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# A Systematic Review on Development of a Project Cost Estimation Framework: a Case Study of Nigeria

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# A SYSTEMATIC REVIEW ON DEVELOPMENT OF A PROJECT COST ESTIMATION FRAMEWORK: A CASE STUDY OF NIGERIA

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**Abstract:**
In Nigeria, there has been an insufficient study in the field of risk-related cost variability. Due to unreliable cost estimation, variations in cost, length, and quality are the direct implications. Cost estimating is difficult, mainly when dealing with uncertainties. The study aims to develop a construction project estimation framework that will aid accurate cost estimating and address cost variability issues through a systematic review. This is critical because initial estimates provided to clients can demonstrate a certain level of consistency and precision on which the client bases other planning activities. In achieving this, the theoretical concept was validated via a processual lens of a systematic literature review with cost variability and construction projects as search string within three databases: Scopus, Web of science, and EBSCO (BSP) (Business source premium), which were further studied and knowledge or research gaps identified. The review indicated factors causing deviation between final accounts and contract sum varied from 1 to 40, which includes Clients change/Changes in owner's requirements, Clients brief, Type of client, Defective design and specification, among others, thus meeting objective 1 of the study. A combination of interview and questionnaire will be used to collect data and consider other objectives of peculiarities, severity, effects and ways of mitigating risk, leading to the development of a cost estimating framework that is adjudged a vital tool in risk shedding rather than risk-sharing in project risk management, which would be a panacea to cost estimation problems, leading to cost variability in the Nigerian construction industry.

**Keywords**: Cost, Variability, Construction projects, Future studies, Nigeria

## 1 Introduction

The construction industry in Nigeria contributes 3.21 per cent to the Gross Domestic Product (GDP) as of the third quarter of 2020 (National Bureau of Statistics, 2020), making it a significant driver of economic development. Most risk management studies have gathered data on East Asia, Europe, the Middle East, and the United States (El-Sayegh and Mansour 2015). The main concern is how these risk factors combine to create the differences between the contract sum and the final account sum. While clients are becoming dissatisfied with seeing their projects completed over-budget, this study, therefore, seeks to influence government policy to build support mechanisms to foster/promote effective risk management practices in the construction industry in Nigeria and then proposes a framework from the perspectives of the different stakeholders involved in the project based on collected primary data.

## 2 Literature Review

Previous researchers like Zakaria et al. (2013); Olatunji, (2008); Ko (2009) have found that the absence of an accurate cost estimation framework leads to cost variability problems in construction, which in turn affects efficiency and effectiveness from the planning stage to the final account stage of the project. Doloi (2011) opined that proper cost estimation continues to be a problem of great concern to project stakeholders. Researchers like Zakaria et al. (2013); Olatunji, (2008); Ko (2009); Doloi (2011); Ameyaw (2015); Salahi and Ali (2018) and several others alluded to the fact that cost variability does exist in the construction industry and accepted that it is a major problem slowing down the construction industry.

Therefore, this study aims to extensively research on issues related to cost variability and identify pending research gaps. This study focusses on the following objectives:

(*1*.) To analyse trends in the literature related to cost variability in construction projects as well as their distribution patterns

*(2*.) To propose a classification framework highlighting emerging themes and unaddressed research issues related to cost variability in construction projects.

## 3 Research Methodology

This systematic review provides recent insights on the state of research into cost variability in construction projects. The Preferred Reporting Items guide the review for Systematic reviews and Meta-Analyses (PRISMA) framework, which offers a well-established protocol to conduct systematic literature reviews (Azril *et al.*, 2019).

The initial stage of the systematic literature review (SLR) concentrates on searching for relevant papers from relevant and essential databases such as Web of Science (WoS), Scopus and EBSCO Business source premium (BSP). Search string designated as cost variability and construction projects were used for the search over two decades. A total of 443 papers, excluding book reviews, forums, and editorials, were retrieved for further analysis, which was eventually filtered down to 280 papers after excluding papers not written in English language and non-peer-reviewed journals. Repeated entries across individual databases were also removed using the Mendeley reference management platform, thereby retaining 83. Further filtration excluded additional four articles that lacked full details such as author(s) details, year and title, which led to a final population of 79 articles that were then carefully considered and subjected to a detailed review as shown in Figure 1.

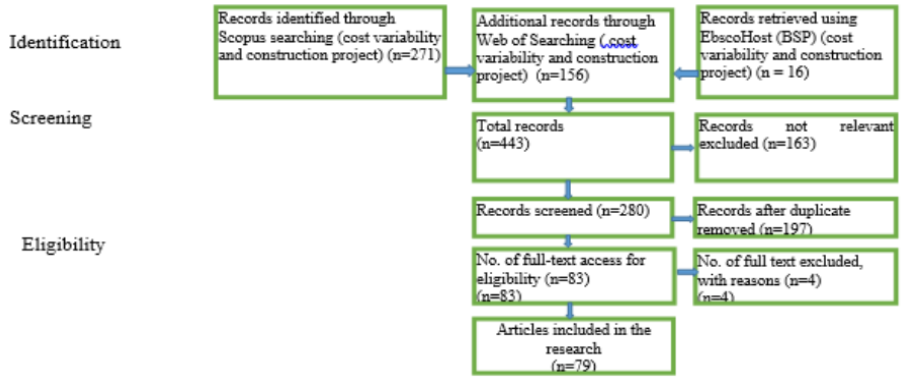


Figure 1.Flow- chart of the methodology

# 4 Findings and Discussion

*Content analysis*

The frequency of publication was not consistent and could be said to be progressing arithmetically until the year 2000, as seen from figure 2 when momentum gradually built up till the year 2019. The implication of this is that researchers are showing an increased interest in the field because the issue is now a significant concern. From 2011 up till 2019, the average number of articles per year increased to 4.4. Moreover, the analysis clearly shows the peak (n=19) in the year 2019. However, over the years from the review, the factors causing cost variability ranged between one and forty-five, while their effects can be grouped into four main classes.


*Figure 2. Publication of Articles per year.*

*Publication distribution among leading journals*

The selected articles belong to 43 journals, as seen in figure.3. The top three journals constitute approximately 34.18% of the total number of journals, and they are the International Journal of Project Management (n=6), the Journal of Construction Engineering and Management (n=13), and the Journal of Construction Management and Economics (n=8). This reflects the degree of importance in cost variability-based publications, which has been handled by core journals closely related to project management and construction.

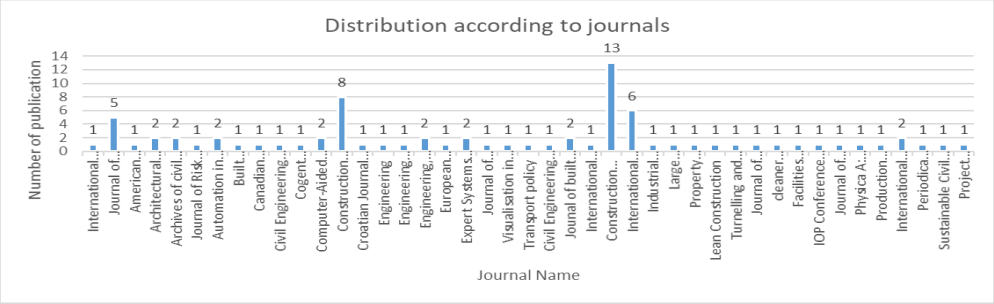


*Figure. 3. Distribution according to journals from SLR 2020.*

## Geographical distribution of the publications

The study shows the spread of publications on the subject matter across different countries, with other parts of the world having 73 (92.41%) while the region being considered (Africa) has (n=6, 7.59%). The existing literature on cost variability is dominated by developed countries, which could indicate advancement in research or researchers in Africa are not yet paying adequate attention in the field of study as realised by the authors.

**Research Gap: Cost Variability**

This SLR has revealed that there have been significant advances in cost variability studies in recent years. However, gaps remain in the provision of solid and reliable frameworks capable of providing accurate estimates. A review of related literature gave insights into the critical risk factors influencing variability in construction projects between contract sum and final account sum. 67 (84.81%) accepted that cost variability is a significant problem, and only 3 (4.48%) is from Nigeria, an indication that the issue needs adequate attention in Nigeria. The same set of reviewed articles established that between1-40 factors (listed in conclusion) affects cost variability.

*Relative importance or ranking of cost variability factors*

Ameyaw (2015) ranked factors causing variability using relative importance index and observed project funding problems with risk impact of 5.91, underestimation of quantities 5.76, variations by the client 5.49, change in scope of works 5.48, inadequate specification 5.37, change in design by client 5.32, defects in design 5.21 and unexpected site (ground) conditions 5.21 are significant causes of cost variability according to relative importance ranking, which may depend on the dynamics of the business environment, which seems to be widely accepted by a majority of other scholars, and this could be embraced for this study also.

*Cost variability risk mitigation strategies*

Salahi and Ali (2018) suggested that the best way to mitigate issues causing cost variability is through sharing or transferring, since risk is considered an umbrella term that is often associated with opportunities and threats.

*Symptoms/risks associated with project failure (number of articles = 68)*

From the 79 reviewed articles, 18 authors stated that: Time overrun, cost overrun, Abandonment and Low-quality jobs were effects of cost variability on construction projects, while 26, said Time overrun, cost overrun, and Disputes, 15 asserted that Time overrun, cost overrun, Disputes and Low-quality jobs, 9, claimed that Time overrun, cost overrun, Disputes, Insolvency Bankruptcy and 11, did not state any effect(s). The publications in this theme investigated the symptoms/risk associated with cost variability, prediction opportunity, and challenges, and scope for learning from cost variability.

# 5 Conclusion and Further Research

The followings are the conclusions drawn:

Researchers have not yet shown the required interest in the field of cost variability which is becoming an emerging problem within the study area based on the number of outcome from the area, this is an issue that desperately requires attention to curtail the risk across the project life cycle. There is the need to develop a cost estimating framework that will consider the effects of cost variability linked to cost, time, quality, and sustainability, which are aided by location, culture, security, and behavioural attitudes which portray a serious problem in the study area according to the peculiarities of the area. Further studies in this field might reveal the path to the construction industry's rapid growth and sustainability. This is a clarion call for researchers and practitioners in the construction industry to look deeper into studies that will facilitate the rapid development of the framework to evaluate effective estimation processes, and also give stakeholders a more in-depth understanding of the estimation effectiveness and efficiency to be adopted.

Some papers on cost variability may have been left out of this review because of the inclusion and exclusion criteria in figure 1 that were developed by the researchers to include peer reviewed publications alone, however investigation on risk from the review, shows that 67, (84.81%) of authors stated between 1-40 risk causing cost variability, which includes Complexity of design and construction, changes in owner requirements, client change, expertise of consultants, government legislation, under estimation, project scope and market condition, labor /materials, scope at pre-contract preparation, defective design and specification, changes in estimating or cost planning data, quality of information and flow requirements, availability of design information, projects team experience of the construction type, project location, inadequate cost plan/tender documentation, type and quality of cost planning data, method of construction, site investigation(geological/sub-ground condition), bad weather, site constrain, zonal rates, strikes, politics, procurement system, legal requirements, availability and supply of labor, tender inflation ,planning requirements or restriction, little or no information about mechanical/electrical works, type of project, unforeseeable fluctuation in material prices, availabilities and supplies of materials, security ,client brief, type of client, unforeseeable fluctuation in labor prices, type of bidding, type of structure and contract condition.6 authors came from Africa and only 3, (4.48%) authors from Nigeria with between1-18 of the identified risk causing cost variability from reviewed literature, which could indicate that issue of cost variability is presently not adequately looked into, and the need to develop a framework to accurately estimate contract sum is considered important, as it will be a great contribution to knowledge when the research work is eventually completed.

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