Int Journal of Social Sciences Management and Entrepreneurship 6(1): 159-169, 2022
ISSN 2411-7323
© **SAGE GLOBAL PUBLISHERS** www.sagepublishers.com

PROJECT SCHEDULE AND PERFORMANCE OF ROAD CONSTRUCTION PROJECTS AT THE KENYA NATIONAL HIGHWAYS AUTHORITY

[1] Mugweru David, [2] Muchelule Yusuf

[1]Masters student, Jomo Kenyatta University of Agriculture and Technology, Kenya

[2]Lecturer, Jomo Kenyatta University of Agriculture and Technology, Kenya

ABSTRACT

In Kenya the number of construction projects is increasing radically. However, majority of these Projects are not completed within allocated cost and time. Controlling cost of road construction has become one of the major challenges in Kenya Construction Industry. The main objective of this study was to determine the influence of project schedule on performance of road construction projects at the Kenya National Highways Authority. The study adopted descriptive research with a study population of 200 roads construction project done at KeNHA. Who have been involved in the supervision of large road construction projects within KeNHA completed between the years 2000 to 2020? The study employed purposive sampling design by using a to select a sample size of 134 respondents. The main data collection instrument was questionnaires containing both open and close ended questions. Descriptive statistics data analysis method was applied to analyze data aided by Statistical Package version 25 for Social Science (SPSS) to compute response frequencies, mean, standard deviation and covariance. Finally linear regression model was used to establish the significance of the independent variables on the dependent variable. The study findings indicated that project schedule accounts for 22.5% of changes in performance of road construction projects when other factors are held constant. The study concluded that project schedule influence performance of road construction projects in KeNHA significantly. The study recommends that Projects managers in construction companies embrace effective contract planning methods.

Key Words: project cost management, project schedule, performance of road construction projects

INTRODUCTION

Construction industry, these days is confronting extreme issue of poor cost management bringing about enormous measure of cost variance. The issue of changes in project cost is a major issue in both developed and developing countries. This needs serious attention for improving the construction cost performance as rarely projects are completed within budget. Within the past years, massive construction projects have been recognized for their cost fluctuation and delay in completion (Aljohani Ahiaga-Dagbui & Moore, 2017).

As per the Kenya Construction Industry Status Report, 2015, development industry is an excellent mark of financial action as the business is frequently used not exclusively to animate development yet additionally to help monetary recuperations from downturns. Given the huge capital sums related with development projects, the presentation as far as cost are firmly checked, particularly where citizens' cash is involved (Kerzner and Kerzner, 2017). In this manner, development projects possess a fundamental spot in the country's financial framework. As a public area, a significant piece of the confident ventures emerges in that. These speculations pull and push close by various interests in the non-public corporate and little and house businesses areas. The issue of undertaking defers and cost vacillation is of worldwide concern (Shehu, Endut and Akintoye, 2014).

Both created and agricultural nations are dealing with uncommon financial issues, and can't commit the assets important to appropriately extend and keep up with it (Othman, Zain and Hamdan, 2010). Development projects happens everywhere, it involves building works, water works common works, Road works and numerous others. Each development project has the accompanying requirements; time, cost and quality. It is normal to encounter delays during development projects. It is against this background, states and region legislatures are going to compelling arranging interaction of these tasks (Engel, Fischer and Galetovic, 2010). PMI (2011) characterized arranging as those cycles performed to build up the all-out extent of the work, characterize and refine the goals, and foster the strategy needed to accomplish those targets. The goal of the improvement of the venture plan is utilized to make a reliable, sound archive that can be utilized to direct project execution and control (Gupta, Aha, Nau, and Munoz-Avila, 2014). The arrangement ought to incorporate general plans with respect to all spaces of the task, for example, project targets, time plan, financial plan among others (PMBOK, 2011).

In Nigeria, Aljohani Ahiaga-Dagbui and Moore (2017) found that average escalation of the cost was 188% and 14% respectively. Similarly in Malaysia, several studies have been carried out to investigate the performance and factors of cost fluctuation in construction industry. In Nigeria, cost variations are constantly occurring in road construction projects and they could cause great impact on economic growth. It is one of the most common problems that upset the construction companies in terms of competitiveness and long-term sustainability in the global market.

Due to the population growth, industrialization and urbanization, more roads and highways are required for the easy access to market, economy and other vital purposes such as transportation and delivering goods and services (Shah, 2016). He highlights that cost is one of the major issues which has to be considered throughout the project life cycle and it can be considered as one of the most important factors causing the project delay and failure if appropriate consideration is not taken into account. The issue of cost fluctuation in project is

attracting more researchers over the past decades and still more research is running to address the issue.

Due to the significance of roads in socio-financial development of the country, the government has in the past progressively accelerated budget allocation to the road subsector. Road projects in Kenya are facing diverse challenges, which encompass postponement in completion and cost fluctuation (Wanjiku, 2015). The figure varies from country to country, however in step with Murimi (2016), authorities spending on public services accounts for anywhere between 15-forty-five% of GDP. The sheer quantity of this spending has a large impact on the financial system. In step with Kenya Roads Board report, Kenya national Highways Authority is yearly allotted about forty-five (45) % of the entire fund allocated to the ministry of roads. Many projects experience price fluctuation and thereby exceed preliminary contract amount.

In Kenya, the quantity of public road construction ventures is expanding every once in a while. Considering the rare assets of the nation, cost change is one of the serious issues in Kenya. Statistics from the Republic of Kenya report show that Road agencies have been experiencing cost fluctuation in Roads projects. For instance, in the construction of Thika Super Highway by Kenya National Highways Authority (KeNHA), the cost escalated from Kes.26.44 billion to Kes.34.45 billion (World Bank, 2014). In addition, the initial deadline of the Thika super highway project was July 2011, which was later revised to July 2013.

Cost changes have obvious effects for the key stakeholders in particular, and on the construction industry in general. To the client, cost fluctuation implies added costs over and above those initially agreed upon at the onset, resulting in less returns on investment. To the consultants, cost fluctuation implies inability to deliver value for money and could well tarnish their reputations and result in loss of confidence reposed in them by clients. To the contractor, it implies loss of profit. To the industry as a whole, cost fluctuation could bring about project abandonment and a drop in construction activities, bad reputation, and inability to secure project finance or securing it at higher costs due to added risks. All these consequences undermine the viability and sustainability of the construction industry (Markenson, 2016).

Statement of the Problem

One major worry to professionals in the construction industry is the wide gap between final account figures, the tender sum and the preliminary estimates earlier arrived at, at the pre-contract stage. This has caused a lot of anxiety to clients in going into infrastructural project development. Before a project is embarked upon, bills of quantities are prepared for which the agreed sum becomes the contract sum on which tenders are floated for tenderers to tender. The contract sum in the bill of quantities is expected not to be exceeded after the project but, interestingly, upon completion when the final account is prepared it is realized that there have been fluctuations; either the contract sum exceeds the final account or the final account exceeds the contract sum. Due to the issue of fluctuation, some researchers like (Pheng & Ming, 1997) have criticized the bills of quantities as lacking precision. However, Davis et al. (2004) claim that the bill of quantities still remains an unsurpassed model on which to obtain bids and is a useful tool for post-cost control activities.

The tradition in Kenya has been that project expenditure is monitored to the final stage after which the final accounts are prepared. If the contract sum exceeds the final accounts, then the general convention is that the remainder is given to the client and it becomes an advantage to the client or the financiers as well as the contractor's team and that of the consultant. This may imply that the contractor's outfit may have employed very stringent cost control systems to keep the construction cost within budget. The client would have also achieved value for the money committed into the project. Additionally, the consulting team would have gained the credibility of being able to supervise and manage a construction project within its initial

established budget. However, if the final account exceeds the contract sum, additional money will then be required and this becomes a disadvantage to the client, the project's consulting team and the contractor as well, causing a whole lot of disappointment on the part of the client. A great deal of prospective clients has had to shelve future infrastructural development schemes due to previous experiences where the initial budgets were exceeded when the construction phase of the projects came to an end as there was the sense of not having achieved value for money.

One other occurrence these days is the abandonment of most funded projects by the KeNHA. The major reason that is known to be responsible is the lack of funds to finance these projects to completion stage as estimates prepared, which formed the basis for initiating these projects. Such occurrences signify injudicious spending of the tax payer's money. Again, foreign donors may quit funding developmental projects and on the whole the country gains a bad economic rating and reputation. From the discussion above, the country is in no winning position; hence, this study sought to identify project cost management and performance of road construction projects at the Kenya National Highways Authority.

Research Objectives

i. To assess how project schedule influence performance of road construction projects at the Kenya National Highways Authority

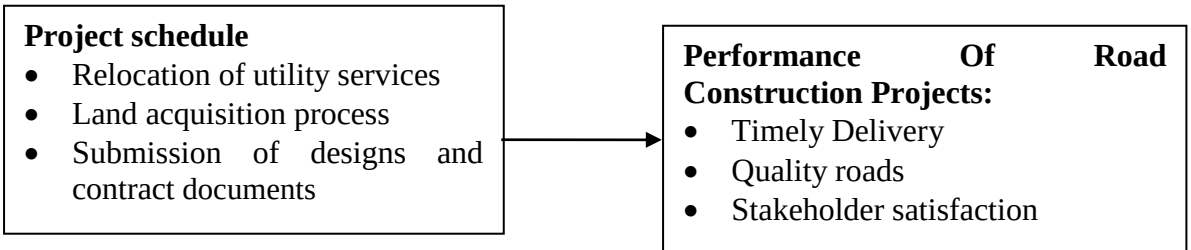
LITERATURE REVIEW

Theoretical Framework

Project Design and Schedule Theory

The theory of project design and schedule is concerned with how individuals and organizations allocate resources through time to recover from or avoid disasters (Arrow, 1965). The theory seeks to explain how solutions to the problems faced in allocating resources through time are facilitated by the existence of risks in the project environment (David, 2007). The concept of project schedule theory involves studying the various ways by which businesses and individuals can avoid, mitigate, transfer and accept risk during the project life cycle (Sarkis, 2011). Numerous theories have explained the role of project schedule in a project environment. The underlying theories under project schedule include financial theory, agency theory, contract theory, prospect theory and new institution economic theory. Tseng (2007) posit that project schedule theory focuses on how an organization or an individual can adopt a systematic and consistent approach to manage all kinds of risks. According to this theory, one component in project life cycle affects the next level therefore there is need to adopt multi-directional approach in project schedule. The theories considered include project schedule models developed within the body of the agency theory, stakeholder theory and new institutional economics (Klimczak, 2007).

Conceptual framework



Project Schedule

Construction project like roads and railway lines generally takes various stages. The primary stage is typically project commencement where the task is distinguished and a plausibility

study did to set up the reasonability and fabricate a business case. The subsequent stage is the undertaking arranging stage and in here the venture configuration is completed, assets and funds designated. Venture execution which is the third stage includes carrying out the plans inside the apportioned assets in the set term and to the set determination and quality (Mohammed, 2012). Inability to obviously understand the task, every one of its angles can prompt works being executed wrongly and the restorative strides to cure the mistakes will cause project delay and extra expense. The outcomes are really grave, going from prosecution to cases and questions, to inside and out surrender of the venture (Olatunji, 2010).

Hussin and Omran (2011) contend that, when an undertaking cost variety can at this point don't be consumed by the customer, the venture is deserted. It assists then with anticipating and recognizes issues in the beginning phases of the task life cycle. Arranging stage is consequently extremely key to accomplishment of development project. "Conveyance of materials on location will very influence project progress. Assuming the stockpile doesn't guarantee quality, materials are followed through on location, it will create setback for project culmination" (Wambugu, 2013). This is on the grounds that material not gathering determinations will doubtlessly be dismissed and the most common way of getting the right material will take more venture execution spending plan. At the point when materials are missing nearby it implies that the representatives won't have work to do. This is very dispiriting and will influence the venture conveyance contrarily.

Empirical Review

Land acquisition problem is more pronounced in transportation sector such as Highway-Roads and Railway projects. For example, for a new rail line project in India, land for the first phase of the project was to be acquired by October 2009. Notwithstanding, because of postponements in starting the land procurement process and between State debates, the land was re-booked to be obtained by January 2011. Additionally, one of the loftiest ventures in street area was postponed by around six years because of the land procurement issues. The undertaking which was begun in 2000 with booked fulfillment date of December 2004 got finished uniquely in January 2012 (Subramani, Sruthi and Kavitha, 2014).

Chilipunde, (2010) distinguishes workers for hire's inappropriate preparation as one of the reasons for project delay. In case a worker for hire neglects to concoct a useful work program at the underlying stages, this will influence project opportune finish. A comparative perception is made by Jagboro and Aibinu, (2002) in Nigeria. Similarly underscoring on the requirement for appropriate preparation of development project is Pakir et.al (2012) in a review did in Sudan. McMiniminee et. al., in (2009) observed that it was clear interests in arrangement ahead of time and venture improvement paid off. Mojahed, (2005) states that legitimate preparation in all stages and parts of development project are important to keep away from re work which thusly prompts delay in project culmination. Pakir et al., (2012) express that precise development arranging is a critical determinant in guaranteeing the conveyance of the task on time and inside spending plan.

In his expounding on the pretended by arranging in deciding the fate of the agricultural nations, Kaming et al., (2009) contend that, very much like it is hard to appropriately anticipate funds, work, dangers, checking and assessment, materials fortune and a lot more in the assembling business, the foundation execution area in creating states has been hit with a similar issue for long. The World Bank (2013) report shows that the condition of framework in Kenya is impeded by arranging as a significant component by which individuals engaged with creating plans do quality anticipating paper that thinks about the undertaking execution and assessment just however it is restricted as far as realization. This has surrendered to 60% of the Kenyan undertakings taking longer than arranged and causing extra expenses or others biting the dust coming.

RESEARCH METHODOLOGY

The study adopted a descriptive survey research design. The target population for this study was 200 staff from KeNHA and Construction and who have been involved in supervision of road construction projects completed between the years 2000 to 2020 within the three cities. The project sample size selection was based on the Yamane ‘s Formula (Yamane, 1967). A total of 134 senior Staff of the contraction companies, client representatives and the consultants were targeted where they gave their feedback on factors influencing performance of road construction projects within KeNHA. Purposive sampling was used since the research was confined to specific target sample space meaning known respondents provide information. Primary data was collected using structured questionnaires. Secondary data was collected through contract documents and progress reports from the identified projects. The drop and pick method were used to administer questionnaires so as to give respondents enough time to give well thought out responses.

Descriptive statistics such as frequencies, percentages, mean score, variance and standard deviation was computed for all the quantitative variables using Statistical Package for Social Sciences (SPSS Version 26.0). The qualitative data from the open-ended questions were analysed using conceptual content analysis and presented in prose.Inferential data analysis was done using regression and correlation analysis. The regression analysis was used to establish the relations between the independent and dependent variables.

DATA ANALYSIS AND DISCUSSION

Out of this sample size of 134 respondents, 107 questionnaires were filled and returned to the researcher. This represented a response rate of 79.9%. According to Mugenda and Mugenda (2003), a 50% response rate is adequate, 60% good and above 70% rated very good. This also concurs with Kothari (2004) assertion that a response rate of 50% is adequate, while a response rate greater than 70% is very good. Therefore, based on these assertions; the response rate of 79.9% for this study is satisfactory.

Project Schedule

The study findings show that project schedule influence performance of road construction projects since challenges associated with relocation of services, lengthy land acquisition process, prolonged abnormal weather conditions delay commencement and completion time for constructionprojects urban areas in Kenya as tabulated in table 1.

Table 1: Project schedule mean & standard deviation

Variable	N	Mean	Std. Dev.
Relocation of utilities (power, water, data services and sewer lines)	107	4.08	0.859
land acquisition process	107	4.57	0.601
Time lines between design and procurement phase	107	4.03	0.874
Supply of raw materials and equipment by contractors (mobilization)	107	3.85	1.062
Issuance of EIA and mining license by NEMA	107	4.21	0.810
Weather condition due to heavy rains and flooding,	107	4.03	1.022
Time lines for reparation of drawings and other Contract documents by the client	107	3.40	1.063
Political interference during project implementation	107	4.21	0.922
Availability of manpower, skilled, unskilled labour & experts for specialized work items	107	3.66	0.921
Approval of proposed subcontractors by the Engineer	107	3.65	1.125
Average	**107**	3.969	0.926

The findings indicated that majority of the respondents indicated that relocation of utility services, land acquisition process, and weather conditions during project implementation and timelines for preparation of drawings and other contract documents were the key schedule indicators influencing performance of road construction projects. All the listed projects schedule indicators were found to be have influence on performance of road construction projects in KeNHA, however, delays attributed to lengthy land acquisition process and Incremental weather condition during project implementation were found to have significant effect on project schedule hence influencing performance of road construction projects.

Delays due to utility relocation are very significant, often observed to be in the range of 6-12months according to the study. The critical factors causing these delays are slow response from utility agencies, difficulty in identification of the nature and location of underground utilities often due to lack of information, as well as conflict between agencies. The study noted the process of acquiring land for road construction was a lengthy and tedious process that involved many legal and social procedures and complex financial settlements for the project affected people which ultimately affect road construction cost if not adequately dealt with during planning. Abnormal weather conditions such us too much rainfall outside the documented rainy seasons and flash floods greatly slowed down the progress of work since certain work items such as Earthworks, laying of bituminous mixes and concrete works can only be done during dry season. Adverse weather conditions entitle a contractor to extension of time beyond the contract provisions resulting to extra cost on the road construction projects. The study also found that manpower shortage skilled, unskilled labour & experts for specialized work items, delay in supply of raw materials and equipment by contractors (mobilization) result in change in performance of road construction projects in Kenya.

The findings are in line with Findings from a study done by Kogi (2013) reported that delay and cost overrun of public sector construction projects occur entirely in the early stages of the project i.e., during the planning stages of project development. The project owners may be responsible for the delays, suspensions or interruptions to all or part of the work are caused by an act or failure to act by the owner resulting from breaches of owner‘s obligations, stated or implied. These include failure of the owner or his representative (consultants) to furnish the contractor with relevant information, details, etc., for which the contractor has specifically requested in writing. In addition, he said that the project owners were responsible for delays in issuing approvals, signing contracts and allowing site access. These findings also concur with Jeykanthan and Jawardena (2012) that Inadequate feasibility studies, Errors and omissions in detail designs, improperly harmonized procurement documents, Shortcomings in contract document, Stakeholder identification and management issues, Variation and scope changes, Land acquisition and resettlement, Extreme weather, Shortage of construction materials were major factors influencing performance of road construction projects.

Pathiranage and Halwatura (2010) also found that financial problems of the owner as well as the contractor, Poor site management by the contractor, Poor weather condition, Contract modification, Incomplete document/slowness in making decision, Shortage of site labour and material, Lack of sub contractor’s skill/ poor skills, Construction mistakes and defective works, Poor site condition were main causes of changes in cost of infrastructure projects. Chilipunde, (2010) noted that contractors’ improper planning is one of the major causes of project delay. Failure by the contractor to come up with a workable work program at the initial stages of the project affect project timely completion leading changes in project cost.

Performance of road construction projects

The study sought to establish the factors that determine cost of roads construction projects in Kenya and the findings are shown in the table below.

Table 2: Performance of road construction projects mean & standard deviation

Variable	N	Mean	Std. Dev.
Project delivery timelines	107	4.01	.986
Availability of quality construction materials	107	3.81	.859
Stakeholder satisfaction	107	3.99	1.005
Land tenure	107	4.29	.880
Average	**107**	**4.025**	**0.9325**

Majority of respondents agreed that land tenure, project timelines, stakeholder satisfaction and availability of quality construction materials influence performance of road construction projects in urban areas,

Regression Analysis

The study sought to finds out the relationship between the independent variables and the dependent variables

Multiple regression analysis

Multiple regress analysis was applied to investigate the combined effect of all the independent variables on performance of road construction projects in KeNHA.

Table 3: Multiple regression model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.811[a]	.658	.641	.527

a. *Predictors: (Constant), contract management, project schedule, Project design, financial control systems,*

Table 3 gives values of R, R^2, adjusted R^2 and its standard error of estimate, showing how a regression model fits into the data. The value of R^2 is 0.658, an indication that all the five independent variables notably; (X1) Contract management; (X2) Project scheduling; (X3) Project design; and (X4) Financial control systems account for 65.8% of Y= performance of road construction projects. This meant that 34.2% of performance of road construction projects in KeNHA was influenced by other factors not covered in this study.

Table 4: Multiple regression One Way ANOVA

ANOVA[a]

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	53.977	5	10.795	38.883	.000[b]
Residual	28.042	101	.278		
Total	82.019	106			

a. Dependent Variable: Performance of road construction projects
b. Predictors: (Constant), contract management, project schedule, Project design, financial control systems,

From ANOVA table 4, the value of F is 38.883 and the *p* value is .000 which is <.05 meaning that collectively; contract management, project schedule, Project design, financial control systems and government policies had significant influence on performance of road construction projects in KeNHA. Subsequently, we reject the hypothesis that there are no the combined independent variables have no significant influence on performance of road construction projects at the Kenya National Highways Authority

Table 5: Multiple regression coefficient of determinant

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.268	.305		.879	.382
Project schedule	.548	.070	.574	7.791	.000

a. Dependent Variable- performance of road construction projects

From the regression results in table 5, project scheduling has the highest contribution to performance of road construction projects (β=0.574). The significance, *p* value for project scheduling is .000, meaning that project scheduling had a significant effect on performance of road construction projects. This is confirmed by the *t* value being 7.791 which is greater than the critical value of +2.

Substituting the standardized β coefficients for three variables to the above equation yields

$Y = 0.268 + 0.574X_2 +$ which was interpreted as:

Performance of road construction projects in KeNHA = 0.268 + 0.574 Project scheduling

The findings also displayed that putting all other variables constant, a unit increase in project schedule led to a 0.574 change in performance of road construction projects in KeNHA.

Conclusions

The study concluded that project schedule influence performance of road construction projects in KeNHA significantly. The study also established that project schedule influence performance of road construction projects in KeNHA due to delayed relocation of utility services by the service providers, lengthy land acquisition process, late preparation of drawings and other Contract documents by the client, delay in approval of proposed subcontractors by the Engineer.

The study noted delays between design and implementation phase implied by the time the project is implemented so many variations in terms of prevailing market prices, ground conditions and traffic demands would have occurred leading to extra cost requirements for the project. Incremental weather due to heavy rains and flooding slowed down progress of activities falling on the critical path, ultimately affecting the project completion timelines. Political interference during project implementation such as labour issues, mining rights and route locations also delayed road construction projects leading to changes in cost.

Recommendations

Project managers should source qualified local contractors; award road construction tenders to construction companies with project managers with professional project management skills and look at the capacity of contractors in terms of construction equipment's. Local contractors should also acquire qualified project implementation staff that are capable of executing complex infrastructure projects. Government should enact and enforce effective government policies that help in promotion of construction sector in the country. The road regulatory bodies should enforce policies on road construction and prosecute contractors who fail to complete projects in time. The government should speed up statutory approvals and lengthy licensing procedures for road construction companies should be reduced.

Recommendations for Further Research

Similar study should also be undertaken for road construction projects financed, constructed and supervised by the financier, a case study of Ngong road phase I & III under Japanese Government and the JKIA Westlands by pass. The research recommends that a study be done in the construction industry/sector so as to find out the different strategies adopted by construction companies and Government agencies on implementing infrastructure projects within the budget and set timelines.

REFERENCES

Adam, A., Josephson, P. E. B., & Lindahl, G. (2017). Aggregation of factors causing cost fluctuation and time delays in large public construction projects: trends and implications. *Engineering, construction and architectural management*, *24*(3), 393-406.

Adam, A., Josephson, P. E., & Lindahl, G. (2015). Implications of cost fluctuation and time delays on major public construction projects. In *Proceedings of the 19th International Symposium on Advancement of Construction Management and Real Estate* (pp. 747-758). Springer, Berlin, Heidelberg.

Agyeman, S., Asare, E. K., & Ankomah, E. N. (2016). The effects of Design Information on reliability of progress and cost estimates of construction projects: The case of two Civil Engineering projects. *American Journal of Civil Engineering*, *4*(6), 326-336.

Ahiaga-Dagbui, D. D., & Smith, S. D. (2014). Rethinking construction cost fluctuation: cognition, learning and estimation. *Journal of Financial Management of Property and Construction*, *19*(1), 38-54.

Aliakbarlou, S., Wilkinson, S., Costello, S. B., & Jang, H. (2017). Achieving post disaster reconstruction success based on satisfactory delivery of client values within contractors' services. *Journal of Management in Engineering*, *34*(2), 04017058.

Aljohani, A., Ahiaga-Dagbui, D., & Moore, D. (2017). Construction Projects Cost fluctuation: What Does the Literature Tell Us? *International Journal of Innovation, Management and Technology*, *8*(2), 137.

Arditi, D., Nayak, S., & Damci, A. (2017). Effect of organizational culture on delay in construction. *International Journal of Project Management*, *35*(2), 136-147.

Bert, W. & Tukel, O.I. (2012). A new framework for determining critical success/failure factors in projects. International Journal of Project Management 14(3), pp. 141-151.

Boru, A. (2016). Determinants of Cost fluctuation in Kenya's Public Sector Construction Projects: A Case of Meru County, Kenya. *International Journal of Business and Social Sciences*, *3*(4), 25-33.

Cantarelli, C. C., Flybjerg, B., Molin, E. J., & Van Wee, B. (2013). Cost fluctuation in large-scale transportation infrastructure projects: Explanations and their theoretical embeddedness. *arXiv preprint arXiv:1307.2176*.

Cardoso, P., Dominguez, C., & Paiva, A. (2015). Hints to improve motivation in construction companies. *Procedia Computer Science*, *64*, 1200-1207.

Cheng, Y. M. (2014). An exploration into cost-influencing factors on construction projects. *International Journal of Project Management*, *32*(5), 850-860.

Choge, J. K., & Muturi, W. M. (2014). Factors affecting adherence to cost estimates: A survey of construction projects of Kenya National Highways Authority. *International Journal of Social Sciences and Entrepreneurship*, *1*(11), 689-705.

Creswell, J. W. & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Dwork, C., Feldman, V., Hardt, M., Pitassi, T., Reingold, O., & Roth, A. L. (2015, June). Preserving statistical validity in adaptive data analysis. In *Proceedings of the forty-seventh annual ACM symposium on Theory of computing* (pp. 117-126). ACM

Gardezi, S. S. S., Manarvi, I. A., & Gardezi, S. J. S. (2014). Time extension factors in construction industry of Pakistan. *Procedia Engineering*, *77*, 196-204.

Gituro, W., & Mwawasi, S. (2017). Time and Cost Fluctuation in Road Construction Projects in Kenya Under Kenya National Highways Authority. *ORSEA JOURNAL*, *6*(1).

Gorard, S. (2013). *Research design: Creating robust approaches for the social sciences*. Sage.

Grathwohl, M. (2018). *World Energy Supply: Resources-Technologies-Perspectives*. Walter de Gruyter GmbH & Co KG.

Hair Jr, Joseph F., and Bryan Lukas. *Marketing research*. Vol. 2. McGraw-Hill Education Australia, 2014.

Hammalund, B.-G. & Lim, E.S.J. (2012). Critical Success Factors for Key Project Players and Objectives: Case Study of Singapore. Journal of Construction Engineering and Management 1(1), pp. 446-446.

Ismail, I. (2014). *Risk assessment of time and cost fluctuation factors throughout construction project lifecycle* (Doctoral dissertation, University Tun Hussein Onn Malaysia).

Jomo, K. S. (2016). *Growth and structural change in the Malaysian economy*. Springer.

Kerzner, H. (2015). *Project management 2.0: leveraging tools, distributed collaboration, and metrics for project success*. John Wiley & Sons.

Kerzner, H., & Kerzner, H. R. (2017). *Project management: a systems approach to planning, scheduling, and controlling*. John Wiley & Sons.

Kithinji, E. (2016). The Importance of Standard Gauge Railway (SGR) Project.

Kwatsima, S. A. (2017). *An Investigation into the Causes of Delay in Large Construction Projects in Kenya* (Doctoral dissertation, COETEC, JKUAT).

Larsen, J. K., Shen, G. Q., Lindhard, S. M., & Brunoe, T. D. (2015). Factors affecting schedule delay, cost fluctuation, and quality level in public construction projects. *Journal of Management in Engineering*, *32*(1), 04015032.

Lewis, S. (2015). Qualitative inquiry and research design: Choosing among five approaches. *Health promotion practice*, 16(4), 473-475.

Love, P. E., Smith, J., Simpson, I., Regan, M., & Olatunji, O. (2015). Understanding the landscape of fluctuation in transport infrastructure projects. *Environment and Planning B: Planning and Design*, *42*(3), 490-509.

Marzouk, M. M., & El-Rasas, T. I. (2014). Analyzing delay causes in Egyptian construction projects. *Journal of advanced research*, *5*(1), 49-55.

Mbaluku, W., & Bwisa, R. (2013). The significant factors causing delay of building construction projects in Malaysia. Engineering, Construction and Architectural Management, 14(2), 192-206

Memon, A. H., Rahman, I. A., Abdullah, M. R., & Azis, A. (2014). Factors affecting construction cost performance in project management projects: Case of MARA large projects. *International Journal of Civil Engineering and Built Environment*, *1*(1).

Meyers, L. S., Gamst, G., & Guarino, A. J. (2016). *Applied multivariate research: Design and interpretation*. Sage publications.

Murimi, M. J. (2016). *Influence of leadership styles on timely completion of road construction projects in Kenya: a case of Norken ltd, Nairobi, Kenya* (Doctoral dissertation, Master's Thesis). University of Nairobi, Nairobi, Kenya).

Mwawasi, S. W. (2015). Time And Cost Fluctuation in Road Construction Projects in Kenya Under Kenya National Highways Authority.

Ndunge D. Kyalo; Nyonje Raphael; Itegi Muthoni (2011), Project Planning and Management - Project Planning, Design and Implementation: Notes for Beginners; VDM Verlag Dr. Muller No. ISBN-13: 978-3-639-33782-2

Nyandika, O. F., & Ngugi, K. (2014). Influence of Stakeholders' Participation on Performance of Road Projects at Kenya National Highways Authority. *European Journal of Business Management*, *1*(11), 384-404.

Odeck, J. (2014). Cost fluctuation in road construction—what are their sizes and determinants? *Transport policy*, *11*(1), 43-53.

Ogutu, S. O. (2017). *Extent of adoption of best human resource management practices in private secondary schools in Kisumu East Sub-County, Kenya* (Doctoral dissertation, School of Business, University of Nairobi).

Rahman, K.-W. (2013). The Critical Success Factors for Project in Dynamic Environments.

Ramanathan, C. (2012) Construction delays causing risks on time and cost. Australian Journal of construction Economics and Building.

Shah, R. K. (2016). An Exploration of Causes for Cost fluctuation In Construction Projects: Case Study of Australia, Malaysia & Ghana. *Journal of Advanced College of Engineering and Management*, *2*, 41-55.

Shehu, Z., Endut, I. R., & Akintoye, A. (2014). Factors contributing to project time and hence cost fluctuation in the Malaysian construction industry. *Journal of Financial Management of Property and Construction*, *19*(1), 55-75.

Song, S., Coit, D. W., Feng, Q. & Peng, H. (2014). Reliability analysis for multi-component systems subject to multiple dependent competing failure processes. *IEEE Transactions on Reliability*, 63(1), 331-345

Sovacool, B. K., Nugent, D., & Gilbert, A. (2014). Construction cost fluctuation and electricity infrastructure: an unavoidable risk? *The Electricity Journal*, *27*(4), 112-120.

Subramani, T., Sruthi, P. S., & Kavitha, M. (2014). Causes of cost fluctuation in construction. *IOSR Journal of Engineering*, *4*(6), 1-7.

Subramani, T., Sruthi, P. S., & Kavitha, M. (2014). Causes of cost fluctuation in construction. *IOSR Journal of Engineering*, *4*(6), 1-7.

Tawil, N. (2013). Factors contributing to delay in construction projects in Higher Learning Education. Research Journal of Applied Sciences, Engineering and Technology.

University of Warwick

Vhumbunu, C. H. (2016). Enabling African Regional Infrastructure Renaissance through the China-Africa Partnership: A Trans-Continental Appraisal. *International Journal of China Studies*, *7*(3), 271.

Wang, K. T. (2015). *Research design in counseling*. Nelson Education.

Wanjiku, S. M. (2015). Monitoring and Evaluation: Factors Influencing the Performance of Road Infrastructural Projects: A Case Study of Nyandarua County, Kenya.

Williams, T. P., & Gong, J. (2014). Predicting construction cost fluctuation using text mining, numerical data and ensemble classifiers. *Automation in Construction*, *43*, 23-29.