	34 weeks	50	12.3	13.5	1.2	10
10	36 weeks	73 weeks	37 weeks	100	0.70	1.1	0.4	57

Source: Akinwonmi (1991) study on 10 selected Building Contracts in Nigeria

These streams of research in construction cost overrun clearly reveal the reality of this challenge and the growing need for proactive management-minimization, or elimination of tendencies that lead to variability between Cost at award and Cost on Completion. Contractors are often faced with a variety of situations involving many unknown, unexpected, frequently undesirable and often unpredictable factors in the course of their project delivery.

Research by Elinwa and Buba, 1993; Akinwonmi, 1991; Jahren and Charles,1990; Charles and Andrew, 1990; Okpala and Aniekwu, 1988; Zaki and James, 1987; Morris and Hough, 1987; Langford and Wong, 1979 reveal numerous risk factors responsible for construction overrun. The most common include: Scope and Quantity increases, Engineering and Design changes, faulty design and late project decisions leading to delays, Under-estimation, Mis-estimation, Unforeseen inflation, Inclement weather, Cash-flow problems, Project size and complexity, Unforeseen technical difficulties, Schedule changes, Tight schedules, Poor Project definition, Poor Contract administration, Labour Problems, Poor industrial relations, Government legislation, Statutory requirement and external factors.

Flyvbjerg, Holm and Buhl, (2004) views cost overrun as the difference between final contract cost and the contract award amount. Considering the high propensity of these risk factors and their apparently devastating effects on the integrity of predetermined construction benchmarks, the need for a renewed awareness has become more discerning than before. Perry and Hayes (1985) classify risks in projects according to the following primary sources:

(a) Physical: Loss or damage by fire, earthquake, flood, accident, landslip.
(b) Environmental: Ecological damage, pollution, waste treatment.
(c) Design: New Technology, innovative applications, reliability, safety detail; Precision and appropriateness of specifications; Design risks arising from surveys, investigations; Likelihood of Change; Interaction of design with method of construction.
(d) Logistics: Loss or damage; availability of specialized resources-expertise, designers, contractors, suppliers, plant, scarce construction skills, materials; access and communications; organizational interfaces.
(e) Financial: Availability of funds, adequacy of insurance; adequate provision of cash flow; losses due to default of contractors, suppliers; exchange rate fluctuation, inflation; taxation.
(f) Legal: liability for act of others, direct liabilities; local laws, legal differences between home country and home country of suppliers, contractors, designers.
(g) Political: Political risks in countries of owner and suppliers, contractors-war, revolution, changes in law.
(h) Construction: Feasibility of construction methods, safety, industrial relations, extent of change, climate, quality and availability of management and supervision.
(i) Operational: Fluctuations in market demand for product and service, maintenance needs, fitness for purpose, safety of operation.

In spite of the above grouping of project risks according to their primary sources; risks specifically responsible for project cost overrun are broadly classified into - 'financial risks' and 'design risks'. On the basis of this postulate, a study conducted by Odeyinka (1987) on nineteen (19) completed building projects in Nigeria indicates the following financial and design risks:

Table 3: Financial and Design Risk Factors Responsible for Cost Overrun

PRN	AAC N'000	TDS N'000	COR N'000	FLC N'000	PFL %	VAR N'000	PVR %	RPQ N'000	PRM %	PCA N'000	PPC %	PSA N'000	PPS %	M	N
1	921.06	831.00	90.06	57.50	63.89	12.88	14.25	5.50	6.11	9.63	10.75	4.50	5.00	4.50	5.00
2	945.80	866.00	79.80	45.50	57.02	18.75	23.50	3.59	4.50	11.95	14.98	-	-	.	.
3	965.20	880.00	85.20	54.45	63.50	15.75	18.50	.	.	11.50	13.50	3.49	4.10	3.45.	4.10
4	962.20	892.00	70.50	41.55	58.94	15.97	22.65	2.82	4.00	6.59	6.35	3.57	5.06	3.57	5.06
5	1,250.00	900.00	349.80	245.20	70.10	41.98	12.00	17.49	5.00	31.13	8.90	13.99	4.00	13.99	4.00
6	1,294.60	1,090.00	204.60	92.00	44.97	48.41	24.15	25.78	12.60	20.58	10.03	16.88	8.25	16.88	8.25
7	1,450.00	1,200.00	250.00	155.45	62.18	44.55	17.82	12.50	5.00	31.25	12.50	6.25	2.50	6.25	2.50
8	1,490.00	1,350.50	139.50	72.28	51.81	39.33	28.19	9.90	7.10	12.21	8.75	5.57	4.15	5.75	4.15
9	1,950.00	1,685.50	264.50	156.00	58.97	54.62	20.65	10.60	4.03	29.49	11.15	13.75	5.20	13.75	
10	2,300.00	1,750.00	550.00	357.50	65.00	85.25	15.50	.	.	74.25	13.50	33.00	6.00	33.00	6.00
11	2,630.00	1,950.00	680.00	353.60	52.00	138.99	20.44	57.80	8.50	95.60	14.05	34.00	5.00	34.00	5.00
12	2,750.00	2,150.00	600.00	378.45	63.02	101.96	16.92	30.03	5.00	63.05	10.50	27.02	4.50	27.02	4.50
13	3,050.50	2,400.00	650.00	370.50	56.96	87.82	13.50	39.03	6.00	68.30	10.50	84.83	13.04	84.83	13.04
14	4,240.00	2,650.00	1,590.00	856.60	35.67	242.48	15.25	87.58	4.25	316.09	19.88	107.3	6.75	107.33	6.75
15	4,050.00	3,000.00	1,050.00	577.48	55.00	144.38	13.35	65.63	6.25	175.88	16.75	86.63	9.25	85.63	8.25
16	5,950.00	3,210.00	740.00	275.65	37.25	186.35	22.75	56,24	7.60	179.45	24.25	60.31	8.15	60.31	8.15
17	5,200.00	3,550.50	1,650.00	1,050.0	63.64	269.94	16.36	71.78	4.35	159.23	9.65	99.00	6.00	99.00	8.00
18	5,100.00	3,780.00	1,320.00	765.00	57.95	185.46	14.05	68.64	5.20	211.85	16.05	89.10	6.75	89.1o	6.75
19	6,950.00	4,725.00	2,225.00	1,028.5	46.22	239.86	10.78	97.23	4.37	723.13	32.50	136.3	6.13	136.39	6.13

Source: Odeyinka (1987) study on nineteen (19) completed building projects in Nigeria

Where, PRN- Project Number; AAC- Actual Annual Cost (N'000); TDS- Tender Sum; COR- Cost Overrun (N'000); FLC- Fluctuations; PFL- Percentage Fluctuations (%);VAR- Variations (N'000); PVR- Percentage Variations (%); RPQ- Remeasurement of Provisional Quantities; PRM- Percentage Re-measurement (%); PCA- P.C Sum Adjustment; PPC- Percentage P.C Sum Adjustment (%); PSA- Provisional Sum Adjustment (N'000); PPS-Percentage Provisional Sum Adjustment (%)

Odeyinka's study revealed the following as sources of financial risks expressed as a percentage of cost overruns as follows: Fluctuation: 35.67 - 70.10%, Prime Cost adjustment: 6.35 - 32.5% and Provisional Sum: 2.5 - 13.04%

The Study also revealed the following as sources of design risks expressed as a percentage of cost overrun as follows: Variations: 10.78 - 28.19% and Remeasurement of Provisional Quantities: 4-12.60%.

The presence of these risks poses considerable challenge to construction stakeholders, particularly members of both the design and construction teams. The situation requires continuous information on project risks and the distribution of their probability of occurrence. This is a pragmatic approach towards the development of time and cost control mechanisms to checkmate or benchmark their impact on construction project delivery.

The Severity of Impact of Loss and/or Expense Claims on Time and Cost Strategies of Building Contracts

There are two broad classifications of construction claims- Positive and Negative Claims.

(a) Positive Claims

The positive claims are the contractual claims (Circo, 2006). They comprise Claims derivable from specific clauses in the Conditions of Contract and Damages or other remedies obtained by litigation.

(b) Negative Claims

Ibironke (2004) opines that negative claims are often presented by contractors for which they are not entitled to remedy from the contract conditions. The claims according to Hughes and Maeda (2002) include the following: Rectification of tender due to any error whether arithmetic or not in the computation of the contract sum; failure to conceive the full financial implications of the contract documents; inability to determine the actual cost of contractual rates; lack of recruitment of operatives due to labour problems in the geographical area of contract; poor quality of site agent and other supervisory staff; improper economic choice of plant and its misuse; incorrect choice of site operations, such as, dry season work being executed in severe rain storms; lack of proper work programming; inadequate ordering of materials, thus causing unnecessary delays or disruption of the works; failure to utilize the skills of experts, such as work-study engineers, site accountants, quantity surveyors etc.

Knowledge of these negative claims would ensure that financial claims submitted in respect of them are not entertained in the contract, thus leading to cost control. Claims for loss and/or expense are a common feature projects executed in Nigeria irrespective of their size and scope. The occurrence of these claims defeat contract strategy by exceeding estimated time and cost. The possibility of excluding unascertained costs outside the tender figure enables a contractor to only price known factors during the pretender stages. This is because various conditions of contract for both building and civil engineering works have explicit provision for loss and/or expense claims for complying with project requirements.

Studies by Adindu and Oyoh (2011) show that each of the fourteen claimable clauses of the Standard Form of Building Contracts in Nigeria has respective severity of impact on contract strategy. The studies further revealed that Clause 11(6)-Claim for proven extra cost incurred in carrying out variations instructions which cannot be fully accommodated in valuation of variations ranked the first position, indicating the highest impact on project objectives (Table 4).

Table 4: The computed values of Rank Agreement Factors (RAFs), Percentage Agreement Factors (PAFs), Standard Deviations (S), Squares of Standard Deviations (S^2), and Rank Order of Claims (ROCs).

Source**:** Adindu C. C. and Oyoh A. J. (2011), "Empirical Study of the Severity of Loss and Expense Claims on Building Contracts in Nigeria.

Clause No.	Architect's Ranking	Quantity Surveyor's Ranking	Engineers' Ranking	SR	RAF	PAF	S	S^2	ROC
1	2	2	5	9	0.64	77	-13.49	181.98	2
5	10	8	14	32	2.29	18	9.51	90.44	10
6	9	12	10	31	2.21	21	8.51	72.42	9
7	11	13	9	33	2.36	15	10.51	110.46	11
11(4)	5	3	1	9	0.64	77	-13.49	181.98	2
11(6)	1	1	2	4	0.29	90`	-18.49	341.88	1
12	3	6	4	13	0.93	67	-9.49	90.06	4
23	8	4	8	20	1.42	49	-2.49	6.20	7
24	6	5	3	14	1.00	64	-8.49	72.05	5
27	7	9	7	23	1.64	41	0.51	0.26	8
28	14	14	11	39	2.79	0	16.51	272.58	14
31	4	7	6	17	1.21	57	-5.49	30.14	6
32	13	10	13	36	2.57	8	13.51	182.52	13
34	12	11	12	35	2.50	10	12.51	156.50	12

The Conditions of Contract are those forecast or anticipated at the time of tender; but if, during the currency of works, the forecast or anticipated conditions change, then the contractor has the right to claim for loss and/or expense under the relevant clause.

The British Research and Establishment (BRE) states that a change of condition exists under the following premise: Dry season or Rainy season, Day or Night, Normal or Abnormal, Cheap or Expensive, Low or High, Cold or Hot, Dry or Wet, Clean or Dirty, Free or Restricted, Accessible or Inaccessible, Possession or Non-Possession, Normal time or Overtime, Economic or Uneconomic, Supported or Cantilevered, Covered or Exposed, Level or Sloppy, Straight or Shaped, Empty or Occupied, On Time or late, Fast or Slow, Mechanical or Manual, Contractual or Ex-contractual and Profitable or Non-Profitable.

A valid claim exists for the contractor upon provable evidence of change of condition in which the contract works are executed. A proven change of condition implies an impact on predetermined time and cost of the construction and may consequently lead to contract overrun.

3.0 Conclusion

Risks in construction projects manifest in numerous ways, varying over time and across activities. They originate from uncertainty which, in turn is caused by a lack of information. The environment within which the decision

making process takes place is often divided into three parts: - certainty, risk and uncertainty.

Project parameters of time, cost and functionality are susceptible to vagaries of risks and uncertainties especially at post contract stages of construction delivery. Empirical research findings abound on the ravaging effects of construction risks and uncertainties on predetermined construction time and cost benchmarks across the globe. Construction risks in projects arise from various sources including- physical, environmental, design, logistics, financial, legal, political, construction, and operational. The preponderance of these risk factors and their negative impacts on contract strategy creates a renewed interest by construction stakeholders in terms of knowledge of risks, types of risks, sources of risks, probability of occurrence and severity of impact on projects.

4.0 Recommendations

Based on the above findings and conclusion, the paper recommends the following:

1. Design and Construction team must have in-depth knowledge of the Standard Form of Building Contacts in use.
2. The management of conditions under which construction projects are executed is crucial at all project phases to guard against departure from the forecast or anticipated conditions.
3. Project stakeholders must achieve desirable project performance through proactive control mechanisms aimed at checkmating risks and uncertainties in projects.
4. Adequate knowledge of construction risks and uncertainties, including their sources, probabilities of occurrence, and severity of impact based on factual information and empirical research evidence is crucial for risk mitigation.
5. Claims procedure in strict compliance with the Conditions of Contract must be followed by contractors on cases of loss and /or expense.
6. Managerial tact is required at both pre-contract and post-contract stages to curtail the abuse of claim clauses considering their negative impacts on predetermined time and cost and need to avoid overrun of construction projects in Nigeria.

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