

FACTORS AFFECTING ADHERENCE TO COST ESTIMATES: A SURVEY OF CONSTRUCTION PROJECTS OF KENYA NATIONAL HIGHWAYS AUTHORITY**Choge James Kipruto**

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ABSTRACT

In the construction industry worldwide, failure to adhere to cost estimates is prevalent especially during the implementation of the construction projects. Although there have been improvements in the management of construction projects over the years, the problem of cost escalation is still a critical issue in the construction industry. Adherence to cost estimates is a phenomenon that if given attention can play a key role in reducing the occurrence of cost escalation. However, past research has established that adherence to cost estimates has never been honoured in most construction projects especially in road infrastructures, hence leading to a negative impact on the cost estimates of the relevant projects. The study sought to objectively solve the problem of non-adherence to cost estimates in construction projects undertaken by Kenya National Highways Authority on behalf of the Kenyan government and suggest how such occurrences can be reduced through the employment of identified factors that determine the success. The objective of the study was to examine the factors that affect adherence to cost estimates in the implementation of construction projects by Kenya National Highways Authority. By considering these factors and the implementing the recommendations raised by this study, the stakeholders will be enabled to stick to the pre-determined cost estimates thus easing the burden that could have been placed on the taxpayers. This research carried out a literature review which helped in establishing factors affecting adherence to cost estimates in construction projects. The methodology used was a census survey of the employees, top management, consultants, and contractors who were actively working for and on behalf of the Kenya National Highways Authority. The study revealed that there was a significant relationship between design variations and adherence to cost estimates in construction projects in Kenya. The significant aspects identified for this factor were ground conditions, unrealistic initial requirements and specifications and by extension planning. The study also found that there is a substantial relationship between contractors' experience and adherence to cost estimates in the construction industry in Kenya. Even though a good number of the respondents attested that the contractor

was well versed with construction projects, poor distribution of labour and poor site management were found to be of grave concern. Important aspects of adequate technical and managerial skills were found to be worthy. Communication skills were found to be another crucial recipe for adherence to cost estimates. Lastly the study found that most construction organisations rarely consider such principles which should include employment of highly qualified contractor, thorough survey and initial assessment of the project site, definition of specification and requirements of the project. All these are rarely considered. The authorities must therefore have in place a cost management plan, cost performance baseline and do all that appertains design variations and contractors experience to help in adherence to the cost estimates.

Key Words: *Design Variations, Experience, Construction, Cost Estimates, Contractor, Project Theory*

Introduction

Cost is one of the primary measures of a project's success. This is true, especially for Construction projects in developing countries, because public construction projects in these countries are executed with scarce financial resources. Construction has become an important player in the economy of many countries, especially developed countries (Takim, 2005). As mentioned by Olawale, this industry contributes to the GDP and employment rate of many nations and for this reason it is considered vital for the economic development of any nation (Olawale, 2010). Generally, a project is considered successful if the project is completed within a stated cost or budget. The role the construction industry plays in socio-economic development is significant. It provides the basis upon which other sectors can grow by constructing the physical facilities required for the production and distribution of goods and services. The construction industry has a significant multiplier effect on the economy as a whole (Morris, 2006).

In Kenya like other countries construction industry is one of major industry contributing significantly to the socio-economic development growth. Achieving project completion on time, within budget, at specified quality standards, and most importantly without unprecedented cost escalations is major criterion of success of project. Although the government of Kenya sets aside huge sums of money to be spent in construction sector, the industry is facing a lot of challenges such as the expenditure exceeding the budget, delay to complete the project in time, the building defects and over-reliance on foreign workers. Most construction projects especially road infrastructure in Kenya are exposed to extreme cost escalation menace to the extent that it calls not only for extra funding but also specialized expertise hence leading to technical and project managerial conflicts between project's parties. Adherence to cost estimates has been a major challenge and considered to be the biggest problem which hinders project's progress since it decreases the contractors' profit margin hence leading to huge losses leaving the project in a big trouble.

Project Management Body of Knowledge guide (PMBOK) defines cost estimates as a developed approximation of the monetary resources needed to complete project activities. Estimating is the primary function of the construction industry; the accuracy of cost estimates starting from early phase of a project through the tender estimate can affect the success or failure of a construction project. Many failures of construction projects are as a result of cost escalations (Gkritza & Labi, 2008). A study conducted in energy sector on cost overruns in Kenya, problems associated with pioneer power projects and process plants revealed that seventy four percent of cost escalations was caused by poor coordination of projects activities and lack of change management control thus affecting adherence to cost estimates (Kagiri & Wainaina, 2009). The increasing complexity of infrastructure and the environment within which projects are constructed places greater demand on construction managers to deliver projects on time, within the planned budget and with high quality (Enshasi et al, 2009).

Thus, efficient and effective cost management through appropriate use of relevant tools and techniques in asset acquisition is critical. Customers and end users are demanding for better quality product through efficient and timely deliveries at low price and free of cost escalations. It is therefore important, that cost, time, and quality of deliverables are efficiently managed in the entire project life cycle for effective service and product delivery. Non-adherence to project cost estimates can raise the capital-output ratio in the construction sector and elsewhere bringing down the efficacy of investments (Morris, 2008). In a nutshell, adherence to cost estimates is considered the most important element of successful projects, which help to decrease problems for all parties and give new chances to construct other related projects. It also helps to increase the profit margins and development growth of construction sectors in Kenya.

Statement of the Problem

Adherence to cost estimates is considered the most important factor of successful projects, which help to decrease problems for all parties and give new chances to construct other related projects. It also helps to increase the profits and development of construction sectors in Kenya. Adherence to cost estimates in the construction sector is a major challenge and considered to be the biggest setback that hinders project's progress because it decreases the contractor profit leading to huge losses as well as placing the burden to taxpayers. Non-adherence to cost estimates is nearly noticed in every construction project implemented by KeNHA indicating that this problem doesn't receive enough attention from the researchers and the stakeholders. The construction projects are exposed to extreme cost escalations and as a result, little or no efforts have been made to curtail or solve the problem.

Construction as an important sector in Kenya is characterized by chronic non-adherence to cost estimates which portends dire consequences inflicted to the taxpayers and the sponsors of the project. Whenever this menace is experienced, the project management team normally asks not only for extra funding but also for other resources which deepens the cost crisis. While the sponsor or donor may be willing to offer the requested additional funding, the impact is very

detrimental to both the taxpayer and the financial base of the financiers. In this case therefore, it is enough to conclude that adherence to cost estimates have been consigned to a situation of dependency with no regard to factor analysis in sight.

Prevalence of non-adherence to cost estimates cannot be allowed to continue as it brings about the stakeholders' based-conflicts which adversely affect the success of the project and service delivery. KeNHA and its partners needs the understanding of the driving forces behind adherence to cost estimates which is a necessity if the performance and ultimate objectives of the construction industry are to be realized. KeNHA needs a lean and flawless project cost management practices and projects that are not only efficient and effective but also accurate. If KeNHA continues to overlook the main factors affecting adherence to cost estimates, they are not only going to subject the GOK and the sponsor to huge losses but also waste of time and creation of mistrust between the project parties, which jeopardizes the overall efficiency, earned value potential, and the objectives which in turn inhibits the achievement of the goals of project. Also undue mistrust and suffering of time creep could lead to sponsors or donors to stop funding and may consider other countries with clear and more advanced expertise with distinguished project management skills and time/ cost frameworks for megaprojects.

Although there have been improvements in the management of construction projects over the years, the problem of cost escalation is still a critical issue in the construction industry. If these factors are not considered, it is likely to exacerbate underlying success factors of the project. For that reason therefore, it was of paramount importance to imperatively exert utmost effort to accomplish this study in order to determine and examine the hypothesized variables and to treat all the weakness points and from all sides, thus giving specific priorities in order to avoid non-adherence to cost estimates in construction projects in Kenya.

Research Objective

The general objective of the study was to examine the factors that affect adherence to cost estimates in the implementation of construction projects by Kenya National Highways Authority.

Specific Objectives

1. To establish how contractor experience affects adherence to cost estimates; to examine how design variations affects adherence to cost estimates.
2. To ascertain how availability of construction materials and plant affect the adherence to cost estimates in construction projects.

Literature Framework

Theoretical Framework

This section provides overview of the three theories that are relevant to this particular study. The first is the Theory of Constraints which opines that an organization facing challenges in cost management, poor performance and chronic conflicts is as a result of poor management practices and lack of necessary intervention. Eliyahu developed the theory of constraints in the early 1980s to help organizations decide what to change, identify a desirable new condition and how to trigger the change. He recommended first identifying the main factors affecting budget estimates in an organisation. He then suggested that the managers figure out how to handle the constraints or barrier to success within prescribed budget. By focusing on fixing the main problem, overall performance could be improved (Eliyahu, 2004). Additionally, Baloi & Price observed that most organizations fail to examine their operations as a whole when developing cost estimates (Baloi & Price, 2003). By focusing only on short-term goals, long-term success becomes jeopardized so he suggested establishing a long-term view. According to this theory, all systems operate in an environment of cause and effect. One event causes another to happen thus prompting for factors analysis as a measure. Adherence to cost estimates is either a constraint or has the potential to become a constraint. This cause-and- effect relationship can be very complex, especially in complex systems such as those of construction projects. Capturing the essence of cause and effect within the system and identifying factors that emulate these relationships are the keys to system performance and excellent adherence to cost estimates.

The second theory is the Complexity Theory. A prominent author in the field of complexity is Terry Williams who shares the view of other scholars on complexity but extends it by one additional dimension of cost estimates. In addition to the two components of complexity, vis-à-vis the number of factors and the interdependency of these factors, he introduces the third factor which is uncertainty. Since uncertainty adds to the complexity of a project, cost estimates therefore can be viewed as a constituent dimension of project complexity that can be as a result of various factors (Williams, 2008). Projects occasionally demand for more additional funds as there is an increasing desire to reduce time to market thus affecting the cost estimates of the project (Williams, 2008). Kahane on the other hand puts a lot of emphasis on talking and listening to each other when solving tough problems when developing estimate costs. His approach to complexity is deeply rooted in a social environment. He distinguishes complexity in three ways. These are; Dynamic Complexity which means that the cause and effect are far apart and it is hard to grasp from firsthand experience. They usually unfold in unpredictable and unfamiliar ways emanating especially from cost related issues such as design variations (Kahane, 2004).

Knowledge-based Theory of Project Management states that there is no explicit theory of project management and as a result there is a general theory to underpin the discipline and is found in theories of management, planning, control and projects (Koskela & Howell, 2002). There is

'embryonic' theory contained in literature, particularly his books (Turner, 2006). In response, it is noted that explicit theory is lacking (Sauer & Reich, 2007). Knowledge-based project management is the systematic and optimal arrangement and coordination of knowledge and knowledge configurations over a period of time to achieve specific objectives within certain constraints. This includes but not limited to include but not limited to project cost management, project risk management, and project integration management (Onions, 2007).

Design Variations

Variation orders are common in all types of construction projects (O'Brien, 2005, Ibbs et al, 2005). Design Variations in construction projects can cause substantial adjustment to the contract duration and construction cost (Ibbs et al, 2005). Variations can be deleterious in any project and can subjectively lead to overruns, if not considered collectively by all project participants (Ibbs et al, 2005). The most common effect of change orders, during the construction phase, is the increase in project cost (Construction Industry Institute, 2008). Change orders have been found to be a major factor affecting adherence to cost estimates (Jahren & Ashe, 2009). Changes and variations are inevitable in any construction project (Ibbs et al, 2005). In an ideal world, changes will be confined to the planning stages. However, late changes often occur during construction, and frequently cause serious disruption to the project. Project variations were identified as a major source of conflicts and disputes in the construction industries of many countries (Kog & Loh, 2012). The need to make changes in a construction project is a matter of practical reality. Even the most thoughtfully planned project may necessitate changes due to various factors (O'Brien, 2005). Needs of the owner may change in the course of design or construction, market conditions may impose changes to the project, and technological developments may alter the design and the choice of the engineer. Furthermore, errors, additions and omissions during construction may force a change. Variations can be originated from numerous factors pertinent to the construction projects. Causes of change orders include the following; Additions and/or enhancement required by owners, accident or damage, force Majeure, unforeseen conditions, change in Plans and/or specifications, value engineering, and acceleration (O'Brien, 2005).

Variations in designs and contract documents usually lead to a change in contract price or contract schedule. Typically, change orders and variations present problems to all parties involved in the construction process. Usually, these design changes require additional time and cost inputs which ultimately overruns. The impact of change orders or variations varies from one project to another. However, it is generally accepted that change orders or variations can affect construction projects with unpalatable consequences in time and cost (Ibbs et al, 2005). Change orders that are imposed when construction is underway, usually lead to reworks, overruns and delays in project completion (Construction Industry Institute, 2009). Rework and demolition are potential effects of changes in construction, depending on the timing of the occurrence of the changes can ultimately lead to overruns. Researches in construction projects in some developing countries indicate that by the time a construction project is completed change orders or variations

result in an 8.3 % cost overrun (Al-Momani, 2006). Change orders typically average between 2-5 % of construction costs, but can easily soar to more than 10 % depending up on the degree of changes (Olawale & Sun, 2010).

If at any time contractor believes that acts or omissions of customer or owner constitute a change to the work not covered by a change notice, contractor shall within a specific period of time of discovery of such act or omission, submit a written change notice request, explaining in detail the basis for the request. Owner can either issue a change notice or deny the request in writing. If any change under any circumstance causes directly or indirectly an increase or decrease in the cost, or the time required for the performance of any part of the work, whether or not changed by any order, an equitable adjustment shall be made and the contract will be modified accordingly (Morris, 2008).

The agreement may recognize that changes in the work or changes in the method or manner of performance may require changes in the schedule and schedule milestones and this could further necessitate revisions in activity durations, sequence of work items, or interrelationships of various tasks. These changes may have a direct impact on the schedule, as where a change in method requires a greater or lesser period of performance or its effects may be subtler, as where the change merely rearranges priorities thereby protracting the effects of costs. In addition to a time extension, the contract's agreement may by extension provide compensation for any delay resulting from a contract change by allowing an equitable adjustment for the increased cost of the performance of the work caused by the change and so lead to unprecedented increased costs (Morris, 2008).

In any developing country, going with fast swelling of construction industry, it should take more significant care of design-related problems. These are not only found in Kenya but elsewhere in the world. Design factor is constituted by three variables, mistakes in design, design changes and additional works. Mistakes in design or poor design come from low-competence of designer have frequently existed. Inspection and approval of design or drawing process has been poor, especially with Government-funded projects. Design consultancy organizations have been mushrooming from 2000 but the quantity does not mean the quality. Unrealistic designs lead to changes or owners unclearly specify the scope of project results in projects delayed or postponed. These have reduced project's profits or have caused extravagance. (Le-Hoai, Lee, 2008) have suggested that comprehensive planning, risk assessment is important at the outset of project. (Chan et al, 2007) have proposed that design offices should establish a system to control and evaluate variations and an effective contingency plan to deal with unexpected situations. State management of design hasn't been stringent. Applying ISO standard to design works might be a good solution however strict and close management from appropriate authorities or owners is always the best. The more the skilled designer has been identified at the tender stage, the less the cost have to be paid for design-related headache arising later (Chan et al, 2007).

Contractors' Experience

Contractors' experience is a variable that affect adherence to cost estimates. This was rated as one of the highest benefactor that is experienced across the world. Contractors are selected on the basis of price, experience in undertaking particular types of construction project and their reputation or track record in producing high quality work within budget and on time. In most cases there is a trade-off between price, experience and track record but the desire to accept the lowest tender does not always lead to a project that is completed within time and budget. In contracts where the Engineer's estimate is at least 15% greater than the contractor's bid amount there is a strong likelihood of cost escalations (Kog & Loh, 2012). Therefore, these projects need to be carefully tracked and documented. There are cases where the prime contractor and sub-contractors go into bankruptcy during the construction period. This can lead to significant delays and extra costs arising as the project owner has to re-tender the remaining work to be undertaken by another contractor.

The inherent contractors experience during preparation, planning, authorization and evaluation procedures for large infrastructure projects creates obstacles to the implementation of such projects (Commission of the European Union, 2008). There is a fear that obstacles in the planning and implementation phases translate into cost escalation, if they do not block projects altogether (Ardity et al, 2009).

In conclusion, the dependence of cost escalation on the contractors' experience is firmly established for construction projects. There is good reason to be concerned about experience in the event of planning and implementation of such projects. The contractors' ability may, quite simply, be extremely expensive (Hough, 2007). Consequently, before a project owner decides to go ahead and build a project, every effort should be made to conduct preparation, planning, authorization and *ex ante* evaluation in a manner where such problems are negotiated and eliminated that may otherwise resurface as delays during implementation and this is usually achieved through a competent contractor (Flyvbjerg et al, 2008a). Similarly, after the decision to build a project, it is of crucial importance that the project organization and project management are meticulously set up and operated in ways that minimize the risk of cost estimates. If the contractor responsible for a project fail to take such precautions aimed at proactively minimizing the effects and long implementation phases, the evidence indicate that the financiers, be they taxpayers or private investors, are likely to be severely penalized as a result of unprecedented cost escalations of a high magnitude that could threaten project viability (Chan & Kumararswamy, 2007).

Research Methodology

The research employed both primary and secondary data. The primary data collection was through a self-administered survey questionnaire. The research design for this study was descriptive in nature as it involved the accurate description of the features of the population for

the study in relation to the variables of the study. Descriptive research design was employed because the organisation under study was found to be following common practices in its daily operations. It therefore presents an opportunity to fuse both quantitative and qualitative data as a means to construct the “what is” of the objectives of the study. Moreover, exploratory research was also done on related areas of the literature in order to get an intuition of the variables under study. The questionnaires were both hand-delivered and sent to the respondents through email correspondents. The secondary data comprised of information in the form of contract documents, claims documents, monthly, annual and project completion reports, and expenditure. The data and information were recorded on continuous basis and collated at defined periods for monitoring, control, and reporting.

Thereafter, principal component factor analysis was employed to summarize the responses. On the same note, the mean score method was adopted to establish the relative impact of the hypothesized variables. Likert’s scale of five ordinal measures of agreement towards each statement (E.S. = Extremely Significant (5); V.S. = Very Significant (4); M.S. = Moderately Significant (3); S.S. = Slightly Significant (2); N.S. = Not Significant (1) was entered and computed. Statistical Package for Social Science (SPSS) was used to calculate the mean score for each factor in view to determine the relative ranking. Karl Pearson correlation analysis (Chi-Square test) was used to describe the relationship between the independent and dependent variables and to determine whether there was enough evidence to infer that the relationship of the variables in question was significant. Cross tabulation and the chi-squared test was done at 0.05 level of significance to determine whether there was enough evidence to conclude that the hypothesized independent variables and the dependent variable were related (Doloi, 2011).

Research Findings and Discussion

Design Variations

It is sometimes possible that difficult site conditions are overlooked by the initial review or conditions have changed due to adverse weather conditions or changes in sub-soil conditions. Unexpected sub surface conditions can, at times, require fundamental redesign of projects at great expense. The study established that changes in surface ground conditions leads to problems for moving machinery and supplies around the site, and in undertaking excavations and laying foundations. Other aspects of design variations that affect adherence to cost estimates to higher magnitude are construction planning and accidental damage. These in essence led to increased costs and added to the construction time required. However the aspect of acceleration on design variations was found to affect adherence to cost estimates to a low extent.

Communication between project stakeholders has been cited as the most effective tool in identifying, assessing, and mitigating risks. The study found that 79% of the respondents alluded that meetings are normally held to deliberate on design variation issues. Since the meetings was preferred as a means of developing solutions associated with design variations, 78% of the

respondents attested that such meetings are held weekly to assess the progress of the project. The study further found that the aspects of design variations that affect adherence to cost estimates to the largest extent are unexpected ground conditions, unrealistic requirements and specification, inadequate planning, and poor design. However the accidental damage during the execution of the project was found to affect adherence to cost estimates to a low extent.

Cross-tabulation was done to ascertain the relationship between design variations and adherence to cost estimates. The critical value of at $\alpha=0.05$ was 3.841. The calculated Chi-Squared value was 24.496 which translated to a p-value of 0.00000074. This means that the relationship between design variations and adherence to cost estimates is highly significant because the p-value of 0.00000074 was less than 0.05 level of significance. Additionally, correlation analysis at 0.05 confidence level established that there is a strong relationship between design variations and adherence to cost estimates with a correlation value of 0.429 and level of significance of 0.019. Thus the study confidently concluded that there was a significant relationship between design variations and adherence to cost estimates in construction projects in the Construction Industry in Kenya. This in concurrence with Ibbs' study which observed that changes can be deleterious in any project and can cause cost overrun, if not considered collectively by all project participants (Ibbs et al, 2001). The most common effect of change orders is as a result of site conditions, unrealistic initial requirements and specifications, poor planning, and or accidental damage during the construction phase, is the increase in project cost (Construction Industry Institute, 1990). Change orders therefore have been found to be a major contributor to time and cost overruns (Jahren and Ashe, 1990).

Contractors Experience

The study found that 80% of the respondents indicated that experience with rating "high" is a significant factor to adherence to cost estimates. At pre-qualification stage, the study established that contractors past experience in similar assignments and environment coupled with the entire team is among the parameters used in qualifying the contractors invited to bid for works. The study established that aspects of contractor's experience that affect adherence to cost estimates to a great extent or quantum are poor distribution of labour, poor site management, technical and managerial skills. Quality has been known to be having hidden costs which cannot be quantified quite easily. When proper controls are not put in place, the project is put in jeopardy. However, the bankruptcy and communication skills on adherence to cost estimates was found to affect adherence to cost estimates to a moderately low extent.

Cross tabulation and the Chi-Squared test was carried out to determine the relationship between the contractors experience and adherence to the cost estimates. The Chi-Squared critical value at $\alpha = 0.05$ was 3.841 whereas the calculated value was 10.2011 which translates to a p-value of 0.00609339. As a result, the study established that the relationship between contractors experience and adherence to cost estimates was very significant at 0.05 level of significance. The Pearson coefficient of correlation at 0.05 confidence level was found to be 0.397 and a p-value of

0.041, which also showed that the relationship was significant at 0.05 confidence level. This is in agreement to Yates observation which attested that in contracts where the contractors' experience is questionable, there is a strong likelihood of cost escalations (Yates et al, 2003).

Adherence to Cost Estimates

The respondents were required to indicate whether the organisation had previously adhered to the budgeted cost estimates. Based on the findings, 80% of the respondents revealed that the organisation has never managed to do so. Furthermore, Karl Pearson correlation analysis was done and the findings established that there was a positive and significant relationship between adherence to cost estimates and contractors' experience at $\alpha=0.05$ level of significance. The Chi-Squared critical value at $\alpha = 0.05$ was 3.841 whereas the calculated value was 10.2011 with a p-value of 0.00609339. As a result, the study revealed that the relationship between contractors experience and adherence to cost estimates was very significant at 0.05 level of significance. On the other hand, the relationship between design variations and adherence to cost estimates was highly significant because the p-value of 0.00000074 was less than 0.05 level of significance. Therefore the study concludes that the factors that greatly affect adherence to cost estimates in construction projects are contractors' experience and design variations respectively because their p-values are less than 0.05 level of significance.

Correlation Analysis

Karl Pearson correlation analysis was carried out at 0.05 level of significance using SPSS to further establish the relationships between the independent and dependent variables of this study. From the results, it is apparent that there is a significant positive correlation between design variations and adherence to cost estimates with a correlation coefficient of 0.529 and p value of 0.010. There is also substantially significant positive correlation between contractors' experience and adherence to cost estimates with correlation coefficient of 0.497 and a p value of 0.021.

Table 1: Correlation Coefficient of Relationship between independent and dependent Variables

Adherence to Cost Estimates		
Design Variations	Pearson Correlation	.529*
	Sig. (2-tailed)	.010
	N	46
Contractors Experience	Pearson Correlation	.497*
	Sig. (2-tailed)	.021
	N	46

Conclusions

The study has meticulously examined the problems associated with adherence to cost estimates of construction projects in the process of project execution. Through factor analysis, the seventeen significant variables could largely be explained by two underlying factors namely; contractor experience, design variations. These factors offer a general view that would act as a guide in formulating cost estimate policies and strategies in managing complex projects in the future. Design variations can be considered to have been the lead factor affecting adherence to cost estimates on construction projects. The study further concludes that the aspects of design variations that affect adherence to cost estimates to the largest extent are unexpected ground conditions, unrealistic requirements and specification, inadequate planning, and poor design. However the accidental damage during the execution of the project was found to affect adherence to cost estimates to a low extent.

The other factor in order of significance was contractor experience. The study concludes that experience with rating “high” is a significant factor to adherence to cost estimates as indicated by 80% of the respondents. It also established that poor distribution of labour, poor site management, inadequate technical and managerial skills, inadequate quality control skills, and bankruptcy are aspects influence contractors experience thus determining its significance to adherence to cost estimates. This variable have the potential of recurring in future projects implemented by KeNHA or any other body within the same industry under similar circumstances and so the respondents unanimously agreed that the contractor must be highly experienced. The occurrence of any of these factors on a project will largely depend of the project environment at the time of implementation.

Recommendations

In the foreseeable future, the government of Kenya will continue to fund mega construction projects especially road projects through bilateral and multilateral financing agencies. This will continue to place constraints on the type of contracts or procurement strategies that can be adopted when selecting contractors to implement the construction. As a result of strong significance between contractors’ experience and adherence to cost estimates, it is better to identify a contractor with project management skills and whose previous work record has been rated excellent. The distribution of labour (both for works and equipment suppliers) and site management skills will have to be linked closely to resource-based implementation planning of the projects. Contractors should have ability to give their resource and time plans integrated with project plans alongside communication matrix (based on PERT/CPM) and follow them. Enforcing liquidated damages clauses and enhancing incentives for timely completion to contractors will ensure that they are interested in on-time completion. Contractors should be paid on time as per the contract agreement to avoid situations where timely resource planning is affected due to cash flow problems hence avoiding the contractor from running bankrupt.

The parties should consider continuous coordination and direct communication, which will eliminate design discrepancies and errors as well as omissions in design and also provide an opportunity for professionals to review the contract documents thoroughly. This would help in eliminating unprecedented change orders or variations. Project design standards, specifications, ground survey, and construction methods must be carefully selected and reviewed so that they will be appropriate to local financial, human, and material resources required during both the implementation and its subsequent project activities. KeNHA should formulate change management plan at the planning stage. The change management plan adopted should be based on the number of and size of contracts, interface or interlink between the different contracts and their management as it is critical success factor for project performance more so adherence to cost estimates. Contractors are recommended to monitor the quality of activities continuously and to set the required quality system in the different activities of the project so as to avoid any mistakes that may lead to design variations and rework of activities that will finally be impediment to adherence to cost estimates. Lastly, the authorities must have in place a cost management plan, cost performance baseline and do all that appertains design variations and contractors experience to help them adhere to the cost estimates. This study found that design variations and contractors' experience were the most significant factors affecting adherence to cost estimates in construction projects in the Construction Industry in Kenya. As a parting shot and because minimal research has been done and documented on related factors affecting adherence to cost estimates in developing countries and in Asia on such areas as infrastructure and commercial (e.g. high-rise building, and road constructions) development, further research in similar infrastructure developments is therefore recommended.

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