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

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Abstract

In Nigeria, there has been a dearth of 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 research aims to develop a framework for evaluating the impact of risk on cost estimation through a systematic review. This risk is critical because initial estimates provided to clients serves as bases for planning activities. 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 45, thus meeting objective 1 of the study. Data collection will be achieved using interviews and questionnaires to consider other objectives of peculiarities, severity, effects and ways of mitigating risk, leading to the development of a cost estimating framework that is adjudged an essential tool in risk shedding rather than risk-sharing in project risk management, which would be a solution to cost estimation problems, leading to cost variability in the Nigerian construction industry.

Keywords: Cost • Estimating • Variability • Construction projects • Future studies • Nigeria

Introduction

The construction industry in Nigeria contributes 3.21 percent 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. Despite the increased number of studies on Risk Management (RM) in various countries, limited studies have strived to reveal the components driving and obstructing cost estimating risk implementation in the construction industry. Most risk management studies have gathered data on East Asia, Europe, the Middle East and the United States [1]. Traditional risk management practices have been unproductive at assisting stakeholders to deliver projects on time and within budget while meeting quality expectations. Studies have identified that decision making is one of the leading causes of risks on construction projects. The primary concern of the research is how these risk factors combine to create differences in contract sum and the final account sum, thus making estimates probabilistic rather than deterministic. While clients are becoming dissatisfied with seeing their projects completed over-budget, this study, therefore, seeks to identify the immediate and remote causes of cost variability while also examining the effect(s) on construction projects within the study area and 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 construction within the study area based on collected primary data.

Previous researchers like Zakaria Z, et al. [2], Olatunji OA [3] and Kwok CK [4] 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. Furthermore, Doloi HK [5] opined that proper cost estimation continues to be a problem of great concern to project stakeholders.

Therefore, this study aims to extensively research and highlight the latest theoretical and empirical progress related to cost variability caused by estimating inaccuracies and identifying 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 that highlights emerging themes and unaddressed research issues related to cost variability in construction projects.

Background of construction cost risk

According to Brokbals S, et al. [6], Schubert was a pioneer in consideration of risks during the execution of construction projects. Furthermore, he was the first in Germany to bring the risk management process parts into the construction management literature. Risk management in construction projects has remained a continuing effort up to the present day, with scholars worldwide developing concepts aimed at giving an acceptable template to tackle the problem created by risk in general and cost risk in particular. Several researchers have looked at the factors that cause construction estimates to be inaccurate [7-9]. Despite the increasing agreement that process failures and expert inputs underpin inadequate risk management; their assumptions did not isolate the risk dimension for critical investigation. Many construction projects have failed to owe to a lack of attention to pre-contract activities, such as cost estimation [10]. As a result, the failure of discrete project activities predisposes the overall project to failure. Even though numerous researches on construction risk management exist, the extent of construction risk estimation is uncertain. Instead, previous studies have focused on the impact of risks on contractors' estimations, contractors' risk allocation methods during tenders and cost risk detection [11-13]. This study claims that cost risks are multi-faceted, span the project life cycle and contribute to success. As a result, this construction cost study depended on the assumption that cost risk is multi-dimensional and has an impact on construction projects. Before focusing on Nigeria, this study takes a global look at risk issues in order to develop a project risk management

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framework that will aid in the preparation of a more accurate construction cost estimate and, if it cannot be eliminate cost variability, it can reduce the variability between the contract sum and the final account sum of construction projects.

Research Methods

This study uses a systematic literature review as a research design. This systematic review provides recent insights on the state of research into cost variability in construction projects. The Preferred Reporting Items guide the systematic reviews and Meta-Analyses (PRISMA) framework, which offers a well-established protocol to conduct systematic literature reviews [14].

Prior to the final literature search, the study examined multiple databases and academic libraries to identify the one with the highest coverage, accuracy and relevance. Using the same set of keywords, preliminary searches were conducted in Elsevier's Scopus, Web of Science and EBSCO Business Source Premium (BSP).

It was discovered that the majority of the retrieved articles were repeatedly indexed in all the databases. Scopus had the widest coverage. Scopus was also found to be the most user-friendly, easiest to restrict search results and associated with advanced features such as citations and reference tracking functionalities. As such, it was solely used in the literature search process.

The first stage of the systematic Literature Review (SLR) concentrates on searching for relevant papers from applicable databases such as Web of Science (WoS), Scopus and EBSCO Business Source Premium (BSP). Search strings 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.

The second stage is a screening process whereby all 443 articles were screened based on inclusion and exclusion criteria that have been set up. Of these, 163 articles were excluded for not being relevant or published in a language other than English. It was then screened again for duplications. In this case, 197 articles were excluded due to redundancy; hence the total number becomes 83.

The third stage is assessing the eligibility of the sources to ensure that they meet the inclusion requirements. This process also ensures that these articles are suitable for the present study, aimed towards fulfilling the research objective. 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.

As such, this article implemented the SLR using a comprehensive methodological framework of systematic literature search, screening, critical appraisal, metadata extraction and content analysis (Table 1 and Figure 2) [15-51].

Review Findings and Discussion

Annual publications trend on cost variability and construction projects

The articles (79) included in the review spanned from 1983 to 2019 inclusive. As such, past and recent evidence have been synthesized. Figure 3 shows the annual distribution of the selected papers within the 34-year period. The frequency of publication was not consistent and could be said to be progressing arithmetically until the year 2000, as seen from Figure 3 when momentum gradually built up till the year 2019. The implication 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.

Contribution of journals in cost variability and construction projects cost risk studies

The publication distributions of the articles included in the study are important since they show the quality of the studies included in the review. The frequency distribution of the research is shown in Table 2 among 43 peer-reviewed publications. It's worth noting that the bulk of these publications are top-tier construction engineering and management publications. This indicates that the review contained a wide range of high-quality publications. 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 publication trend reflects the degree of importance in cost variability-based publications, which

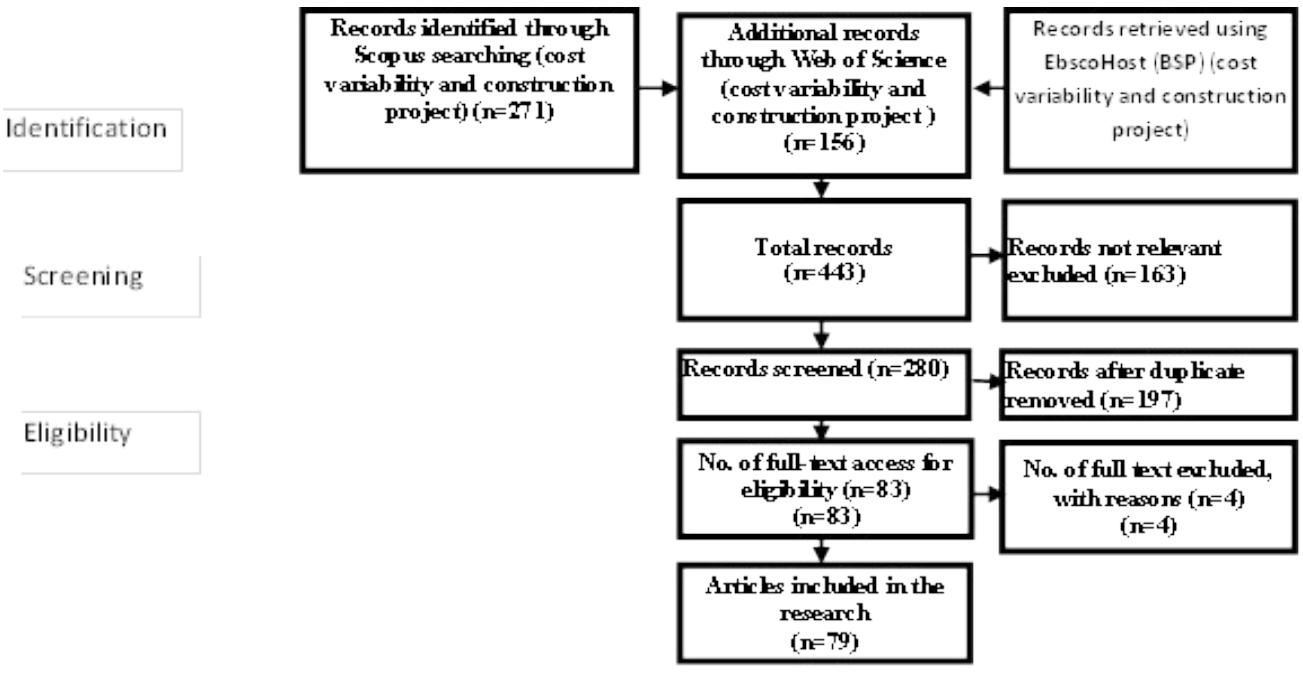

Figure 1. Flow- chart of the methodology.

Table 1. Legend of the serial numbers (S. No.) of publications in the review.

No	Author/Year/Country/ district	Evaluation/Methodologies	Is Cost variability a problem?		Factors Causing variability	Effects of cost variability				
			Yes	No		A	B	C	D	E
1	Legard DA./ 1983/United kingdom	Review, Case study, Empirical		✔	-					✔
2	Morrison N/1984/United kingdom	Review	✔		8			✔		
3	Bennett, J. and Ormerod RN./1984/United kingdom	Review and Empirical	✔		11			✔		
4	Fellows, RF./1991/United Kingdom	Review/comparative study	✔		4			✔		
5	Al-Sadek, et al./1992/New South Wales. Australia	Comparative (Review)		✔	-					✔
6	Winch, Graham, et al./1995/Britain and France	Quantitative, review, case study (Empirical)		✔	-					✔
7	Chao, Li-Chung, et al./1998/Singapore.	Review, case study (Empirical)		✔	-					✔
8	Edward, BW., et al./2000/Texas	A questionnaire survey of contractors regarding current estimating practices in the UK		✔	-					✔
9	Akintoye, A. and Fitzgerald E/2000/ United kingdom	construction industry(Empirical)	✔		20		✔			
10	Picken and David/2000/ Hong Kong	Review and Empirical	✔		1		✔			
11	Isidore, et al./2001/ The USA.	Review and Empirical		✔	-		✔			
12	Hillson/2002/ United kingdom.	Review of literature, questionnaire, interview and case study. (Empirical)	✔		1		✔			
13	Abou Rizk, et al./2002/Canada	Review, case study data collection and analysis. (Empirical)	✔		4					
14	Thomas, HR., et al./2002/ Brasil and Croatia	Review, case study data collection and analysis. (Empirical)	✔		3		✔			
15	Williams, et al./2002/ New jersey	Review, case study. (Empirical)	✔		1		✔			
16	Kaka, AP., et al./2003 United kingdom	Review of literature and Case study. (Empirical)	✔		4		✔			
17	Elhakeem A. and Hegazy T/2005/ Not stated	Review		✔	-					✔
18	Mohamed, Sherif and Srinavin K/2005/ Australia.	Review, Comparative analysis of fieldwork and model development. (Empirical)	✔		2	✔				
19	Ali, Touran and Ramon Lopez/2006/ USA	Quantitative involving review of literature, case study and model development. (Empirical)	✔		7	✔				
20	French, N. and Gabrielli L./ 2006/ Italy	Review of literature, case study	✔		3	✔				
21	Stuckelberger, JA., et al./2006/Switzerland	Review of literature, case study and model development. (Empirical)	✔		3	✔				
22	Chou, JS., et al/ 2007/ TAIWAN	Literature review, case study and model development. (Empirical)		✔	-					✔
23	Tseng, Chung-Li, et al./2009/ USA	Literature review and case study.	✔		4			✔		
24	Sonmez, R/2011/ Turkey.	Model development (Empirical)	✔		21	✔				
25	Ghajar, Ismael, et al./ 2012/Iran.	Review, Case study, data collection and analysis and model development.	✔		4	✔				
26	Wang, Chao, et al./2012/USA	literature review, simulation, case study and model development	✔		45	✔				
27	Gannon, Timothy, et al./ 2012/United States	Comparative analysis of project schedule data from three case studies. (Empirical)	✔		3				✔	
28	Odeyinka, H., et al./ 2012/ United kingdom	Questionnaire and a case study. (Empirical)	✔		26		✔			
29	Wang, Chao, et al./2012Taiwan.	Questionnaire and case study. (Empirical)	✔		1		✔			
30	Lee, Dong-Eun, et al./2012/Korea.	Literature review, case study and model development. (Empirical)	✔		3		✔			
31	Paraskevopoulou, Chrysothemis, et al./2013/Greek	Case-Based Reasoning/ Empirical	✔		2		✔			
32	Fernandez-Solis, JL., et al./2013/USA.	Literature review and case study	✔		15		✔			
33	Migliaccio, GC., et al./ 2013/USA.	Literature review and Model development. (Empirical)	✔		5			✔		

34	Lim, Tae-Kyung, et al./2014/USA.	Literature review, Qualitative research, Model building and verification. (Empirical)	✔		40		✔		
35	Guerrero, MA., et al./2014/Spain	Review, case study and model development. (Empirical)	✔		2		✔		
36	Ochoa and Jorge/2014/ Australia.	Literature review and case study(Empirical)	✔		6		✔		
37	Zhang, et al./2014/China.	Case study and model development. (Empirical)	✔		2		✔		
38	Ishii, N., et al./2014/Japan	Review study and(Empirical)		✔	-				✔
39	Ameyaw, EE., et al./2015/Africa, Ghana	Qualitative and Quantitative, Model development (Empirical)	✔		8		✔		
40	Cao, MT., et al./2015/Taiwan	Literature review and model development. (EMPIRICAL)	✔		3		✔		
41	El-Kholy/2015/Africa/Egypt	Literature review, case study and model development (Empirical)	✔		40		✔		
42	Chong, U and Hopkins/2016/USA.	Review, Empirical and simulation	✔		4		✔		
43	Again, J., et al./2016/New Zealand	Review of literature, Quantitative using Questionnaire(Empirical)	✔		10		✔		
44	Wang, T., et al./2016/China	Case study and model development (Empirical)	✔		29		✔		
45	Again, J., et al./2016/New Zealand	Questionnaire and survey(Empirical)	✔		5	✔			
46	Tehrani, FM./2016/USA	Review and Empirical.	✔		3		✔		
47	Arashpour, M., et al./2016/Australia	Empirical research	✔		4		✔		
48	Moret, Y., et al./2016/ USA.	Review and Empirical	✔		18		✔		
49	Abotaleb, et al/2017/ Tennesse	Review, case study, Empirical and model building.	✔		6		✔		
50	Ricardo, et al./2017/USA	Review, case study and Empirical	✔		4		✔		
51	Bhargava, A., et al./2017/USA	Case study, historical data and Empirical.	✔		4		✔		
52	Yi, CY., et al./2017/ korea	Case study including the use of historical and review of the literature.		✔	-				✔
53	Tanko, BL., et al./2017/ Nigeria	A qualitative and quantitative survey using literature review and questionnaire. Empirical	✔		10	✔			
54	Aghimien, DO and Awodele OA/2017/ Ondo, Nigeria	Literature review with a questionnaire(Empirical)	✔		18	✔			
55	Olatunji, AO., et al./2018/Nigeria	Review/Quantitative and Case study	✔		7	✔			
56	Javanmardi, A., et al./2018/North Carolina United State	Literature review and Model development (Empirical)	✔		5		✔		
57	Li-Chung, Chao and Chiang-Pin Kuo /2018/ Taiwan	Review that will lead to model building.	✔		4	✔			
58	Salahim Pehlivan and Ali Erhan Oztemir/2018/Hong Kong	Case study, Empirical and Model development.	✔		5	✔			
59	Yat, Fai, et al./2018/Hong Kong	Quantitative and Review. (Empirical).	✔		4			✔	
60	Dang, CN and Le-Hoai L./2018/Vietnam	Case study and review of the literature. (Empirical).		✔	-				✔
61	Akinradewo, O., et al./2019/Not stated	Review of literature	✔		12	✔			
62	Sutrisna, et al./2019/ Western Austrailia	Review of literature and cross-case comparative analysis.	✔		7	✔			
63	Zhang, et al./2019/China	Studies from three residential housing projects in (WESTERN AUSTRALIA). (Empirical)		✔	-				✔
64	Enshassi, MSA, et al./2019/Canada.	Quantitative consisting of review, Case study. (Empirical)	✔		5		✔		
65	Akinradewo, O., et al./2019/South Africa.	Review, Case study, data collection and analysis and model development. (EMPIRICAL)	✔		1		✔		
66	Plebankiewicz, E., et al./2019/Poland	Quantitative research approach with the use of questionnaire structured to capture the perceived measures of improving the efficacy of cost	✔		2		✔		
67	Al-Fadhali, N., et al./2019/Yemen	Quantitative (Empirical)	✔		7			✔	
68	Abou-Ibrahim, H., et al./2019/Lebanon	Review of literature, data collection and Model development and Comparison with actual activity(Empirical)	✔		2		✔		

69	Al-Fadhali, N., et al./2019/Yemen	Questionnaire survey, model. (Empirical)	✔	7		✔
70	Tabei, SMA, et al./2019/Iran.	Simulation, review and model building and verification. (Empirical)	✔	5		✔
71	Ayub, B., et al./2019/Australia	Multifaceted, Literature review, Qualitative research, etc., Model building and verification.	✔	4		✔
72	Mohammad, Adam, et al./2019/Malaysia	Case study and Model building.	✔	3		✔
73	Baek, M and Ashuri B./2019/Atlanta USA.	Review, questionnaire (Empirical)	✔	4		✔
74	Plebankiewicz, E., et al./2019/Poland	Review	✔	2		✔
75	Again, J., et al./2019/New Zealand	Review and Empirical.	✔	16		✔
76	Ballesteros-Perez, et al./2019/Spain.	Review, model development and Empirical.	✔	9		✔
77	Enshassi, MSA, et al./2019/Canada.	Review and discussion (Empirical).	✔	7	✔	
78	Mohammed, et al./2019/Canada.	Review and discussion of (Empirical) data and simulation.	✔	18	✔	
79	Golpira/2019/Iran.	Review case study and using life and accurate data for model development. (Empirical)	✔	11	✔	

A = Time overrun, cost overrun, Abandonment and Low-quality jobs; B = Time overrun, cost overrun and Disputes; C = Time overrun, cost overrun, Disputes and Low-quality jobs; D=Time overrun, cost overrun, Disputes, Insolvency Bankruptcy; E= Did not state effect(s).

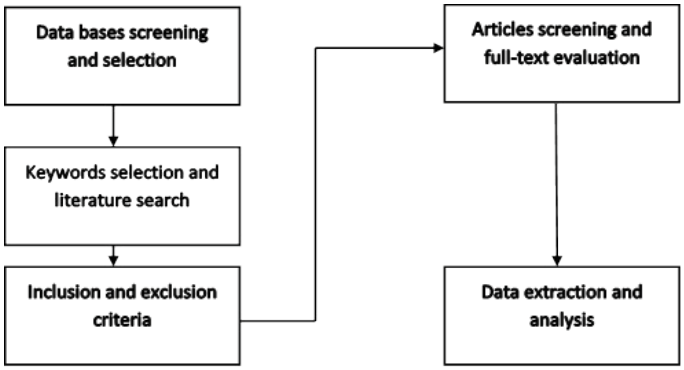

Figure 2. Methodological framework of the study.

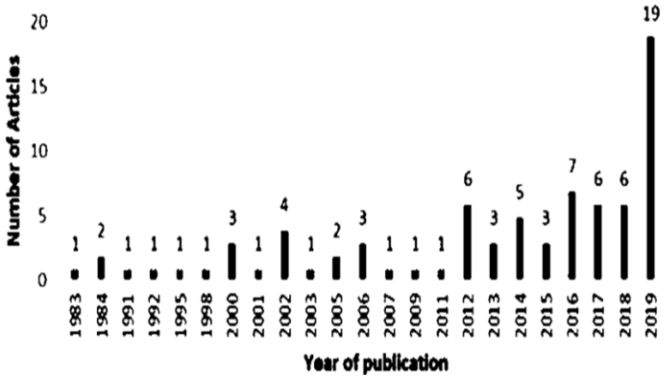

Figure 3. Annual distribution of selected articles from 1995 to 2019.

has been handled by core journals closely related to project management and construction.

Geospatial distribution of research articles on cost variability

It is also a good idea to point out where the publications in the study came from. Figure 4 depicts the geospatial distribution of the study's selected papers. (USA/Canada/Brazil/Croatia), (Japan/Taiwan/China/Hongkong/Singapore), (the United Kingdom/France), (Australia/New Zealand), (Turkey/Spain/Poland/Greek/Ital /Switzerland), (Africa), (Korea/Lebanon/Yemen), (Iran), (Tennessee/Vietnam (Location not stated). Indeed, the major countries of cost variability research are the United States, Canada, Brazil and Croatia; the inclusion of publications from all of these nations highlights the quality and representativeness of the studies included. Figure 4 also illustrates that the study included papers from both developing (e.g. Malaysia, China) and developed economies (e.g. Canada, the United States and so on). As a result, the findings will reflect evidence from both developing and developed countries. As shown in Figure 5, the study reveals the distribution of publications on the subject matter across different countries, with other areas of the world accounting for 73 (92.41 percent) and the region under consideration (Africa) accounting for (n=6, 7.59 per cent). As shown in Figure 6, the existing literature on cost variability is dominated by developed countries, indicating advancement in research or that African researchers are not yet paying adequate attention in the field of study, as the authors realized. Only three studies, or 4% of the total, come from Nigeria, the study area.

Risk factors causing cost variability

In this research, risk factors refer to occurrences, features and processes that have the potential to derail and threaten the accuracy and consistency of construction budgetary provisions.

Research gap: Cost variability

This SLR has revealed that there have been significant advances in cost variability studies in recent years. However, there are remains gaps in the provision of solid and reliable frameworks capable of providing accurate estimates. The 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. The same set of reviewed articles established that between 1-45 as causative factors of cost variability. To consider the effects of cost variability from the review.

Relative importance or ranking of cost variability factors

Ameyaw EE, et al. [50] 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

Pehlivan Sand Öztemir AE [51] suggested that the best way to mitigate issues causing cost variability is through sharing or transferring since the risk is considered an umbrella term often associated with opportunities and threats. This assertion will be a parameter to consider as the research progresses critically.

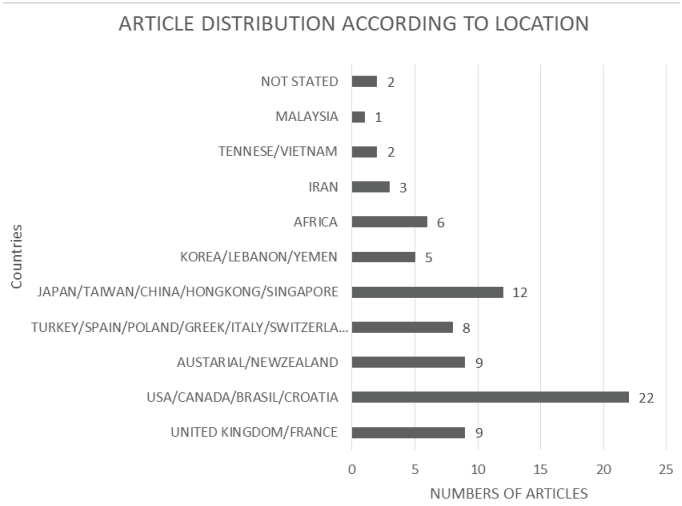

Figure 4. Geographical distribution of selected articles.

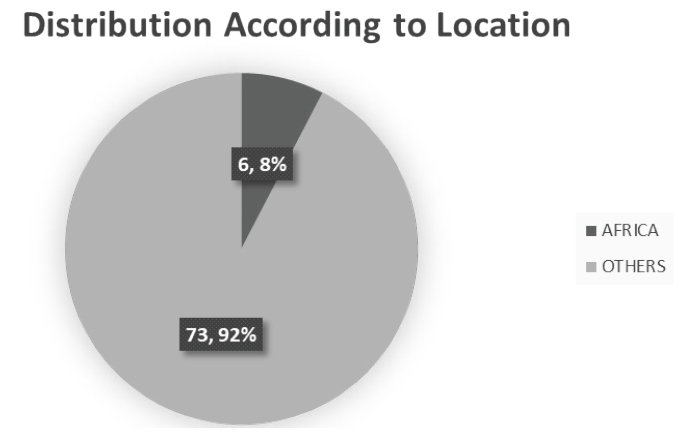

Figure 5. Distribution according to Location.

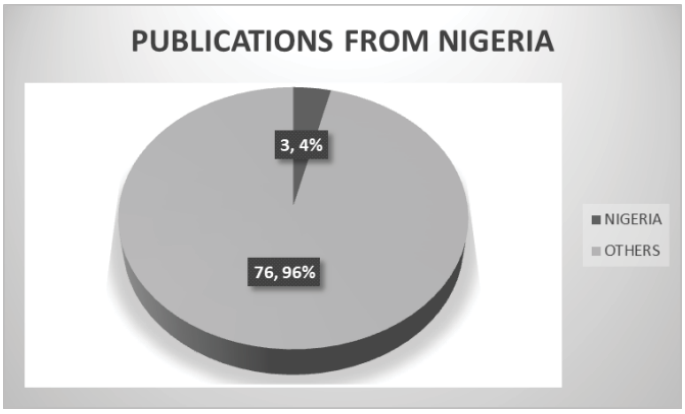

Figure 6. Publications from Nigeria.

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 review investigated the risk factors and resultant effects associated with cost variability and challenges and scope for learning from cost variability.

Table 2. Distribution of selected articles according to journals.

Research Outlet	Number of Articles
Construction engineering and management	13
Construction management and economics	8
International journal of project management	6
Journal of management in engineering	5
International journal of construction management	2
Journal of built environment sustainability	2
Expert systems with automation	2
Engineering, construction and Architectural management	2
Computer-aided civil and infrastructure engineering	2
Automation in construction	2
Archives of civil engineering	2
Architectural engineering and design management	2
International conference on sustainable infrastructural development	1
American society of civil engineers	1
Journal of risk and uncertainty in engineering systems	1
Built environment project and asset management	1
Canadian journal of civil engineering	1
Cogent engineering	1
Croatian journal of forest engineering	1
Engineering	1
Engineering management journal	1
European journal of forest research	1
Journal of construction estimating management	1
Visualizations in engineering	1
Transport policy	1
Civil engineering and management	1
International journal of housing market and analysis	1
Industrial agronomy	1
Large infrastructural projects	1
Property investment and finance	1
Lean construction	1
Tunneling and underground space	1
Journal of financial management of property and construction	1
Cleaner production	1
Facilities management	1
Iop conference series	1
Journal of science and technology management	1
Physica a: statistical mechanics and its applications	1
Production planning and control	1
Periodica polytechnica civil engineering	1
Sustainable civil and construction engineering conference	1
Project management journal	1

Conclusions and Implications

From the review, cost variability causes problems ranging from delay, poor quality jobs, abandonment, disputes and bankruptcy, to mention a few, which should be given the deserved attention required to ensure the sustainability of the construction sector.

Conclusion drawn from the review

Those researchers have not shown the required interest in cost variability, which is becoming an emerging problem within the study area that desperately requires attention to curtail the risk across the project life cycle due to the number of articles from the area. This, therefore, needs concerted efforts. Further studies in this field might reveal the path to the construction industry's rapid growth and sustainability.

The effects of cost variability are linked to cost, time, quality and

sustainability, aided by Location, culture, security and behavioural attitudes portray a severe problem in the study area. Therefore, this research gives 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 provide stakeholders with a more detailed knowledge of the estimation processes and procedures to be adopted by stakeholders in both the private and public sectors.

Some papers on cost variability may have been left out of this review because of the researchers' inclusion and exclusion criteria to include peer-reviewed publications alone. However, the review's investigation of risk shows that 67 (84.81%) of authors stated between 1-45 risk causing cost variability. Six authors came from Africa. On the other hand, only 3 (4.48%) authors from Nigeria with between 1-18 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 estimate contract sum accurately is considered essential.

Conflict of Interest

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References

1. El-Sayegh, Sameh M. and Mahmoud H. Mansour. "Risk assessment and allocation in highway construction projects in the UAE." *J Manag Eng* 31 (2015): 04015004.
2. Zakaria, Zarabizan, Syuhaida Ismail and Aminah Md Yusof. "Cause and impact of dispute and delay the closing of final account in Malaysia construction industry." *J Southeast Asian Stud* 2012 (2012): 1.
3. Olatunji, Oluwole Alfred. "A comparative analysis of tender sums and final costs of public construction and supply projects in Nigeria." *J Financ Manag Prop Constr* (2008).
4. Kwok, Chi Ko. "Study of important factors affecting final account settlement satisfaction of Hong Kong Civil Engineering Projects: Contractor's Perspective." City University of Hong Kong, (2009).
5. Doloi, Hemanta Kumar. "Understanding stakeholders' perspective of cost estimation in project management." *Int J Proj* 29 (2011): 622-636.
6. Brokbals, Stefanie, Vincent Wapelhorst and Ivan Čadež. "Calculation of risk costs in construction projects: Empirical analysis of construction risks applying the Monte Carlo method." *P I Civil Eng-Civ En* 1 (2019): 120-128.
7. Akintoye, Akintola. "Analysis of factors influencing project cost estimating practice." *Constr Manag Eco* 18 (2000): 77-89.
8. Aibinu, Ajibade Ayodeji and Thomas Pasco. "The accuracy of pre-tender building cost estimates in Australia." *Constr Manag Eco* 26 (2008): 1257-1269.
9. Elfaki, Abelrahman Osman and Saleh Alatawi. "Representing the knowledge of public construction project cost estimator by using rule-based method." *J Build Eng* 3 (2015): 189.
10. Ochoa, J. Jorge. "Reducing plan variations in delivering sustainable building projects." *J Clean Prod* 85 (2014): 276-288.
11. Oyewobi, Luqman Oyekunle, Ahmed Doko Ibrahim and Bashir Olanrewaju Ganiyu. "Evaluating the impact of risk on contractor's tender figure in public buildings projects in Northern Nigeria." (2012).
12. Laryea, Samuel and Will Hughes. "How contractors price risk in bids: Theory and practice." *Constr Manag Eco* 26 (2008): 911-924.
13. Jimoh, Richard A. and Shaaba M. Adama. "Assessment of contingency sum in relation to the total cost of renovation work in public schools in Abuja, Nigeria." *Int J Manag Stud Res* 2 (2014): 55-63.
14. Shaffril, Hayrol Azril Mohamed, Asnarulkhadi Abu Samah, Samsul Farid Samsuddin and Zuraina Ali, et al. "Mirror-mirror on the wall, what climate change adaptation strategies are practiced by the Asian's fishermen of all? " *J Clean Prod* 232 (2019): 104-117.
15. Legard, D.A. "Probabilistic analysis of an idealized model of construction projects." *Constr Manag Econ* 1 (1983): 31-45.
16. Morrison, Neill. "The accuracy of quantity surveyors' cost estimating." *Constr Manag Econ* 2 (1984): 57-75.
17. Bennette, J. and Ormerod, R.N. "Simulation Applied to Construction Projects." *Constr Manag Econ* 2 (1984): 225.
18. Fellows, R.F. "Escalation management: Forecasting the effects of inflation on building projects." *Constr Manag Econ* 9 (1991): 187-204.
19. Dosumu, Babatunde, Obuks Ejohwomu and Akilu Yunusa-Kaltungo. "A systematic review on development of a Project cost estimation framework: A case study of Nigeria." In Proceedings of the Construction Business and Project Management Conference Cape Town, South Africa, 24 (2021): 137.
20. Winch, Graham and Elisabeth Campagnac. "The organization of building projects: An Anglo/French comparison." *Constr Manag Econ* 13 (1995): 3-14.
21. Chao, Li-Chung and Miroslaw J. Skibniewski. "Fuzzy logic for evaluating alternative construction technology." *J Const Eng Manag* 124 (1998): 297-304.
22. Back, W. Edward, Donald A. Maxwell and Leroy J. Isidore. "Activity-based costing as a tool for process improvement evaluations." *J Manag Eng* 16 (2000): 48-58.
23. Akintoye, Akintola and Eamon Fitzgerald. "A survey of current cost estimating practices in the UK." *Constr Manag Econ* 18 (2000): 161-172.
24. Sedgley, Norman and Bruce Elmslie. "The geographic concentration of knowledge: Scale, agglomeration and congestion in innovation across US states." *Int Reg Sci Rev* 27 (2004): 111-137.
25. Isidore, Leroy J. and W. Edward Back. "Probabilistic optimal-cost scheduling." *J Const Eng Manag* 127 (2001): 431-437.
26. Hillson, David. "Extending the risk process to manage opportunities." *Int J Proj Manag* 20 (2002): 235-240.
27. Abou Rizk, S.M., G.M. Babey and G. Karumanasseri. "Estimating the cost of capital projects: An empirical study of accuracy levels for municipal government projects." *Can J Civ Eng* 29 (2002): 653-661.
28. Thomas, H. Randolph, Michael J. Horman, Ubiraci Espinelli Lemes De Souza and Ivica Zavřski, et al. "Reducing variability to improve performance as a lean construction principle." *J Const. Eng Manag* 128 (2002): 144-154.
29. Kaka, Ammar Peter, J. Lewis and H. Petros. "The effects of the variability of project planning on cost commitment curves: a case study." *Eng Constr Archit* (2003).
30. Elhakeem, Ahmed and Tarek Hegazy. "Graphical approach for manpower planning in infrastructure networks." *J Const Eng Manag* 131 (2005): 168-175.
31. Mohamed, Sherif and Korb Srinavin. "Forecasting labor productivity changes in construction using the PMV index." *Int J Ind Ergon* 35 (2005): 345-351.
32. Touran, Ali and Ramon Lopez. "Modeling cost escalation in large infrastructure projects." *J Const Eng Manag* 132 (2006): 853-860.
33. French, Nick and Laura Gabrielli. "Uncertainty and feasibility studies: an Italian case study." *J Prop Invest Finance* (2006).
34. Stückelberger, Jürg Andreas, Hans Rudolf Heinimann and Edouard Charles Burlet. "Modeling spatial variability in the life-cycle costs of low-volume forest roads." *Eur J For Res* 125 (2006): 377-390.
35. Chou, Jui-Sheng and James T. O'Connor. "Internet-based preliminary highway construction cost estimating database." *Autom Constr* 17 (2007): 65-74.
36. Tseng, Chung-Li, Tong Zhao and Chung C. Fu. "Contingency estimation using a real options approach." *Constr Manag Econ* 27 (2009): 1073-1087.
37. Sonmez, Rifat. "Range estimation of construction costs using neural networks with bootstrap prediction intervals." *Expert Syst Appl* 38 (2011): 9913-9917.
38. Ghajar, Ismael, Akbar Najafi, Seyed Ali Torabi and Mashalah Khamehchiyan, et al. "An adaptive network-based fuzzy inference system for rock share estimation in forest road construction." *Croat J For Eng* 33 (2012): 313-328.
39. Wang, Chao, Min Liu, Simon M. Hsiang and Michael L. Leming, et al. "Causes and penalties of variation: case study of a precast concrete slab production facility." *J Const Eng Manag* 138 (2012): 775-785.

40. Gannon, Timothy, Peter Feng and William Sitzabee. "Reliable Schedule Forecasting in Federal Design-Build Facility Procurement." *Lean Constr J* (2012).

41. Larkin, Keren, Henry Odeyinka and Robert Eadie. "An exploration of theoretical concepts and methods for assessing risk impacts on the variability between contract sum and final account in design and build projects." *J Constr Eng Manag* 12 (2012): 337-346.

42. Wang, Yu-Ren, Chung-Ying Yu and Hsun-Hsi Chan. "Predicting construction cost and schedule success using artificial neural networks ensemble and support vector machines classification models." *Int J Proj Manag* 30 (2012): 470-478.

43. Lee, Dong-Eun, Tae-Kyung Lim and David Arditi. "Stochastic project financing analysis system for construction." *J Constr Eng Manag* 138 (2012): 376-389.

44. Paraskevopoulou, Chrysothemis and Andreas Benardos. "Assessing the construction cost of Greek transportation tunnel projects." *Tunn Undergr Space Technol* 38 (2013): 497-505.

45. Fernandez-Solis, Jose L. "Building construction: A deterministic non-periodic flow–A case study of chaos theories in tracking production flow." *Archit Eng Des Manag* 9 (2013): 21-48.

46. Migliaccio, Giovanni C., Michele Guindani, Maria D'Incognito and Linlin Zhang, et al. "Empirical assessment of spatial prediction methods for location cost-adjustment factors." *J Constr Eng Manag* 139 (2013): 858-869.

47. Lim, Tae-Kyung, Chang-Yong Yi, Dong-Eun Lee and David Arditi, et al. "Concurrent construction scheduling simulation algorithm." *Comput-Aided Civ Infrastruct Eng* 29 (2014): 449-463.

48. Guerrero, Miguel A., Yolanda Villacampa and Andrés Montoyo. "Modeling construction time in Spanish building projects." *Int J Proj Manag* 32 (2014): 861-873.

49. Ishii, Nobuaki, Yuichi Takano and Masaaki Muraki. "An order acceptance strategy under limited engineering man-hours for cost estimation in Engineering–Procurement–Construction projects." *Int J Proj Manag* 32 (2014): 519-528.

50. Ameyaw, Ernest Effah, Albert PC Chan, De-Graft Owusu-Manu and Ekow Coleman, et al. "A fuzzy model for evaluating risk impacts on variability between contract sum and final account in government-funded construction projects." *J Facil Manag* (2015).

51. Pehlivan, Salahi and Ali Erhan Öztemir. "Integrated risk of progress-based costs and schedule delays in construction projects." *Eng Manag J* 30 (2018): 108-116.

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