ARID ZONE JOURNAL OF ENGINEERING, TECHNOLOGY & ENVIRONMENT
AZOJETE December 2019. Vol. 15(4):1013-1025
Published by the Faculty of Engineering, University of Maiduguri, Maiduguri, Nigeria.
Print ISSN: 1596-2490, Electronic ISSN: 2545-5818
www.azojete.com.ng

ORIGINAL RESEARCH ARTICLE

CATEGORISATION OF ROAD CONSTRUCTION PROJECTS' COST OVERRUNS CAUSES USING FACTOR ANALYSIS

Z. B. Ahmad[1*], N. Anigbogu[2], and J. J. Molwus[2]

([1]Department of Civil Engineering, Modibbo Adama University of Technology, Yola, Adamawa State, Nigeria
[2]Department of Building, University of Jos, Plateau State, Nigeria)
** Corresponding author's email address: engrbelel@gmail.com*

ARTICLE INFORMATION

Submitted 18 January, 2019
Revised 15 June, 2019
Accepted 20 June, 2019

Keywords:
Categorisation
Factor analysis
Latent
Management
Road projects' cost overruns.

ABSTRACT

Cost overrun is a major problem in the construction industry and a threat to the financial freedom of any country. Considering that Nigerian roads are constructed at very high cost, cost overruns could lead to significant reduction in the quality and number of projects that can be implemented. A vast number of cost overruns causes have been identified by various studies. However, the large number of possible causes makes managing and controlling them very challenging. This study, therefore, aims at categorising the causes in order to simplify their minimisation by identifying their latent constructs. Seventy-one (71) factors identified through literature review and ranked by questionnaire survey respondents. The survey involved 267 respondents (clients, contractors and consultants) that have worked on road construction projects. The collected data were analysed using exploratory factor analysis. Eight factors emerged from the 42 retained causes of cost overruns; contract related, economic and political, design and documentation, financial related, technical related, policy related, construction management related, and natural related causes. With this classification, it is easier to identify the group that has the most significant causes of cost overruns thus providing more information for better management.

1.0 Introduction

Roads account for over 90% of all inter and intra city movements of persons, goods, farm produce, merchandise, animals and mobile services in Nigeria. The proper development of road transport network not only reduces the cost of transportation both in terms of money and time but also helps in the integration of various regions within the country and better understanding of neighbouring countries at the international level (Aldagheiri, 2009). However, road construction takes a long time and the funding is always spread out over an extended period of time. Consequently, road projects are exposed to different risks during their various stages of construction and encounter different types of challenges along their routes including cost overruns. Considering that Nigerian roads are procured at outrageous amount (Centre for asocial Justice, 2016), cost overruns are threats to the financial freedom of the country. Cost overruns could lead to significant reduction in the quality and number of projects that can be implemented.

A vast number of comprehensive researches have been conducted worldwide to explain why and how construction projects exceed their estimated costs (Frimpong et al., 2003; Koushki et al., 2004; Flyvbjerg et al., 2004; Koushki, Al-Rashid and Kartam, 2005; Omoregie and Radford, 2006; Nega, 2008; Lee, 2008; Ameh, 2010; Chileshe and Berko, 2010; Mahamid and Bruland, 2011; Abdul Rahman and Abdul Azis, 2012; Love et al., 2012; Memon et al, 2012; Memon, 2013; Love et al., 2013; Abdul Azis et al., 2013; Isma'il et al., 2013; and Love et al., 2014;). These studies have identified a plethora of reasons for the occurrence of cost overruns and according to Allahaim (2006), many of the reasons share similar pattern of impact on cost overruns. Allahaim (2006) noted that it would be functionally useful and conceptually meaningful to classify the causes based on their impact on the overruns. Abusafiya and Suliman (2017) affirmed that prioritising the causes of cost overruns leads to better risks contingency weighing in budget estimates. Classification narrows the problem by grouping related causes thereby making it easier to effectively deal with them.

A deeper knowledge of the causes is necessary to understand the originating factors of poor cost performance (Karunakaran et al., 2018). A better understanding of the cost overruns causes is achieved through understanding the forces driving each factor or where it originates. Classification of the causes helps in identifying the most important frequent relationship between the causes. Grouping also identifies multiple ideal types, each of which represents a unique combination of attributes that bring about the cost overruns. With this understanding, it is possible to design strategies for dealing with the causes. This study therefore aims at classifying the causes of road construction projects' cost overruns using factor analysis with a view to minimise their occurrences.

2. Methodology

The study was carried out in the Satellite Towns Development and the Engineering Departments of the Federal Capital Territory, Abuja in Nigeria. The choice of Abuja was based on the many road projects being constructed. The information necessary for this study was obtained through a detailed review of literature in relevant works such as books, journals, conference proceedings, the Internet and other materials. The information gathered formed the bases for the data collection and analyses. Questionnaire survey of 267 clients, consultants and contractors involved in road construction projects in the Federal Capital Territory Authority, Abuja was carried out. The use of questionnaires for data collection was based on the research question and the large sample required for the analysis. The respondents were asked to rank 71 causes of cost overruns identified from literature review. Exploratory factor analysis was conducted on the collected data to uncover the underlying dimensions in the dataset using statistical package for social science (SPSS) version 23.

Factor analysis is a statistical technique based on the multivariate correlation of interdependence. The technique reduces multiple variables into smaller number of factors by identifying common latent factors that define the grouped variables, thereby also enabling the interpretation of dependences between the factors. There are two basic types of factor analyses: exploratory factor analyses (EFA) and confirmatory factor analyses (CFA). CFA attempts to confirm hypotheses and uses path analysis diagrams to represent variables and factors, whereas EFA tries to uncover complex patterns by exploring the data set and testing predictions (Child, 2006). EFA is used to identify the structure of the relationship between the variable and the constructs. CFA is used to test whether measures of a construct are consistent with the

Corresponding author's e-mail address: engrbelel@gmail.com

researcher's understanding of the nature of the construct. EFA was done in this study to identify the groups of cost overruns causes.

Prior to categorisation of the variables, the adequacy of the survey data was examined by conducting a Kaiser-Mayer-Olkin (KMO) test and the Bartlett's test of sphericity. KMO measure of adequacy is an index used to examine the appropriateness of factor analysis. The KMO represents the ratio of the squared correlation between variables to the squared partial correlation between variables. The KMO statistics varies between 0 and 1. A value close to 1 indicates that the patterns of correlations are relatively compact and consequently factor analysis should yield distinct and reliable factors. The recommended minimum value of KMO for satisfactory factor analysis is greater than 0.7.

Bartlett's test of sphericity was used to measure the strength of the relationship. It is actually a measure of multivariate normality of a set of distribution (Hadi et al., 2016). It also checks the null hypothesis that the original correlation matrix is an identity matrix. The Bartlett's test of sphericity should be statistically significant ($\rho < 0.05$).

A Cattell's Scree Plot was used to determine the number of factors to be considered (Stellefson and Hanik, 2008). The components are extracted by specifying the minimum initial eigenvalue of one. An eigenvalue is any number such that a given matrix minus that number times the identity matrix has zero determinant. The Cattell's Scree Plot is a plot of the extracted eigenvalues associated with each of the factors extracted, against each factor. The eigenvalues are plotted in descending order and the graph is examined to determine the point at which the line levels off.

The factors were then rotated to maximise the variance of the squared loading for each factor and to produce clear factor loadings. Rotation is an attempt to describe the information in several factors by re-expressing them so that loadings on a few variables are as large as possible, and loading on the rest of the variable are as small as possible. The axes were rotated so that the clusters of factors fall as closely as possible to them. This made the factor-loading pattern clearer as one of the two pairs of coordinates for each item tends to be close 0.0. There are many choices of rotation methods, depending on the software being used.

To interpret the solution, variables that relate to each of the extracted factors were determined. This was done by examining the factor loadings, which represented the correlations between the factors and the variables and take values from -1 to +1. High factor loadings indicate that a variable is well represented by a certain factor.

3. Results and Discussion

An analysis of the respondents' demographic profile was done to ensure that the respondents for the study are the appropriate sample. This was to ensure the correctness of the obtained results. The demography of respondents shown on Table 1 shows that all the respondents have a minimum of 5 years' experience road construction projects. This indicates that well experienced personnel with knowledge on road construction were involved in the survey. Their level of education also implies that they are competent and capable of exercising sound judgement. Hence, they can provide the researchers with needed information for the study and the responses given can be relied upon.

Corresponding author's e-mail address: engrbelel@gmail.com

Table 1: Respondents' Demography

Category		Frequency	Percentage
Age (years)	< 30	3	1.12
	31 – 40	86	32.31
	41 – 50	143	38.95
	51 -60	74	21.72
Organisation	Client	106	39.70
	Contractor	99	37.08
	Consultant	62	23.22
Education	OND	19	7.12
	HND/BSc	130	48.69
	MSc	97	36.33
	Ph.D.	21	7.87
Experience (years)	6 – 10	77	28.84
	11 -15	45	16.85
	16 – 20	85	31.84
	≥ 20	60	22.47
Number of road projects worked on	≤ 5	58	21.72
	6 – 10	82	30.71
	> 10	127	47.57

The result in Table 2 indicates that the data set has KMO value of 0.844, hence is suitable for further analysis. The determinant of the correlation matrix is a non-zero depicting that at least one factor can be extracted from the data set. The Bartlett's test of sphericity returned a p-value < 0.001 confirming that the determinant is statistically different from zero at p = 0.05.

Table 2: Determinant, KMO, and Bartlett's Test

Determinant		3.875E-025
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.844
Bartlett's Test of Sphericity	Approx. Chi-Square	19439.936
	Df	1035
	Sig.	.000

The scree plot generated from the data (Figure 1) shows the point where the apparent break occurred in the graph. This break coincided with the number 9 indicating that 8 factors occurred above the point of inflexion. To confirm the number of factors to retain, the Keiser criterion (Table 3) yielded 8 factors with total Eigenvalues > 1. The factors were assigned representative names reflecting the underlying attributes of the causes they measured. The factor loadings ranged from a minimum of 0.574 associated with technical related factor to 0.972 associated with financial related factor. The reported causes had communalities ranging from 0.427 to 0.955 indicating that the loaded causes sufficiently represent their factors (Table 4).

Corresponding author's e-mail address: engrbelel@gmail.com

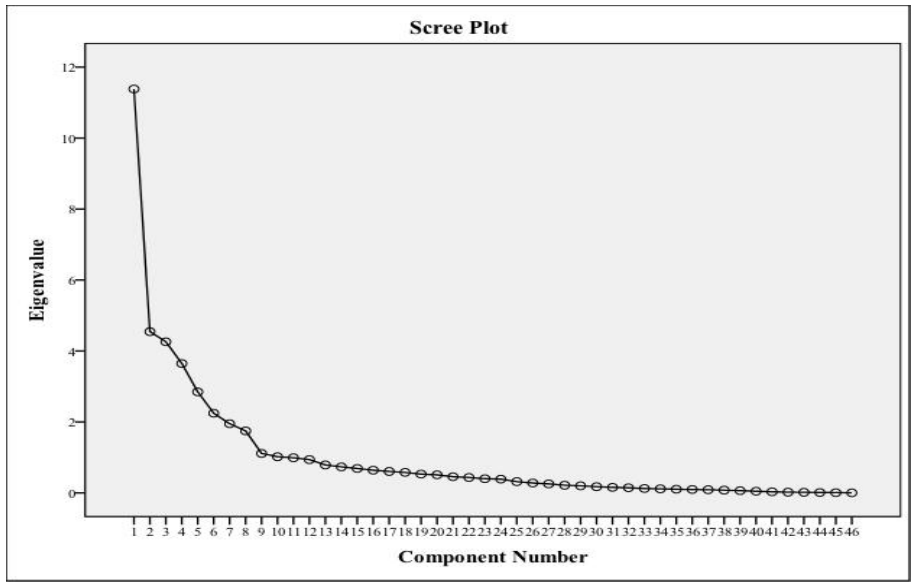

Figure 1: Scree Plot (Eigenvalues against component numbers)

The first factor, which was labelled contract related causes (CRC), explained a total variance of 24.74%. The second factor, economic and political related (EPR) explained 9.88% of the total variance, while design and documentation related (DDR) causes explained 9.261%. Financial related (FRC), technical related (TRC), policy related (PRC), construction management related (CMR), and natural (NRC) causes explained total variances of 7.93%, 6.19%, 4.88%, 4.24%, and 3.80% respectfully. The 8 factors accounted for a total variability of 70.92% of the variables implying that the 8 factors sufficiently represent the causes with minimal loss of information.

Result of reliability analysis shown on Table 5 revealed that the causes and their respective factors have values > 0.7, thus, are reliable. Similarly, the corrected items total correlations (Table 5) satisfied recommended threshold values of internal consistency > 0.3. Economic and political factor had the highest alpha value (a = 0.934) with corrected item-total correlation ranging from 0.914 to 0.941.

The classification of the causes of cost overruns was based on the factors that emerged from the result of the factor analysis. Eight factors emerged from the analysis and each factor contains causes that are interrelated. The groups were labelled contract related, economic and political related, design and documentation related, financial related, technical related, policy related, construction management related, and natural causes of cost overruns. While some of these factors are like those identified in literature review, the causes that loaded on them are different and one of the factors that emerged merged two identified factors from previous studies. Hence, direct comparison of the present result with those of previous studies is difficult as different methodologies were used in data analysis, varied causes of cost overruns were identified, revealing different factors and causes that loaded on each factor.

The first factor, contract related causes of cost overruns deals with procurement and its related issues. This category includes the development of contract strategies, management of contracting activities, contract documentation, contract performance, contract management and administration after its award. The cost overrun causes that are contract related are misinterpretation, optimism bias, short bid preparation time, competition at tender time, etc. The position of this factor is in line with Frimpong et al. (2003) 2nd most important factor that causes cost overruns.

Corresponding author's e-mail address: engrbelel@gmail.com

Table 3: Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance		Total	% of Variance	Cumulative %
1	11.382	24.744	24.744	11.382	24.744	24.744	9.300	20.216	20.216
2	4.545	9.881	34.625	4.545	9.881	34.625	5.840	12.695	32.912
3	4.260	9.261	43.886	4.260	9.261	43.886	3.466	7.535	40.447
4	3.648	7.930	51.816	3.648	7.930	51.816	3.296	7.166	47.613
5	2.847	6.190	58.006	2.847	6.190	58.006	3.187	6.929	54.542
6	2.245	4.881	62.887	2.245	4.881	62.887	3.022	6.568	61.111
7	1.949	4.237	67.124	1.949	4.237	67.124	2.382	5.179	66.290
8	1.747	3.798	70.923	1.747	3.798	70.923	2.131	4.633	70.923

Extraction Method: Principal Component Analysis.

Table 4: Rotated Component Matrixa

	Factors								Communalities
Causes	CRC	EPR	DDR	FRC	TRC	PRC	CMC	NRC	
Lowest bidder policy	0.911								0.704
Lack of coordination	0.901								0.720
Outdated estimates	0.899								0.686
Litigation	0.883								0.533
Mistakes and	0.857								0.590
Poor contract	0.826								0.810
Non adherence to	0.811								0.658
Variations	0.797								0.534
Short bid preparation	0.796								0.667
Lack of communication	0.737								0.528
Poor contract specific	0.717								0.648
Delay in decision	0.710								0.881
Competition at tender	0.704								0.910
Fluctuation of prices		0.935							0.648
Inflation		0.935							0.796
Strategic decision		0.934							0.777
Corruption		0.932							0.738
Escalation of material		0.661							0.565
Economic instability		0.659							0.734
Exchange rate		0.629							0.711
High interest rate on		0.601							0.747
Design errors			0.826						0.534
Design changes			0.800						0.893
Incomplete design at the time of tender			0.787						0.705
Lack of cost reports during construction			0.691						0.869
Poor documentation			0.626						0.851

Corresponding author's e-mail address: engrbelel@gmail.com

Causes	CRC	EPR	DDR	FRC	TRC	PRC	CMC	NRC	Communalities
Monthly payment difficulty				0.972					0.876
Delay in progress payment				0.958					0.922
Contractors cash flow and financial difficulties				0.955					0.955
Owner financial difficulties				0.665					0.937
Lack of experience					0.825				0.537
Ignorance and lack of knowledge					0.781				0.427
Insufficient investigations					0.636				0.597
Unforeseen ground conditions					0.619				0.475
Project complexity					0.619				0.441
Latent conditions					0.574				0.368
Bureaucracy in tendering method						0.923			0.807
Environmental protection and mitigation costs						0.910			0.815
Government related issues like changes in policies, pressures etc.						0.699			0.926
Poor change control							0.767		0.918
Late delivery of material and equipment							0.670		0.926
Material related problem							0.645		0.635
Schedule delay							0.641		0.478
Contractor related problem							0.594		0.925
Flood								0.858	0.573
Inclement weather								0.819	0.653

Corresponding author's e-mail address: engrbelel@gmail.com

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 6 iterations.

The second group comprises the economic and political related causes. This category of causes of cost overruns encompasses some political related factors in Haddad (2018) study and some causes from Abusafiya and Suliman (2017) environmental related factors. Exchange rate, poor economic and political situations, inflation, price fluctuation, high interest rate on loans, strikes, corruption, etc. are causes that fall under the economic and political related group. The construction industry is market driven; the prices of materials, equipment, and labour do change regularly which could in turn affect the cost of a project. Inaccurate assessment of market conditions can lead to inaccurate estimates. Fluctuations in exchange rate of dollars to Naira also affect the cost of construction. High level of corruption has effects on the cost of construction projects as it involves additional transaction costs like bribes. Inflation and fluctuation in prices loaded equally and highest on cost overruns in this category. While this factor is the 2nd most important factor that contributes to cost overruns in this study, the political factor in Haddad (2018) was ranked 10th of 11 causes of cost overruns and the environmental factors in Abusafiya and Suliman (2017) had the least ranking.

The third group is the design and documentation related causes of road construction projects cost overruns group. Design and documentation related causes category was the factor with highest contribution to cost overruns in both Memon (2013) and Abusafiya and Suliman (2017) studies. This category includes design errors and changes, incomplete design at the time of tender, lack of cost reports during construction, and poor documentation. Design and documentation are important aspects and can adversely impact on the cost performance of any construction project. Design creates a work plan for attaining projects' goals and documentation creates records of what happened at what time during the project that can be referred to at any time. Inadequate and deficient designs and documentations have direct impacts on construction process by leading to delays, rework and variation, which in turn, contribute to increases in project time and cost. Design changes being the most severe cause of cost overruns in this category was also the most severe cost overruns cause in Memon (2013) design and documentation related causes category.

Table 5: Reliability Test Result

Factor	Causes	Corrected inter-total correlation	Cronbach Alpha if item deleted	Scale's Cronbach Alpha
Design and Doc.	Design changes	0.695	0.786	0.835
	Incomplete design at the time of tender	0.695	0.786	
	Lack of cost reports during construction	0.586	0.820	
	Poor documentation	0.541	0.827	
Technical	Lack of experience	0.646	0.712	0.774
	Ignorance and lack of	0.611	0.720	

Corresponding author's e-mail address: engrbelel@gmail.com

	knowledge			
	Insufficient investigations	0.529	0.738	
	Project complexity	0.509	0.744	
	Latent conditions	0.471	0.760	
	Unforeseen ground conditions	0.399	0.768	
Policy	Environmental protection and mitigation costs	0.836	0.738	0.867
	Bureaucracy in tendering method	0.852	0.717	
	Government related issues like changes in policies, pressures etc.	0.585	0.973	
Contract	Mistakes and discrepancies	0.865	0.957	0.962
	Poor contract management	0.849	0.957	
	Variations	0.822	0.958	
	Lowest bidder policy	0.894	0.956	
	Lack of communication	0.692	0.961	
	Non adherence to contract conditions	0.815	0.958	
	Poor contract specific attributes	0.695	0.961	
	Short bid preparation time	0.818	0.958	
	Competition at tender	0.608	0.954	
	Delay in decision making	0.688	0.961	
	Out-dated estimates	0.879	0.957	
	Litigation	0.865	0.957	
	Lack of coordination	0.884	0.957	
Financial	Contractors cash flow and financial difficulties	0.896	0.870	0.921
	Monthly payment difficulties	0.926	0.860	
	Delay in progress payment	0.914	0.864	
	Owner financial difficulties	0.571	0.980	
Construction Management	Material related problem	0.412	0.668	0.699
	Poor change control	0.544	.611	
	Late delivery of material and equipment	0.465	.646	
	Schedule delays	.457	.650	
	Contractor related problem	.399	.673	
Natural	Inclement weather	.767	-	.868
	Flood	.767	-	
Economic	Strategic decision	.903	.914	.934

Corresponding author's e-mail address: engrbelel@gmail.com

and Political	Inflation	.912	.914
	Fluctuation of prices	.912	.914
	Exchange rate	.662	.932
	High interest rate on loans	.560	.941
	Corruption	.909	.914
	Escalation of material prices	.654	.933
	Economic instability	.650	.933

The fourth group represents the finance related causes of road construction projects cost overruns. Though according to Abdul Azis, Memon, Abdul Rahman and Abd Karim (2013) financial management is an important criteria in achieving successful construction project, the category seemed to be the least important in the same study, which suggest that finances are better managed in Malaysia than Nigeria, hence their low impact. The importance of this category is also low in Abusafiya and Suliman (2017) study as compared to the present findings.

The causes in this category include owners' financial difficulties, delay in progress payment, contractor cash flow and financial difficulties. Finance is normally the first and most important requirement for any construction project. Problems related to finance cause delays and expose construction projects to various risks including inflation. This results in contractors procuring materials and equipment at costs above estimates, hence increasing the cost of construction.

The fifth factor, which is the technical related causes group of cost overruns, represents lack of experience, ignorance and lack of knowledge, insufficient investigations, unforeseen ground conditions, project complexity, and latent condition. This category is in line with the 5th category in Frimpong et al. (2003) study. Actual conditions of a construction site for the full length of a road projects are usually only determined as work commences. Unexpected ground conditions along the route may necessitate changes that can increase construction cost, cause delays and subsequently lead to overruns.

The sixth factor is related to bureaucracy in tendering, government related issues including changes in policies, and environmental protection and mitigation costs, hence labelled policy related causes of cost overruns. Basically, government sponsors most road projects in Nigeria; hence, their implementation must be in line with government policy. Since government is the largest client of the construction industry, any change in policy towards construction is likely to have significant effect on the industry's performance.

Construction management related group which is the seventh factor of road construction cost overruns causes is similar to Ameh et al. (2003) construction factor and Abusafiya and Suliman (2017) contractor site management related factor, however it was found to be the 2nd most contributing cost overruns factor in both of the previous. The causes of cost overruns that are construction management related include lack of experience, poor site management and supervision, inadequate planning and scheduling, ignorance and lack of knowledge, shortage of material, inaccurate material estimate, shortage of labour, delay in decision making, etc. Successfully managing construction requires efficient management of all resources on site. Anything short of that leads to compromise in quality, schedule delays and cost escalations. Despite this category having low importance in this study, it is key in achieving construction success.

Corresponding author's e-mail address: engrbelel@gmail.com

Natural causes of road construction projects' cost overruns, which is the eighth factor comprises of inclement weather and floods. These causes are beyond the control of the construction parties; however, they need to be considered when estimating project costs. Such factors can bring a construction to a halt and are referred to as act of God. Adverse weather can lead to reduced labour productivity or even stoppage of work. Bad weather and flood can cause damage to equipment and materials and even destruction to site. These delays and damages could increase the cost of construction and lead to cost overruns. The ranking of this group in the present study agrees with that of Frimpong et al. (2003). Although this is the most difficult and unknown factor (Frimpong, 2003), it is the least ranked in both studies. This can be attributed to the fact that both Ghana and Nigeria have two seasons (dry and rainy) and effects of bad weather are usually minimised by working during dry seasons. Similarly, cost overruns due to flooding, which is the second cause of cost overruns of the natural related factor in this study rarely occur.

4. Conclusion

The aim of the study was to classify the causes of road construction projects' cost overruns. While several studies have classified construction cost overruns wide range of causes, road construction projects' cost overruns causes cannot be overlooked. Through exploratory factor analysis, 42 causes out of the 71 obtained from the review of literature were retained. Eight factors namely: contract related, economic and political related, design and documentation related, financial related, technical related, policy related, construction management related, and natural causes of cost overruns emerged from the analysis.

It has being observed that a one size fits all solution cannot be applied in solving the problem of cost overruns as the comparison of this study's result with previous ones indicates that every study has different classification depending on the causes identified, perception of the respondents and area studied. However, the classification of the causes, the essence is to identify the group that most significantly causes cost overruns by identifying the effect of each group. The classification has reduced the large number of cost overruns causes by narrowing them down into factors (underlying root causes) thereby making it easier to identify the group of causes that has the most impact on FCTA road construction cost overruns. This will aid in simplifying managing the causes and providing the required solution to minimise them and prevent their future occurrence.

This study is not without limitations. The survey was limited to clients, contractors and consultants only. Future studies should include subcontractors to shed more light on the causes of road construction cost overruns.

Acknowledgement

The authors thank all those that participated in the questionnaire survey.

Reference

Abdul Azis, AA., Memon, AH., Abdul Rahman, I. and Abd. Karim. AT. 2013. Controlling Cost Overrun Factors in Construction Projects in Malaysia. Research Journal of Applied Sciences, Engineering and Technology, 5(8): 2621-2629.

Corresponding author's e-mail address: engrbelel@gmail.com

Abusafiya, HAM. and Suliman. SAM. 2017. Causes and Effects of Cost Overrun on Construction Project in Bahrain: Part I (Ranking of Cost Overrun Factors and Risk Mapping). Modern Applied Science, 11(7): 20-27.

Aldagheiri, M. 2009. The Role of the Transport Road Network in the Economic Development of Saudi Arabia. WIT Transactions on the Built Environment, 107: 275-286. Retrieved from https://www.witpress.com/Secure/elibrary/papers/UT09/UT09025FU1.pdf

Allahaim, FSA. 2006. An Empirical Classification of Cost Overrun in Infrastructure Projects by Using Cluster Analysis. 4th International Utzon Symposium-Sydney Australia. Retrieved from https://pdfs.semanticscholar.org/7c18/9b9583b923b3140ed14a8101c6f7076746c2.pdf?_ga=2.39957666.1439119211.1583734867-346520788.1583734867

Ameh, OJ., Soyingbe, AA. and Odusami, KT. 2010. Significant Factors Causing Cost Overrun in Telecommunication Projects in Nigeria. Journal of Construction in Developing Countries, 25(2): 49-67. Retrieved from http://web.usm.my/jcdc/vol15_2_2010/JCDC%2015(2)%202010-ART%203_corrected_(49-67)_21.12.2010.pdf

Centre for Social Justice 2016. Engaging the approved 2016 Federal Works Budget. Retrieved from http://csj-ng.org/wp-content/uploads/2018/06/2016-Works-Budget-Review.pdf

Child, D. 2006. The Essentials of Factor Analysis. (3rd ed.), Exploratory and Confirmatory Factor Analysi, pp. 6, Continuum, London

Chileshe, N. and Berko, PD. 2010. Causes of Project Cost Overrun within Ghanaian Road Construction Sector. Proceedings of Built Environment Conference held in Durban, South Africa, 18 – 20 July 2010. ASOCSA 2010-20, 5: 66-81.

Retrieved from https://www.irbnet.de/daten/iconda/CIB_DC22741.pdf

Flyvbjerg, B., Holm, MKS. and Buhl, SL. 2004. What Causes Cost Overrun in Transport Infrastructure Projects? Transport Reviews, 24(1): 3-18.

Frimpong, Y., Oluwoye, J. and Crawford, L. 2003. Causes of Delay and Cost Overruns in Construction of Groundwater Projects in Developing Countries: Ghana as a Case Study. International Journal of Project Management, 21(5): 321-326.

Hadi, N., Abdullah, N. and Sentosa, I. 2016. An Easy Approach to Exploratory Factor Analysis: Marketing Perspective. Journal of Educational and Social Research, 6(1): 215-223.

Isma'il, U., Zakari, A. and Gambo, D. 2013. Prioritizing Cost Overrun Causes in the Nigerian Road Construction. Interdisciplinary Journal of Contemporary Research in Business, 5(6): 287-294.

Karunakaran, P., Abdullah, AH., Nagapan, S., Sohu, S. and Kasvar, KK. 2018. Categorization of Potential Project Cost Overrun Factors in Construction Industry. Proceedings of IOP Conference Series: Earth and Environmental Science held in Langkawai, Malaysia, 4-5 December 2017. ConCEES 2017, 4: 66-81. Retrieved from http://iopscience.iop.org/article/10.1088/1755-1315/140/1/012098/pdf

Koushki, PA. and Al-Rashid, KN. 2005. Delays and Cost Increases in the Construction of Private Residential Projects in Kuwait. Construction Management and Economics, 23(3): 285-294.

Lee, J. 2008. Cost Overrun and Cause in Korean Social Overhead Capital Projects: Roads, Rails, Airports and Ports. Journal of Urban Planning and Development, 134(2): 59-62.

Corresponding author's e-mail address: engrbelel@gmail.com

Love, PED., Edwards, DJ. and Irani, Z. 2012. Moving beyond optimism bias and strategic misrepresentation: An explanation for social infrastructure project cost overruns. Institute of Electrical and Electronics Engineers (IEEE), Engineering Management Transactions, 59(4): 560–571.

Love, PED., Sing, C., Carey, B. and Kim, JT. 2014. Estimating Construction Contingency: Accommodating the Potential for Cost Overruns in Road Construction Projects. Journal of Infrastructure Systems, 21(2): 1-10.

Retrieved from http://ascelibrary.org/doi/pdf/10.1061/%28ASCE%29IS.1943-555X.0000221

Love, P., Wang, X., Sing, C. and Tiong, R. 2013. Determining the Probability of Project Cost Overruns. Journal of Construction Engineering and Management, 139(3): 321–330.

Mahamid, I. and Bruland, A. 2011. Cost Overrun Causes in Road Construction Projects: Consultants' Perspective. International Conference on Construction and Project Management, IPEDR. IACSIT Press, Singapore, 2011., 2: 6-10. Retrieved from http://www.ipedr.com/vol15/2-ICCPM2011A00003.pdf (Accessed May 2014).

Memon, AH. 2013. Structural Modelling of Cost Overrun Factors in Construction Industry. PhD Thesis, University of Tun Hussein Onn, Malaysia, pp.127.

Retrieved from http://eprints.uthm.edu.my/3948/1/Aftab_Hameed_Memon1.pdf (Accessed October 2015)

Memon, A., Abdul Rahman, I. and Abdul Azis, A. 2012. The Cause Factors of Large Project's Cost Overrun: A Survey in the Southern Part of Peninsular Malaysia. International Journal of Real Estate Studies, 7(2): 1-15.

Nega, F. 2008. Causes and effects of cost overrun on public building construction projects in Ethiopia. Master of Science thesis, Addis Ababa University, Addis Ababa, Ethiopia, pp. 111.

Omoregie, A. and Radford, D. 2006. Infrastructure delays and cost escalation: Causes and effects in Nigeria. International Postgraduate Research Conference, Delft University of Technology and TNO. The Netherlands, 3rd- 7th April 2006., 6: 79-93.

Stellefson, M. and Hanik, B. 2008. Strategies for Determining the Number of Factors to Retain in Exploratory Factor Analysis. Paper presented at the Annual Meeting of the Southwest Educational Research Association, New Orleans, 7th February 2008., pp. 36.

Retrieved from https://files.eric.ed.gov/fulltex/ED500003.pdf (Accessed 11 June 2018)

Corresponding author's e-mail address: engrbelel@gmail.com