VOL. 26 NO. 4
ISSN: 2196-1789
SEPTEMBER, 2022

African Scholar Publications & Research International

African Scholar Journal of Built Env. & Geological Research (JBEGR-4)

Effect of Cost-Related Risks in Building Construction Projects

Okigbo, Olushola Ndefo; and Mamman, Ekemena Juliet
Department of Quantity Surveying, Federal Polytechnic, Bida

Abstract
The construction industry is characterized by inherent risks and uncertainties as a result of its fragmented and competitive nature. This, therefore, makes it difficult to accurately estimate the cost of a construction project. Cost-based risks are the cost that directly affects the project cost during construction. Many projects have suffered abandonment because of cost overruns due to unnecessary occurrences of cost-related risk. For a project to be adequately completed especially within cost and quality, a manager should be able to ascertain cost-related risks to be able to prepare adequately for the risks. Therefore, this paper aims at evaluating cost-based project risks in building projects and also to determine the effect on building project costs. A quantitative approach was used in obtaining data through structured questionnaires administered to the construction professionals practising in the F.C.T. Abuja. 102 questionnaires were distributed and 75 were returned (73.5% response rate). Using a two-dimensional scaling, with a Likert scale of 0-4, the likelihood of the identified risk factors occurring and their perceived impacts in case of occurrence. The data were analysed using the Relative important index (RII) and multiple regression analysis. The study revealed that cost-based risks have a very positive significant effect on a project. The paper recommended that accuracy of data in the form of scope, specification and drawings be provided by the specialist in order to avoid change of scope, design and specification which would result to inflation of contract sum in order to avoid cost overrun and project abandonment.

Keywords: *Building, Construction, Cost-related, Projects, Risks.*

Introduction

Risks in construction projects are significant elements of the total project costs and thus their allocation has a major effect on the project budget (Zaghloul and Hartman 2003; Ayub *et al.,* 2019). The knowledge of significant risk factors requires greater attention and thus the incorporation of the whole process of risk management for projects to be completed as budgeted (Oluranti *et al.,* 2009). Bello

and Odusami (2009) concluded that the effectiveness of contingency management can strongly influence project success. Furthermore, the importance of forecasting an accurate and effective construction contingency is essential to the client's satisfaction with the estimated final construction cost and hence, the construction contract delivery. In addition, the knowledge about risk reserve and cost estimation can provide an advantage in a rapidly changing business environment. The purpose of risk reserves estimation is to ensure that the budget set aside for project execution is realistic and sufficient to contain the risks of unforeseen cost increases (Karlsen and Lereim 2005; Koks *et al*., 2019). The accuracy of the contingency thus provides a realistic budget which could aid the completion of a project on time, in good quality and within budget. Therefore, there is a need to identify various forms of cost risks related risk and determine the effect on building project delivery this will enable the stakeholders to have a better knowledge of how to manage these risks. Because of the above, the paper tends to identify and rank the various sources of cost-related risks in building projects and to determine the effect of cost-related risks identified on project cost.

Literature review

Risk Management and Construction Projects

The effective management of risk is crucial to the success of any construction project. Since project risks are not inevitable, the management of risks must be optimized and not ignored (AACE, 2000; AACE, 2008; Jayalath and Gamage, 2022). According to Li *et al*. (2022), the risk management system presents a clear concise diagrammatic overview of the cost estimating process. Jagun (2020) and Odeyinka and Iyagba (2000) defined risk management as the act of planning, organizing, directing and controlling an organization's assets and activities to minimize the adverse operational and financial effects of accidental losses upon that organization and as a system that aim to identify and qualify all risks to which the business or project is exposed to. According to Wang (2004), risk management is a formal and orderly process of systematically identifying, analyzing, and responding to risks throughout the life – cycle of a project to obtain the optimum degree of risk elimination, mitigation and/or control. Risk management according to Abd El-Karim *et al.* (2017) is the identification, measurement and economic control of risks. Jahan *et al.* (2022) argued that the main benefit of risk management is to help project managers ensure that project objectives are not affected by adverse effects. Though risk management is not a means of removing all risks, but facilitates explicit decisions making which will mitigate the effects of certain risks. Other benefits include providing an improved understanding of the project, promoting feedback, information transfer and, heightening awareness of the range of possible outcomes (Maruping *et al*., 2019; Afzal *et al*., 2020; Deep *et al*., 2021). Managing project risks effectively required identification, analysis and mitigation (Bereriche and Ait-Kadi, 2015). Carcillo *et al*. (2017) identified and categorized Risk

mitigation strategies into four, namely; Risk reduction, Risk avoidance/ elimination, Risk transfer; and risk retention

Risk Reduction

Risk reduction deals with reducing the expected monetary value of risk events and this can be done by reducing the probability of occurrence, reducing the risk event value, or both (Deep *et al*., 2021). According to Bello and Odusami (2009) since risk cannot be eliminated, project reduction actioners make efforts to reduce either their likelihood of occurrence or eventual impact. Construction organizations would visit and conduct site investigations to ascertain any inherent problems with the land and decide on how to deal with them before signing a private Finance Initiative project (Bello and Odusami 2008; Bello and Odusami, 2009).

Risk Avoidance/ Elimination

Risk avoidance according to Shrestha and Shrestha (2016) involves taking preventative measures to avert jeopardizing project objectives to ensure that the risk cannot arise again. This does not result in a design team that is ignorant of the potential for risk-induced problems on-site rather a team who at the risk identification stages is made aware of the severity, source and impact of the potential risk.

Oyelami (2021) stated that eliminating a specific threat, usually by eliminating the cause is another way of avoiding risk. Vegas-Fernández (2022) further explained that a contractor not placing a bid or the owner not proceeding with project funding are two ways of eliminating risk. It was however argued that risk can never be eliminated but the possible adverse effect could be reduced (Oyelami, 2021; Vegas-Fernández, 2022).

Risk Transfer

Vegas-Fernández (2022) observed that the construction industry is not strong enough in coping with the issue of risks. Risk transfer was found to dominate the construction industry. Risk transfer according to Denga and Rakshit (2022) involves a shift in the burden of risk from one stakeholder to another. The essential characteristic of risk transfer is to share it with or to transfer the total risk to the other party. The transfer of allocation of risk to another party can be done either through the condition of the contract to another party or through an insurance policy by payment of an agreed insurance premium for the risk (Carcillo *et al*., 2017)

Risk Retention

Risk-retention should only be advocated where reduction or transfer of risk is impossible. According to Smith *et al.* (2006) in some situations, the only option available is to retain a risk. The party that is holding a risk might be the only one that can manage the risk or accept the consequence should the risk be realized. Risk-retention in the words of Carcillo

et al. (2017) involves the method of dealing with risk by a company that controls them. This has to do with devising a deliberate management strategy after a conscious evaluation of possible losses and making a contingency plan should the risk event occur.

Cost Related Risk In Building Projects

Cost-related risk is the risk that a project will spend more money than originally budgeted. It usually leads to overspending on the project and it causes project overrun if not well managed (Karlsen and Lereim 2005; Koks *et al*., 2019). Aarthipriya *et al*. (2020 Identifies Data inaccuracy, Inflation, Performance/ availability, Volume/demand, Currency fluctuation,Change in law, Solution/design risk, Delivery risk (Project delay), Scope change /specification, Supplier defaults, Termination, Subcontractor insolvency, Industrial action, and lastly unforeseen events (force majeure). These mentioned cost-related risks are the risks that were made use of in this paper.

Methodology

This paper aims to identify and rank the various sources of cost-related risks in building projects in some selected sites in the Federal Territory, Abuja Nigeria. In achieving the aim 102 questionnaires were distributed and 75 were returned (73.5% response rate) and found useful for further analysis. The sample size of the respondents was determined by the use of purposive sampling techniques. The questionnaire was identified from the literature and through discussion with the respondents who are professionals in the construction industry who have experience in project management and risk management. Using a two-dimensional scaling, respondents were requested to score on a Likert–type scale of 0-4, the likelihood of the identified risk factors occurring and their perceived impacts in case of occurrence. The measuring scale of 0 represents a situation where there was no likelihood of occurrence or impact, while 4 represents a very high likelihood of occurrence or impact. This then gives the measuring scale the property of an interval scale, which enables the collected data to be subjected to various statistical analyses. Their opinions were collected by the use of a Likert scale as earlier stated. The questionnaire analyzed using a relative importance index and regression analysis.

Data Analysis and Results

Data analysis was carried out by evaluating the relative importance of the identified risk factors at the project level. The numerical scores assigned by respondents were transformed into a relative importance index (RII) using the following formula:

$$\text{RII} = \sum_{k=0}^{1=4} \mathbf{E}^{i}\mathbf{P}^{i}$$

Where: Ei = the number of the likelihood of occurrence of risk factor or impact

Pi = the percentage of respondents to the number of the likelihood of occurrence or impact.

Further analysis was carried out using multi-linear regression analysis to determine the impacts of the identified cost-related risk factors on total project cost and time.

Table 1: Classification of Organisation and the Distribution of the Questionnaire

Professionals	No distributed	Number retrieved	% of number retrieved	% of number distributed
Quantity surveyors	30	23	30.7	29.4
Builders	22	14	18.7	21.6
Civil engneers	20	15	20	19.6
Archtect	10	7	9.3	9.8
Others	20	16	21.3	19.6
Total	102	75	100.0	100

Source: Researcher Data Analysis 2022

Table 1 shows the the professionals that responded to the questionaires. 102 questionaires were distributed and 75 were retrieved indicating 73.5% level repondents which is adequate for the research. The result shows that quantity surveyors are the highest respondents for the study. This is inline with the findings of some previous studies that the quantity surveyers are the major proffessionals that are usually involve in risk management.

Table 2: years of experience of the respondents

S/N	Years	Frequency	Percentage
1	**Less than 5years**	**5**	**6.7**
2	**5 - 10**	**15**	**20**
3	**10 – 15**	**10**	**13.3**
4	**15 - 20**	**30**	**40**
5	**20 years and above**	**15**	**20**
	Total	**75**	**100**

Source: Researcher Data Analysis 2022

Table 2 shows the year experience of the respondents. The results indicated that the majority of the respondent are highly experience those with the 15 – 20 years and 20 years above are 40% and 20% respectively.

Table 3. Cost Related Factors and their Likelihood of Occurrences in Building Projects

Cost Related Risk	Likelihood of risk occurrence index(RII)	Rank
Scope change /specification.	**0.95**	**1**
Supplier defaults.	**0.94**	**2**
Data inaccuracy.	**0.93**	**3**
Subcontractor insolvency.	**0.90**	**4**

Inflation.	**0.89**	**5**
Industrial action.	**0.89**	**5**
Unforeseen events (force majeure)	**0.85**	**7**
Solution/design risk.	**0.83**	**8**
Performance/ availability.	**0.78**	**9**
Delivery risk (Project delay).	**0.76**	**10**
Change in law.	**0.75**	**11**
Termination.	**0.73**	**12**
Volume/demand	**0.70**	**13**
Currency	**0.69**	**14**

Source: Researcher's Analysis of Data (2022)

Table 3 shows the fourteen (14) cost-related factors gotten from literature, which was analysed using the relative importance index analysis. The result shows that the most important factor that occurs in a building project was changing of scope and specification of a project with an RII of 0.95 followed closely by suppliers defaults with an RII of 0.94, which indicated that since the contractor cannot control the activities of the suppliers there are likelihood of suppliers having default in their services, these findings are in line with Afzal *et al* (2020) and Aarthipriya, *et al*. (2020). Other factors also followed closely till the last factor was currency which was ranked last with an RII of 0.69, the level of importance of all the fourteen variables was significant they range between 0.69 – 0.95 Jahan *et al*. (2022).

Table 4: Assessment of the Effects of Cost-Related Risk on Building Project Cost and time

Model			Beta Coefficient	R Square	F	T Value	P-Value	Remark
$H1_1$	Data inaccuracy	CRR1 – BPCT	0.150	0.308	14.739	0.563	0.000	SSE
$H1_1$	Inflation	CRR2 – BPCT	0.045	0.260	13.287	0.184	0.000	SSE
$H1_1$	Performance/ availability	CRR3 – BPCT	0.510	0.370	15.288	2.206	0.000	SSE
$H1_1$	Volume/demand	CRR4 – BPCT	1.104	0.401	10.528	2.586	0.000	SSE
$H1_1$	Currency	CRR5 – BPCT	0.341	0.240	12.777	0.456	0.002	SSE
$H1_1$	Change in law	CRR6 – BPCT	0.341	0.362	18.643	0.456	0.002	SSE
$H1_1$	Solution/design risk	CRR7 – BPCT	0.134	0.402	74.344	3.014	0.000	SSE
$H1_1$	Delivery risk (Project delay)	CRR8 – BPCT	0.053	0.332	57.134	1.100	0.000	SSE
$H1_1$	Scope change / specification	CRR9 – BPCT	0.304	0.321	71.493	6.562	0.000	SSE
$H1_1$	Supplier defaults.	CRR10 – BPCT	0.283	0.391	71.905	6.281	0.000	SSE
$H1_1$	Termination.	CRR11– BPCT	0/383	0.310	68.615	8.864	0.000	SSE
$H1_1$	Subcontractor insolvency.	CRR12 – BPCT	0.013	0.290	4.600	0.192	0.003	SSE
$H1_1$	Industrial action.	CRR13 – BPCT	0.134	0.402	74.344	3.014	0.000	SSE

H1₁ Unforeseen events (force majeure)CRR14 – BPCT0.082 0.267 13.706 1.112 0.000 SSE

Source: Researcher's Analysis of Data (2022)

It was deduced from model 1 the degree to which the data accuracy affects building project cost and time is moderate, the model had a moderate predictive power of 31% ($R^2 = 0.308$; F change = 14. 739 with a P-value of 0.000). The same thing applies to all the variables the 14 variables have a significant effect on project cost and time and the R^2 ranges from 0.267 – 0.402 which indicated a percentage of effects between 26% to 40%. The detail of the result of the model is as shown in table 2.

Conclusion and Recommendations

From the literature reviewed and the analysis of the result, there is a precarious effect of cost-related risk on project cost, resulting to cost overrun and project abandonment. It was concluded that data inaccuracy and inflation are the major cause of risk in building projects in Nigeria, this is as a result of change of scope and specification. The study recommended that accuracy of data in the form of scope, specification and drawings should be made available by the specialist to the contractors in order to avoid the occurrence of change of scope, design and specification which would result to inflation of the contract sum in order to avoid cost overrun and building project abandonment. The study will guide construction professionals in identifying the cost related risks and help them make adequate provisions for them to avoid the occurrence, in order to curtail cost overrun and project abandonment. Further study should be carried out to identifying the time related risks as well as its impact on project cost.

REFERENCE

AACE (American Association of Cost Engineers) (2000). AACE International Risk Management, Dictionary. *Cost Engineering* 42 (4): 28 – 32

AACE (American Association of Cost Engineers) (2008). Contingency Estimating – General Principles. AACE International Recommended Practice 40R – 08.

Aarthipriya, V., Chitra, G & Poomozhi, J. (2020). Risk and its impacts on time and cost in construction projects. *Journal of Project Management*, 5(4), 245-254.

Abd El-Karim, M. S. B. A., Mosa El Nawawy, O. A., & Abdel-Alim, A. M. (2017). Identification and assessment of risk factors affecting construction projects. *HBRC Journal*, *13*(2), 202-216.

Afzal, F., Yunfei, S., Junaid, D., & Hanif, M. S. (2020). A cost-risk contingency framework for managing cost overrun in metropolitan projects: Using fuzzy-AHP and simulation. *International Journal of Managing Projects in Business*, *13*(5), 1121- 1139.

Ayub, B., Thaheem, M. J., & Ullah, F. (2019). Contingency release during project execution: the contractor's decision-making dilemma. *Project Management Journal*, *50*(6), 734- 748.

Baccarinni, D. (2007). The maturing concept of estimating project cost. *The Construction and Building Research Conference of the Royal Institution of Chartered Surveyor, Leeds, 10th -11th September 2007.*

Bello, W.A. and Odusami, K.T. (2009). Project Variables Influencing Contingency on Construction Contract in Nigeria. *The Construction and Building Research Conference of Royal Institute of Chartered Surveyor, University of Cape Town, 10-11th September 2009.*

Bello, W.A. and Odusami, K.T. (2008).The Practice of Contingency Allocation in Construction Projects in Nigeria.*Proceedings of The Construction and Building Research Conference of the Royal Institution of Chartered Surveyors, September 2008*

Bereriche, Y., & Ait-Kadi, D. (2015). Contingency design for reliability in a supply chain. *International Journal of Risk and Contingency Management (IJRCM)*, *4*(2), 31- 44.\

Carcillo, J. A., Sward, K., Halstead, E. S., Telford, R., Jimenez-Bacardi, A., Shakoory, B., & Hall, M. (2017). A systemic inflammation mortality risk assessment contingency table for severe sepsis. *Pediatric Critical Care Medicine*, *18*(2), 143-150.

De Marco, A., Rafele, C., & Thaheem, M. J. (2016). Dynamic management of risk contingency in complex design-build projects. *Journal of Construction Engineering and Management*, *142*(2), 04015080.
Deep, S., Bhoola, V., Verma, S., & Ranasinghe, U. (2021). Identifying the risk factors in real estate construction projects: An analytical study to propose a control structure for decision-making. *Journal of Financial Management of Property and Construction*.
Denga, E. M., & Rakshit, S. (2022). Supply Chain Logistics Risk Mitigation: Impact of the COVID-19 Pandemic. In *Global Risk and Contingency Management Research in Times of Crisis* 99-121. IGI Global.
Diab, M. F., Varma, A., & Panthi, K. (2017). Modelling the construction risk ratings to estimate the contingency in highway projects. *Journal of construction engineering and management*, *143*(8), 04017041.
Elinwa, A.U. and Joshua, M. (2001): "Time – Overrun Factors in Nigerian Construction Industry," *Journal of Construction Engineering and Management. ASCE, 27(5):419 – 425.*
Ford, D. N. (2002). Achieving multiple Project Objectives through Contingency Management. *Construction Engineering and Management Journal. 128: 30-39.*
Jagun, Z. T. (2020), "Risks in feasibility and viability appraisal process for property development and the investment market in Nigeria", *Journal of Property Investment & Finance*, 38 (3) 227-243. https://doi.org/10.1108/JPIF-12-2019-0151 I*nternational Journal of Project Management, 21 (6): 419-424.*
Jahan, S., Khan, K. I. A., Thaheem, M. J., Ullah, F., Alqurashi, M., & Alsulami, B. T. (2022). Modelling Profitability-Influencing Risk Factors for Construction Projects: A System Dynamics Approach. *Buildings*, *12*(6), 701. *The 40th Conference/Annual General Meeting of The Nigerian Institute of Building.*
Jayalath, C., & Gamage, I. (2022). Theory and Practice in Contingency Allocation: Characterizing Evidence from a Multiple Case Study in Sri Lanka. *Journal of Risk and Contingency Management (IJRCM)*, *11*(1), 1-16.
Joshi A., Kale S., & Pal D. (2015). Likert Scale: Explored and Explained. *British Journal of Applied Science & Technology*. 7 396 – 403 DOI 10.9734/BJAST/2015/14975
Karlson, J. T. & Jon, L. (2005). Management of project Contingency and Allowance. *Cost Engineering Journal 47 (9): 24 – 29.*
Koks, E. E., Rozenberg, J., Zorn, C., Tariverdi, M., Vousdoukas, M., Fraser, S. A., & Hallegatte, S. (2019). A global multi-hazard risk analysis of road and railway infrastructure assets. *Nature communications*, *10*(1), 1-11.
Li, J., Tao, X., Gong, T., & Li, X. (2022). How Confirmation Bias Influences Risk and Contingency Management: Lessons From Global Leaders' Responses to the 2020 Pandemic. *International Journal of Risk and Contingency Management (IJRCM)*, *11*(1), 1-12.
Love, P. E., Sing, C. P., Carey, B., & Kim, J. T. (2015). Estimating construction contingency: Accommodating the potential for cost overruns in road construction projects. *Journal of Infrastructure Systems*, *21*(2), 04014035.
Maruping, L. M., Venkatesh, V., Thong, J. Y., & Zhang, X. (2019). A risk mitigation framework for information technology projects: A cultural contingency perspective. *Journal of Management Information Systems*, *36*(1), 120-157.\
Mieth, R., Dvorkin, Y., & Ortega-Vazquez, M. A. (2022). Risk-Aware Dimensioning and Procurement of Contingency Reserve. *IEEE Transactions on Power Systems*.
Odeyinka, H.A., Kelly, S. and Perara, S. (2009). An Evaluation of the Budgetary Reliability of bills of Quantities in Building Procurement. *The construction and Building Research Conference of the Royal Institution of Chartered Surveyors was held at the University of Cape Town. 435-446.*
Omede, V. O. (2021). *Influence Of Materials Price Fluctuation On Performance Of Building Projects In Abuja, Nigeria* (Doctoral Dissertation).
Oyelami, C. F. (2021). *Assessment Of Risk Response Techniques For Construction Projects Under Design Bid Build And Design & Build Procurement Methods In Abuja* (Doctoral Dissertation).
Richard Oduro Asamoah, Kofi Offei-Nyako & Kwadwo Twumasi-Ampofo (2021) Relative importance of triggers influencing cost contingency determination for building contracts - the perspective of quantity surveyors, International Journal of Construction Management, DOI: 10.1080/15623599.2021.1930638
Shrestha, K. K., & Shrestha, P. P. (2016). A contingency cost estimation system for road maintenance contracts. *Procedia Engineering*, *145*, 128-135.
Smith, N., Merna, T, & Jobling, P. (2006). Managing Risk in Accommodating Client Risk. *Journal of Financial Management of Property and Construction* 8:49 – 56.
Sunday, S. O., & Mohammed, Y. D. (2021). Evaluating The Factors Militating Against The Use Of Insurance Policies In Managing Building Construction Risks In Abuja. The Proceedings Of The 16th Interdisciplinary Academic Conference, University Of Ibadan Conference 2021.
Vegas-Fernández, F. (2022). Project Risk Costs: Estimation Overruns Caused When Using Only Expected Value for Contingency Calculations. *Journal of Management in Engineering*, *38*(5), 04022037.
Wang, S.Q, Dulaimi,M.F. and Aguri, M.Y. (2004). Risk Management Framework For Construction Projects. Construction Projects in Developing Countries. *Journal of Construction Management and Economics* 22 (1):237-252.
Zhang, Y., Long, J., & Shi, C. (2015). A comprehensive contingency management framework for supply chain disruption risk management. *International Journal of Automation and Logistics*, *1*(4), 343-369.