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Effect of Exceptional Climatic Conditions and Mitigating Measures on Cost Overruns of Infrastructure Projects in Kenya

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ABSTRACT
The implications of cost overruns in road infrastructure projects are wide ranging. The most notable effect being the strain on the resources due to additional costs over and above the budgeted costs as well as reduced benefits to the intended users. In some cases, these costs are passed on to the road users. The problem in this study is that Highways construction projects in Kenya experience huge cost overruns. However, the contribution of exceptional events to cost performance of Highways projects is not well understood. Further, the current standard forms of contract lack a preventive mechanism for exceptional events in the construction industry in Kenya. Therefore, this study was conducted to address these concerns. The objective of the study was to assess the impact of exceptional climatic conditions on the cost of infrastructure projects by KeNHA as well as to determine influence of mitigation measures applied on the cost of infrastructure projects by KeNHA. The study design adopted was both qualitative and quantitative. The target population was active KeNHA projects within Nairobi Metropolitan where 14 projects were considered, with a sample size of 42 respondents selected using simple random method. The respondents were drawn from three levels of workmanship in the projects which included skilled labour, project supervisors and site engineers. The primary data was collected using structured questionnaires. Data collected was analysed using descriptive statistics. The findings revealed that exceptional climatic events and mitigation measures had an average mean above 3.0. The correlation of the two variable was found to be strong and positive at 0.973 and 0.886 for exceptional climatic events and mitigation measures, respectively. Regression analysis revealed that both variables had a significant effect on cost of infrastructure projects in Kenya with a P-value of 0.000 and 0.025, respectively. Therefore, based on the correlation and regression analysis findings, the study concluded that climatic conditions and mitigating factors had significant positive effect on cost of infrastructure projects.

***Keywords*: Exceptional events, exceptional climatic conditions, Mitigating Measures, cost overruns**

1.1 INTRODUCTION

In Kenya, road transport accounts for 93% of all freight and passenger traffic with the balance attributed to other modes of transport mainly air, and water. This underscores the significance of the sub-sector to the Kenyan economy. Research suggests that close to 30% of the productivity handicap faced by Kenya is attributable to infrastructure constraints majorly the power sector closely followed by the transport sector (Briceno-Garmendia and Shkaratan, 2011). It is imperative that the Government consistently increases investment in this sector in order to improve the economic performance of the country. Due to the capital-intensive nature of such investment, cost is thus an important determinant on the level of roads network development and has a direct impact on how long the country will take to achieve an adequate and reliable road network and by extension a sustainable economic growth.

Furthermore, evidence suggests the robustness of the construction industry in Kenya is attributed to *inter alia* the improved infrastructural networks which seek to enhance connectivity and mobility in the Country. Among the notable developments thus far include; the completion of the Single-track Standard Gauge Rail (SGR) from Mombasa to Nairobi, the second Phase of SGR running 120 km from Nairobi to Naivasha, expansion and modernization of Outer Ring Road, Expansion of Ngong Road, Construction of Kenya Western Bypass, Dongo Kundu bypass and Nuno-Modogashe Road (KRB, 2018). Importantly, The Big Four Agenda that defines the Government`s priorities and development path for the 2018-2022 planning cycle provides impetus for increased construction activities for the next five years. This study posits that for Kenya to realize the vision in its development blue-print, the construction industry must operate at optimal performance through enhanced efficiency in the management of construction projects than it is presently done.

Cost is said to be an essential consideration and one of the major constraints in implementation of any project to the extent that cost overruns are sometimes viewed as a major determinant of the success or failure of the project (Wijekoon and Attanayake, 2011). Researchers have termed cost overrun as a common phenomenon in the road projects in the world and is measured by the difference between the final total cost of the project and the original contract amount. The magnitude varies from one project to another and are more prevalent in the developing countries than in Europe and North America (Flyvbjerg, Skamris Holm, and Buhl, 2004; Wijekoon and Attanayake, 2011; Chantal Cantarelli, Flyvbjerg, Molin, and Van Wee, 2010).

Over the last few decades cost overruns have remained common with some projects recording up to 60% increase from the original contract sum (Foster and Garmendia, 2010). Of even more concern is the fact that historical data shows no improvement in cost performance in the last few decades indicating that no significant learning has occurred in this area (Flyvbjerg et al., 2009). The implications of cost overruns in the road infrastructure projects are wide ranging. The most notable effect of cost overrun is the strain on the resources due to additional costs over and above the budgeted costs as well reduced benefits to the intended users.

At the centre of cost overruns in road projects, is the aspect of exceptional events which often lead to change orders that ultimately, alter the scope, duration, or cost of a project. The impact of exceptional events in the Kenyan construction projects is still not well understood. The projects stakeholders (e.g., clients, contractors, and consultants) still deal with exceptional events in a corrective manner rather than a preventive one. Therefore, exceptional events have significant effects on cost, time, safety, labour productivity, and work quality. Furthermore, the current standard forms of contract lack a preventive mechanism for exceptional events in the construction of buildings in Kenya. According to the Kenya National Highways Authority (KeNHA) annual report (2020/2021), the Authority faced challenges emanating from inadequate budgetary allocation, with the pending bill on land acquisition and works being at KES 50.7 billion at the end of the financial year. The outbreak of COVID-19 slowed down construction works due to supply chain disruptions for both road construction materials and specialized labour. Other challenges that affected project delivery during the year included vandalism of road furniture which compromises road safety, delays in the relocation of utilities and encroachment on road reserves. These challenges continue to hinder timely project completion and often lead to escalation in project cost due to interest charges and contractual claims. To this end, the study sought to assess the effect of exceptional climatic conditions and mitigation measures on the cost of infrastructure projects by KeNHA. The research was guided by two hypotheses as follows:

i. Exceptional climatic conditions have no significant effect on the cost of infrastructure projects by the Kenya National Highways Authority
ii. Mitigation measures have no significant influence on the cost of infrastructure projects by the Kenya National Highways Authority

1.2 Literature Review

Researchers have varied findings on the occurrence of cost overruns. Part of the reasons for inconsistencies in the findings emanate from diversity of theories, which have been fronted by different authors to explain the phenomenon of cost overruns. Cantarelli et al. (2010) use theories from behavioural studies to explain manifestation of cost overruns in the road construction projects. Included in this category are two theories primarily on optimism bias; planning fallacy theory and the prospective theory. The planning fallacy theory was first proposed by Daniel Kahneman and Amos Tversky in 1979. It is a phenomenon in which predictions about how much time will be needed to complete a future task displays an optimism bias. The definition was expanded in 2003 to include individuals' tendency to underestimate time, costs and risks of future actions while overestimating the benefits of the same actions.

According to Daniel Kahneman and Amos Tversky (1979) this phenomenon occurs regardless of the individual's knowledge that past tasks of a similar nature have taken longer to complete than generally planned. The bias only affects estimates or forecasts about one's own tasks; when outside observers predict task completion times, they show a pessimistic bias, overestimating the time needed. The optimism bias is attributed to the cognitive biases of the forecasters such as scenario thinking, anchoring of estimations and extrapolation of current trends (Cantarelli et al., 2010). The anchoring trap is well explained in the "Hidden Traps in Decision Making'' by John S. Hammond and others. According to these authors, the old numbers become anchors which the forecaster adjusts based on other factors. While this approach may lead to reasonably accurate estimate, it relies too much on past events giving little weight to other factors. This may lead to misguided choices especially in a situation where the market place changes rapidly resulting to underestimation of costs and eventually lead to cost overruns. Thus, the planning fallacy results not only to time overruns but cost overruns as well with reduced benefits. This theory can be used to explain the occurrence of cost overruns in that the contract price, which is compared against the actual cost to determine the cost overruns, is a function of the Engineers estimates. The engineers estimate on the other hand is a product of estimation and is largely derived from historical data. Cost overruns are likely to occur if the engineer relies too much on the historical information without incorporating other determinants that may affect the cost of a project.

Closely related to the planning fallacy theory is the prospect theory by the same authors Daniel Kahneman and Amos Tversky in 1979. This is a behavioural economic theory that designates the way people choose between probabilistic alternatives that involve risk, where the probabilities of outcomes are known. According to this theory people make decisions based on the potential value of losses and gains rather than the final outcome and evaluate these losses and gains using certain heuristics. Under prospect theory, value is assigned to gains and losses rather than to final assets; also, probabilities are replaced by decision weights. The value function is defined on deviations from a reference point and is normally concave for gains (implying risk aversion), commonly convex for losses (risk seeking) and is generally steeper for losses than for gains (loss aversion).

Decision weights are generally lower than the corresponding probabilities, except in the range of low probabilities. Like in the planning fallacy theory, the linking of the optimistic theory to cost overruns can be seen through the engineer's

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estimates which are the basis upon which bidding is carried out to obtain the lowest evaluated bidder. This optimistic forecast is as result of decision-making process involving risk and uncertainties. (Chantal C. Cantarelli et al., 2010).

Cost is one of the major considerations throughout the lifecycle of a project. Unfortunately, most of projects fail to achieve project completion with the estimated cost. Besides time overrun, cost overrun is also a serious problem in the construction industry. This is a major problem both in developed and developing countries. The trend is more severe in developing countries where these overruns sometimes exceed 100% of the anticipated cost of the project (Azhar et al. 2008). The challenge is becoming more critical as revealed in World Bank (2005) report. The report pointed out that 63% of the 1778 financed construction projects faced poor performance with overrun in budget at an average of 40%. Contributing to this discussion, Flyvbjerg et al. (2003) had studied 258 projects in 20 nations which approximately US$90 billion worth of project with size ranging from US$1.5 million to $8.5 billion. They found that cost escalation happened to almost 9 out of 10 projects with an average of 28% higher than forecasted costs. The study concluded that cost performance has not improved over the time and its magnitude has not changed for the past 70 years. Another study conducted by Odeck (2004) shows that average cost overrun was rather small with approximately 7.9% of project cost. The problem of cost overrun is common issue in both developing and developed countries (Angelo and Reina, 2002).

The beginning points to understanding this challenge is perhaps to look at what constitutes a cost overrun. Exhaustive conclusion on the definition of cost overrun is hard to come by, but generally, cost overrun is also called “cost escalation,” “cost increase,” or “budget overrun” (Zhu and Lin, 2004 in Enshassi, Al-Najjar, and Kumaraswamy, 2009). Cost overrun is the excess of actual cost over budgeted cost which occurs when the final cost of the project exceeds the original estimates (Avots, 1983; Azhar et al., 2008). Cost overrun has become a universal phenomenon (Endut et al., 2009) which adds pressure to investment decisions (Ali and Kamaruzzaman, 2010). Cost overrun is measured as a percentage of actual costs over the estimated costs of the project (Cantarelli, 2009; Choudhury and Phatak, 2004) as shown in equation (1) in which C_o is cost overrun, C_a is actual cost and C_e is estimated cost.

$$C_o = \frac{C_a - C_e}{C_e} \qquad (1)$$

Actual costs are defined as real and accounted construction costs determined at the time of project completion. Estimated costs are defined as budgeted or forecasted construction costs determined at the start of projects (Cantarelli, 2009). Despite using up to date project control methods and software packages, such as Gantt Bar Chart, Program Evaluation and Review Technique (PERT), Critical Path Method (CPM), Microsoft Project, Asta Power Project, Primavera, among others, to control cost performance of projects, many construction projects in developed countries still suffer cost overruns (Olawale and Sun, 2010).

Tejale Khandekar and others (2015) carried out a study on analysis of project cost overrun by statistical methods in Pune region in India. Their survey identified 45 common factors causing cost overruns which they ranked based on relative important index value computed on each group of respondents. The ten most factors based on the ranking were material shortage, shortage of labour, late delivery of materials and equipment, unavailability of competent staff, low productivity level of labour, quality of equipment and raw materials, delay in progress payments, financial difficulties by contractor, poor site management, escalation and fluctuation of material prices and poor communication and coordination by owner and other parties. Chileshe and Berko (2010) listed similar factors including delays in monthly payments to contractors; variations; inflation, and schedule slippage as significantly important. They identified other factors as poor communication, technical complexity and size of the project as not very important but of concern. They also found that project management practices such as value management and risk management were not being practised within the Ghanian roads sector.

A similar study by Muianga, Granja and Ruiz (2015) in Mozambique identified 95 factors which they classified into eleven categories namely government relations, contractual issues, organization, management, financing, design and documentation, schedule and control, scope changes, environment and economy materials and labour and equipment. Using statistical analysis, they attached values of importance to each factor with a relevance average set at 2.5. Fifty-three (53) factors across the eleven categories were identified as relevant. The study however did not rank the factors nor the group of factors.

Singh, (2009) in his study of extent and causes of cost overruns in 850 infrastructure projects in India divided the causal factors in four categories; technical and natural factors, contractual failures, organizational or institutional failures and economic factors. Included in the technical and natural factors are the cost estimation techniques, technological and material requirements as well as natural factors such as flood and other natural conditions. The contractual failures relate to the ability of the contract to specify every detail of the works that are to be performed by the contractor’ in each possible scenario. He refers to this as ‘complete-contingent- contracts. He however notes that in reality it is difficult to develop a contract that describes in detail every possible scenario that may occur during the implementation of the project. This makes the construction contracts intrinsically ‘incomplete’. The ‘incompleteness’ varies as the project complexity increases. Organizational or institutional failures refer to cooperation of several departments within and among various ministries. The hierarchal relationships within these organizations and conflicts between the individuals and the social objectives within the organization mean that the projects have to face the consequences of many sources of failures within the sponsoring organizations. Included in the economic factors are the state of other infrastructural development and income level.

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1.3 Methodology

The current study was a survey of knowledge and information which the construction industry players had regarding the impact of exceptional events on the cost performance of Highways projects in Kenya. Therefore, the study sought to search for information from contractors and consultants in the industry. This study can be said to have been descriptive research using a cross-sectional survey design. The research design for this study was both qualitative and quantitative. Qualitative research design is that which employs narrative and quantification in the collection and analysis of data as observed (Bryman, 2004). This strategy was preferred since the aim of the research was to collect information from sampled respondents using questionnaires and interviews and later quantitative techniques were used in data analysis. The target population for this study were active KeNHA projects within Nairobi Metropolitan. As at December 2022, there were 14 KeNHA projects within Nairobi Metropolitan.

Stratified sampling method was used to establish the sampling frame. The study focused on ongoing KeNHA projects in the Nairobi Metropolitan. The target population was first grouped in strata (projects in every county within Nairobi Metropolitan) to form a sampling frame. This study used stratified sampling to identify the sampling units where the counties in the areas formed the strata. Then from every stratum, a subset of active projects was selected as shown in the sampling frame. The study sample size was identified through simple random selection where a skilled labourer, a supervisor and engineer were picked from every project. Purposive sampling was used to select the respondents based on their involvement in construction projects. The sample size for the study was 42 respondents.

In this study, emphasis was given to both primary data and secondary sources. The primary data was collected using a structured questionnaire. The primary data was obtained directly from respondents through administration of self-completion questionnaires and interviews. The primary data provided first-hand information to this study about exceptional events, how they influence cost of projects implementation and other issues necessary for this research. Secondary data was obtained from literature review obtained from written theses, journal papers, textbooks, newspapers, and literature on change orders. The aim of the secondary source was to interpret, offer commentary, analysis and draw conclusions about events described in primary sources. Prior to the main study, pilot testing was conducted to establish the validity and reliability of the research instrument

The field data collected using questionnaires was subjected to both qualitative and quantitative analysis techniques through use of Statistical Package for Social Science (SPSS) Version 20. The responses from closed-ended questions were categorized as numerical data and open-ended questions categorized as string (text) data. The raw data was edited, and then entered in the SPSS computer program by assigning symbols in a process referred to as coding. Thereafter, descriptive and inferential statistics analysis was done to generate the relevant frequencies, descriptive charts and graphs. Data gathered from opened ended questions and interviews was used to support the explanations of the analysis outcome.

This study used Cronbach alpha model for internal consistency based on the correlation to test scaled items. An alpha (α) score of 0.70 or higher is considered satisfactory (Gliem and Gliem, 2003). Table 1 presents the results on reliability test. It was observed that the reliability and internal consistency of the items were above the required cut-off minimum value of 0.7; therefore, all the items in the questionnaire were reliable.

Table 1: Reliability test

Variables	Number of Items	Cronbach's Alpha
Cost overruns	5	0.890
Exceptional Climatic Conditions	5	0.890
Mitigation Framework	5	0.889

1.4 Results and Discussion

Table 2 indicates that the overall response rate of 95.2% was excellent according to Bryman (2016) and Walliman (2016) who rated response rates as: 85% and above is excellent, 70-85% is very good, 60-69% is acceptable, 50-59% barely acceptable, while below 50% is not acceptable, for further data analysis.

Table 2: Response rate

Response rate	Frequency	Percent
Responded	40	95.2
Did not respond	2	4.8
Total	42	100

The descriptive results on the effect of various constructs of exceptional climatic conditions on cost of infrastructural projects in Kenya are presented in Table 3. All the means of the various constructs were above 3.50 meaning that the respondents agreed on the various constructs that exceptional climatic condition has an effect on contraction cost. The standard deviations were low with a minima variance implying that the respondents were almost of the same opinion regarding the questions asked. These finding are supported by those of EL-Kholy (2015) and Ronog (2020) who noted that the success of infrastructure projects relies on many other surrounding factors. The studies further noted that climatic conditions would hinder construction work plan as well as improvising costs that were not initially factored in the budget.

Table 3: Effect of exceptional climatic conditions on cost overruns of infrastructure projects

Exceptional climatic conditions	Mean	Standard deviation

Flooding has increased cost of the projects by a significant margin	3.90	1.130
Heavy rains cause delays in the project hence cost escalation	3.81	1.112
Exceptional whether changes cause review of the project schedules	3.78	1.106
Projects are affected by adverse climatic conditions	3.93	1.103
Weather changes lowers labourers' productivity	3.80	1.102

The results on the level of response regarding the influence of mitigation measures on cost of infrastructure projects are shown in Table 4. From the results it was found that: all the constructs had mean values above 3.50. The interpretation of this findings is that the respondents were in agreement on various measures undertaken as a mitigation factor. In the eventuality of exceptional events, the managers and supervisors adopted some strategies which would reduce cost. Similar findings were reported by Ronog (2020) that there was a significant relationship between planning, resource scheduling, project communication, and project monitoring and evaluation, and project performance. Ronog (2020) recommended that application of cost management strategies in the construction projects would be good for project performance.

Table 4: Influence of mitigation measures on the cost of infrastructure

Mitigation Framework	Mean	Standard deviation
Negotiation of salaries with employees has helped manage construction cost	3.55	1.281
Seeking of moratorium from funding entities during a pandemic	3.52	1.157
Including a budget for adverse climatic conditions	3.70	1.154
Adopt alternative methods / source of materials to avoid delays	3.60	1.108
There is adequate supply of construction materials at all the time	3.63	1.073

The results on the level of agreement on the various constructs regarding cost performance of construction project in Kenya are presented in Table 5. From the results, the established means of the various cost variables were again all above 3.5. The findings show that the various exceptional events such as economic conditions, were a cause for cost escalation.

Table 5: Cost performance of project

Cost overruns of construction projects	Mean	Standard deviation
Our operating cost has gone up in our company	3.8333	1.09183
Our variables cost has been growing constantly in our company	3.5333	1.05552
Sometime it is difficult to sustain the budget	3.7167	1.05913
We have changes in repairing machineries due to high cost involved	3.8667	1.06511
We have experienced challenges in sustaining our field cost in our company	3.7333	1.15552

Further, from Table 6, it can be observed that the correlation between the independent variables (i.e., exceptional climatic conditions and mitigation measures) and the dependent variable (i.e., project cost and time) was high and positive at 0.973** and 0.886** for exceptional climatic conditions, and mitigation measures, respectively. The implication is that the high correlation between the exceptional events and performance of project explains that they were a main cause of cost and time variations in construction projects.

Table 6: Correlation results

Variables		Cost overruns of project	Exceptional climatic conditions	Mitigation measures
Costs overruns of project	Pearson Correlation	1.000		
	P-value			
Exceptional climatic conditions	Pearson Correlation	0.973**	1.000	
	P-value	0.000		

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Variables		Cost overruns of project	Exceptional climatic conditions	Mitigation measures
Mitigation measures	Pearson Correlation	0.886**	0.256**	1.000
	P-value	0.000	0.000	

On the other hand, Table 7 shows the fitting statistics in terms of explanation power of the exceptional climatic conditions and mitigation measure variables included in the model. The results show that the variables explain up to 90.3% influence on cost of construction projects in terms of cost. This implies that factoring exceptional events (i.e., exceptional climatic conditions and mitigation measures) in the model contributed to about 90.3% variations on cost of infrastructure projects in Kenya. Thus, the general null hypothesis of no significant relationship between exceptional events and cost of infrastructure projects in Kenya was rejected in this case.

Table 7: Good-of-fit statistics

Model	R	R^2	Adjusted R^2
	0.901[a]	0.903	0.900

Regression analysis

Table 8: Regression coefficients

Variables	Coefficients	Std. Error	t-statistic	P-Value
(Constant)	0.108	0.111	0.969	0.337
Exceptional Climatic Conditions	0.650	0.064	10.158	0.000
Mitigation Measures	0.119	0.052	2.307	0.025

$$\text{Cost of Project} = 0.108 + 0.650\ \text{Exceptional Climatic Conditions} + 0.119\ \text{Mitigation Measures} + \varepsilon$$

One of the specific objectives of the study was to determine the effect of exceptional climatic conditions on the cost of infrastructure projects by KeNHA. From Table 8, the regression coefficient of exceptional climatic conditions was found to be 0.650. This value shows that holding other variables in the model constant, an increase in exceptional climatic conditions by one unit causes the cost performance of infrastructure projects in Kenya to increase by 0.650 units. The positive effect showed that there was a positive association between exceptional climatic conditions and cost performance of infrastructure projects in Kenya. The coefficient was statistically significant with a t-statistic value of 10.158. The p-value, which indicated the probability of getting a t-statistic value bigger than 10.158, was found to be 0.000.

Based on the findings above the null hypothesis (H_0): exceptional climatic conditions have no significant effect on the cost of infrastructure projects by the Kenya National Highways Authority is hereby rejected. The study adopts the alternative hypothesis that exceptional climatic conditions have significant effect on the cost of infrastructure projects. This finding supported those of EL-Kholy (2015) and Ronog (2020) who noted that the success of infrastructure projects relies on many other surrounding factors.

The second specific objective of the study was to determine the influence of mitigation measures on the cost of infrastructure projects by the Kenya National Highways Authority. From Table 8, the regression coefficient of mitigation measures was found to be 0.119. This value shows that holding other variables in the model constant, an increase in mitigation measures by one unit causes the cost of infrastructure projects in Kenya to increase by 0.119 units. The positive effect showed that there was a positive association between mitigation measures and cost performance of infrastructure projects in Kenya. The coefficient was statistically significant with a t-statistic value of 2.307. The p-value, which indicated the probability of getting a t-statistic value bigger that than 2.307, was found to be 0.000.

From the findings above the null hypothesis (H_0): mitigation measures have no significant influence on the cost of infrastructure projects by the Kenya National Highways Authority is hereby rejected. The study adopts the alternative hypothesis that mitigation measures have significant effect on the cost of infrastructure projects.

1.5 CONCLUSIONS

The findings of the study revealed that exceptional climatic conditions affect the cost performance of projects in Kenya. Therefore, the study concluded that when the climatic conditions are not favourable, the cost performance of construction projects is negatively affected. Further, the findings show that mitigation measures influence the cost performance of projects in Kenya. The results that mitigation measures had a positive effect on cost performance of project was a good indication that increase in mitigation measures motivate cost performance of project in the country. This variable was found to have a statistically significant effect on cost performance of project.

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REFERENCES

Ali A S and Kamaruzzaman S N 2010 Cost performance for building construction projects in Klang Valley, J. Build. Perform. 1 110–118

Angelo, W.J. and P. Reina, (2002): Megaprojects Need More Study Up Front to Avoid Cost Overruns. McGraw-HilL New York.

Ashworth A. Harlow:Pearson Education Ltd USA 1998 Contractual procedures in the Construction Industry 3rd Edition.

Avots, I. (1983), "Cost-relevance analysis for overrun control. "International Journal of Project Management, 1(3), 142-148.

Azhar, N., Farooqui, R. U. and Ahmed, S. M. (2008). Cost overrun factors in construction industry of Pakistan, in Proc. of the 1ICCIDC-I Conference, Karachi, Pakistan, 2008.

Briceno-Garmendia, C., and Shkaratan,M.(2011). Kenya's Infrastructure: A Continental Perspective (SSRN Scholarly Paper No. ID 1792254). Rochester.

Bryman, A. (2012). Social Research Methods. Oxford: Oxford University Press.

Cantarelli, C.C., B. Flyvbjerg, B. Wee van, and E.J.E. Molin.2009 Lock-in and its influence on the project performance of large-scale transportation infrastructure projects. Investigating the way in which lock-in can emerge and affect cost overruns. Paper presented at the 8th annual meeting of the Transportation Research Board, Washington, D.C.

Cantarelli, Chantal C., Flyvbjerg, B., Molin, E. J., and Van Wee, B. (2010). Cost overruns in large-scale transportation infrastructure projects: explanations and their theoretical embeddedness. European Journal of Transport Infrastructure Research, 10(1), 5–18.

Chileshe, N., Berko, P.D. and Haupt, T. (2010) Causes of Project Cost Overruns within the Ghanaian Road Construction Sector. Retrieved from http://www.irbnet.de/daten/iconda/CIB_DC22741.pdf.

EL-Kholy, A. . (2015). Predicting Cost Overrun in Construction Projects. International Journal of Construction Engineering and Management, 4(4), 95–105.

Endut Rohani, Akintola Akintoye and John Kelly(2009). Cost and time overruns of projects in Malaysia.

Enshassi Addan (2009). Delays and cost overruns in the construction projects in the Gaza strip. onference.

Flyvbjerg B. et al (2009) Delusion and Deception in Large Infrastructure Projects Two Models for Explaining and Preventing Executive Disaster.

Flyvbjerg, B., Skamris Holm, M. K., and Buhl, S. L. (2004). What Causes Cost Overrun in Transport Infrastructure Projects? Transport Reviews, 24(1), 3–18. https://doi.org/10.1080/0144164032000080494a.

Foster, V., and Briceño-Garmendia, C. (2010). Africa's Infrastructure: A Time for Transformation. World Bank Publications.

Gliem, J., & Gliem, R. (2003). Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for LikertType Scales. 2003 Midwest Research to Practice Conference in Adult, Continuing, and Community Education , 82-88.

Kenya National Highways Authority (KeNHA) (2011). KENHA Annual Report 2010-2011

Muianga, E., Granja, A. & Ruiz, J., (2015). Influencefactors on cost and time overruns in Mozambicans construction projects: Preliminary findings. Journal of Ambient Construction (Ambiente Construido), 15(1), pp. 79-97.

Odeck, J. (2004). Cost overruns in road construction—What are their sizes and determinants? Transport Policy, 11(1), pp. 43-53.

Olawale Y. Adisa and Ming Sun(2010). Cost and time control of construction projects: inhibiting factors and mitigating measures in practice.

Singh Harbahajan (2009). Construction Project Management ISBN 9350438194,9789350438190.

Tejale, D. S.; Khandekar, S. D.; and Patil, J. R. (2015), "Analysis of Construction Project Cost Overrun by Statistical Method," International Journal of Advance Research in Computer Science and Management Studies, 5, 219-227.

Tversky Amos and Kahneman Daniel (1979). Prospect theory :An analysis of decision under risk.

Wijekoon, S.B., Attanayake, A.M.(2011) : Study on the cost overruns in road construction projects inSri Lanka. In: Proceedings of the 2nd International Conference on Sustainable BuiltEnvironment, Kandy, Sri Lanka, pp. 111–121.

World Bank (2005) World Bank Annual Report 2005.

Zhu. K. and Lin. L., 2004, A stage-by-stage factor control frame work for cost estimation of construction projects, Owners Driving Innovation International C