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Investigation into the Causes of Delays and Cost Overruns in Uganda's Public Sector Construction Projects

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Abstract: There is great concern in Uganda about delays and cost overruns in public sector construction projects because such projects are implemented using taxpayers' money. At the national and international levels, there is considerable debate regarding how to minimise project delays and cost overruns. The main objective of this study was to investigate the causes of construction project delays and cost overruns in Uganda's public sector. Specifically, this study was conducted to identify the causes of delays and overruns and to rank them according to their frequency, severity and importance. The Civil Aviation Authority (CAA) was selected as a case study as a means of validating the results of the survey. Frequency index, severity index and importance index values were computed and all 20 factors involved were ranked. The five most important causes of delays in construction projects were found to be the following: changes to the scope of work, delayed payments, poor monitoring and control, the high cost of capital and political insecurity and instability. The relationship between the factors that cause delays and those that cause cost overruns was found to be moderate. Recommendations are made for improved project management, a change from the traditional contract type to the design–build type and improved cash flow on the part of the client to reduce payment delays. The results of this research should help construction practitioners, policy makers and researchers in the field of construction management.

Keywords: Cost overrun, Time overrun, Public projects, Construction, Uganda

INTRODUCTION

The inability to complete projects on time and within budget continues to be a chronic problem worldwide and is worsening. According to Ahmed et al. (2002), overruns on construction projects are a universal phenomenon. Azhar (2008) states that the trend of cost overruns is common worldwide and that it is more severe in developing countries. For instance, most of the construction projects in Uganda have had problems with delays in completion and cost overruns, which has caused considerable concern. The debate in the construction industry on how to minimise or eliminate delays and cost overrun has continued for some time among professionals, clients, end users and policy makers.

In many countries, the funding for construction industry activities is used to regulate the economy. As the construction industry continues to grow in size, so do planning and budgeting problems, because it is common for projects to not be completed on time and within the initial project budget. There are quite a number of examples of this at the national and internal levels. A local example is the Northern By-pass in Kampala, which was scheduled to take two and a half years to construct and instead took more than five years and the cost increased by more than 100% (Ssepuya, 2008).

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Cost and schedule overruns can occur for a wide variety of reasons on various types of projects. If project costs or schedules exceed their planned targets, client satisfaction could be compromised. The funding profile may no longer match the budget limit and further slippage in the schedule could result. The resulting effects are detrimental, especially in the case of developing countries, the measure of whose wealth is greatly dependent on their performance in providing infrastructure through the construction industry. Delays and cost overruns have a debilitating effect on clients, contractors and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, cash flow problems and a general feeling of trepidation towards each other (Ahmed et al., 2002). Because of construction delays and cost overruns, less and less work is performed, despite the increases in construction budgets.

In a bid to improve the economy, the Government of Uganda has over the past several years spent many resources on construction projects. The contribution of the construction industry to the gross domestic product in recent years has been more than 12% (Uganda Bureau of Statistics, 2009). However, many major public construction projects in Uganda have had problems with delays and cost overruns and this has caused considerable concern. There have been a few investigations of the root causes of the major problems on some of the major projects.

The aim of this research was to investigate the causes of delays and cost overruns on construction projects in Uganda's public sector. The major causes and effects of cost overruns and schedule delays on public construction projects in Uganda were identified. Specifically, this research was conducted to identify and rank the causes of delays and cost overruns on construction projects in Uganda's public sector.

By investigating into the causes of delays and cost overruns in Uganda's public sector, this research seeks to make a contribution towards finding solutions for reducing construction costs and time. It is hoped that the findings of this research will be used by project managers, consultants, contractors and students of engineering and construction management.

Background on the Ugandan Construction Industry

The Uganda construction industry uses traditional methods of procurement. Client organisations are separate from contractors. Clients normally employ consultants to design and supervise construction projects (Abbas, 2006). Procurement of construction projects is governed by the public procurement laws and guidelines, but even these can be a source of contention.

The construction industry in Uganda contributes approximately 12% of the gross domestic product and makes a significant contribution to the economy. The construction sector also employs more than 50% of the non-farm workers in Uganda. It was envisaged that more than 45% of the 2011–2012 budget would be spent on construction-related activities (Uganda Bureau of Statistics, 2011). These figures convey how important construction is to public expenditure in Uganda.

Causes of Delays and Cost Overruns

According to Abbas (2006), delay is the late completion of construction projects compared to the planned schedule or contract schedule. Delay occurs when the progress of a contract falls behind schedule. Delay may be caused by any party to the contract and may be a direct result of one or more circumstances. A contract delay has adverse effects on both the owner and the contractor (either in the form of lost revenues or extra expenses) and it often raises the contentious issue of responsibility for the delay, which may result in conflicts that reach the courts.

A cost overrun occurs when the final cost of the project exceeds the original estimates (Leavitt, Ennis and McGovern, 1993; Azhar and Farouqi, 2008). A cost overrun is the increase in the amount of money required to construct a project over and above the original budgeted amount. In the India Infrastructure Report, Datta (2002) described cost escalation as a ubiquitous problem in government projects. There is a relationship between the schedule, the scope of work and project conditions. Changes to any one or more of these can affect the budget and the time of completion. It has been argued that it is necessary to create awareness of the causes of project schedule delays, their frequency and the extent to which they adversely affect project delivery (Al-Khalil and Al-Ghafly, 1999).

Kaliba, Muya and Mumba (2009) found that the major causes of delays in construction projects in road construction projects in Zambia were delayed payments, financial deficiencies on the part of the client or the contractor, contract modifications, economic problems, material procurement problems, changes in design drawings, staffing problems, unavailability of equipment, poor supervision, construction mistakes, poor coordination on site, changes in specifications, labour disputes and strikes. As an executive at the Public Procurement and Disposal Authority (PPDA), Agaba (2009) argued that it is erroneous to blame PPDA rules for delays in construction projects because delays are primarily caused by poor designs and specifications and problems with management and supervision.

El-Razek, Bassioni and Mobarak (2008) found that delayed payments, slow delivery of payments, coordination problems and poor communication were important causes of delay in construction projects in Egypt. Sambasivan and Soon (2007) found that poor planning, poor site management, inadequate supervisory skills on the part of the contractor, delayed payments, material shortages, labour supply shortages, equipment availability and failure, poor communication and rework were the most important causes of delays in the Malaysian construction industry.

Kouskili and Kartan (2004) identified the main factors affecting cost and time overrun as inadequate/inefficient equipment, tools and plants; unreliable sources of materials on the local market and site accidents.

Le-Hoai, Lee and Lee (2008) identified the three top causes of cost overruns in Vietnam as materials cost increases due to inflation, inaccurate quantity takeoffs and labour cost increases due to environmental restrictions. In their research, Kaliba, Muya and Mumba (2009) concluded that cost escalation of construction projects in Zambia was caused by factors such as inclement weather, scope changes, environmental protection and mitigation costs, schedule delays,

strikes, technical challenges and inflation. Bubshait and Al-Juwait (2002) list the following as factors that cause cost overruns on construction projects in Saudi Arabia: the effects of weather, the number of projects going on at the same time, social and cultural impacts, the project location, a lack of productivity standards in Saudi Arabia, the level of competitors, supplier manipulation, economic stability, inadequate production of raw materials by the country and the absence of construction cost data.

A summary of the key factors affecting time and cost overruns is provided in Table 1.

Table 1. Factors that Cause Delays and Cost Overruns

Serial Number (SN)	Factors	Reference
1	Inadequate or inefficient equipment, tools and plants	Frimpong, Oluwoye and Crawford (2003); Kouskili and Kartan (2004)
2	Unreliable sources of materials on the local market	Kouskili and Kartan (2004)
3	Strikes by site personnel	Iyer, Chaphalkar and Joshi (2007); Kouskili and Kartan (2004)
4	Inadequate manpower, e.g., in terms of numbers, poor training, lack of training, etc.	Kousliki and Kartan (2004); Stoner, Freeman and Gilbert (2005)
5	Delayed payment to contractors, subcontractors and/or suppliers	El-Razek, Bassioni and Mobarak (2008)
6	Rework required due to poor work or the wrong materials used by contractors	Alinaitwe, Mwakali and Hansson (2007)
7	Change of work scope and/or changes in material specifications	Al-Khalil and Al-Ghafly (1999)
8	Poor communication, e.g., slow responses to site queries, late receipt of drawings, etc.	Berechman and Wu (2006); Bubshait and Al-Juwait (2002)
9	Poor schedule management	Avots (1983)
10	Poor monitoring and control, e.g., due to incompetent and/or unreliable supervisors	Masambaji and Ssegawa (2008); Alinaitwe, Mwakali and Hansson (2007)
11	Discrepancies and/or deficiencies in contract documents	Ellis and Thomas (2002)
12	Disputes among the parties involved in the project (clients, contractors, consultants)	Bubshait and Al-Juwait (2002)

(*continued on next page*)

Table 1. (*continued*)

Serial Number (SN)	Factors	Reference
13	High inflation, insurance and interest rates	Samset (1998); Kaliba, Muya and Mumba (2008)
14	Fuel shortages	Majid and McCaffer (1998)
15	Political insecurity and instability	Alinaitwe, Mwakali and Hansson (2007)
16	Bad weather	Kaliba, Muya and Mumba (2008)
17	Differing site conditions	Ellis and Thomas (2002)
18	Site accidents	Kouskili and Kartan (2004)
19	Large and complex projects	Ghoddosi, Husseinalipour and Jalal (2008)
20	Project location, e.g., remoteness from business centres, remoteness from the client's base, remoteness from the contractor's base, etc.	Bubshait and Al-Juwait (2002)
21	Bureaucracy, e.g., PPDA rules regarding approval of changes	Bordat, McCullouch and Sinha (2004)
22	Contractor's work load	Bubshait and Al-Juwait (2002)

Despite the large number of studies on the causes of cost escalation and schedule delays in construction projects, little or no research has been undertaken in Africa in general and Uganda in particular to address the challenges identified in these studies. The studies mentioned were conducted predominantly in developed countries and might not adequately highlight the factors that affect the construction sector in developing countries. The fact that there is no literature on similar studies conducted in Uganda suggests that little attention has been paid to this area of investigation.

METHODS

The causes of delays and cost overruns in construction projects in Uganda's public sector were investigated in this study. The delays and cost overruns considered in this study were those that occur during the implementation (construction) phase of construction projects. Delays and cost overruns were compiled on the basis of a review of the literature and discussions with contractors, government ministry officials and consultants working on public projects, as well as personal experience with public-sector construction projects, as indicated in Figure 1.

Contract duration and fraudulent activities were excluded after the testing of the questionnaire because the respondents thought they were vague terms. Previous experience of the contractor and technical challenges were excluded because, according to the format of the PPDA bidding documents, these are taken care of. No contractor can obtain a public contract if he does not meet these criteria. The government policy of lowest bidders and the level of competition were not included in the questionnaire because in the public works tenders, the policy of identifying the best evaluated bidder is applied, as opposed to the lowest bidder. The labour cost increase due to environmental restrictions was not included because it is not applicable in Uganda. Lack of labour productivity standards and lack of construction cost data were excluded because information on these variables is available from the Ministry of Works and Transport.

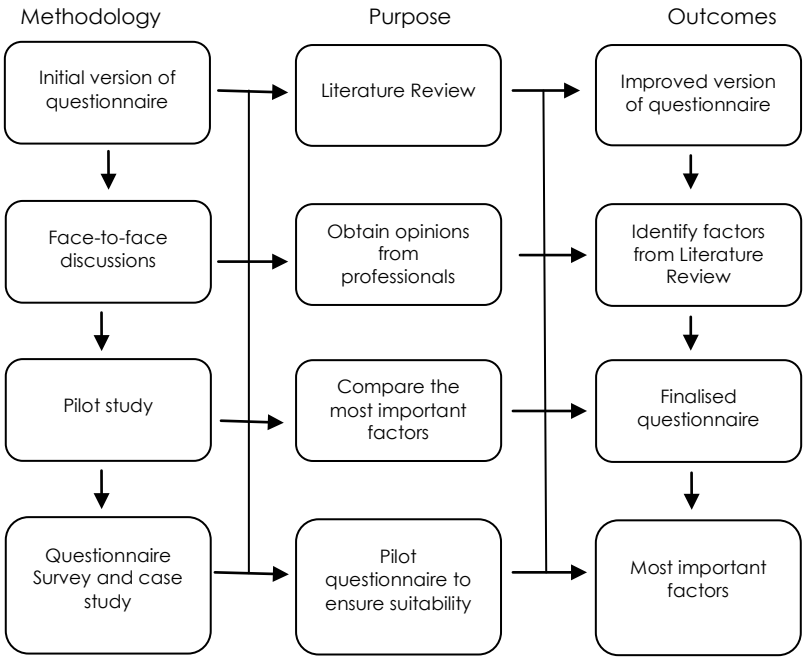

Figure 1. Summary of Methodology and Outcomes

The research was conducted using a questionnaire survey and the CAA was used as a case study to validate the findings of the survey. Both the survey and the case study in this research were primarily quantitative. The questionnaire was complied on the basis of a compiled list of causes of delays and cost overruns developed in a pilot study. The pilot study was conducted to improve the wording of the questionnaire and increase the reliability of the questions. The questions were of a closed type because it is easier and faster to analyse the information collected using such questions. The respondents were asked to give their opinions on the frequency and severity of each of 22 factors using a 4-point Likert scale, rather than a standard 5-point scale. The neutral point (which allows respondents to declare no opinion on the matter) was eliminated from the 5-point scale to

obtain the respondents' views on the subject (Amin, 2005). This is because the respondents who were chosen were assumed to be knowledgeable about the subject. When the respondents were asked to state how often they thought each factor contributed to delays and cost overruns on construction projects, the options were always, often, sometimes and never (corresponding to scale values of 3, 2, 1 and 0, respectively). When the respondents had to weigh the impact of the factors on time and cost in construction projects, they options were very severe, severe, somewhat severe and no effect (corresponding to scale values of 3, 2, 1 and 0, respectively).

The survey was administered to corporate members of the Uganda Society of Architects (USA), corporate members of the Uganda Institution of Professional Engineers (UIPE) and registered Quantity Surveyors who had participated in the implementation phase of construction projects in Uganda's public sector. These respondents are scattered all over the country. Therefore, those residing and working outside Kampala had to be contacted via electronic mail. Many of those who ordinarily work in Kampala had to be contacted in person. Telephone reminders were used to follow up on the responses. The distribution of the respondents is provided in Table 2.

Table 2. Distribution of the Respondents

Category of Respondents	**Population**	**Sample size**
Registered engineers	221	141
Registered architects	109	85
Registered quantity surveyors	22	21
Total	352	247

The respondents were also categorised in terms of the parties they represented, i.e., clients, contractors and consultants, as shown in Figure 2.

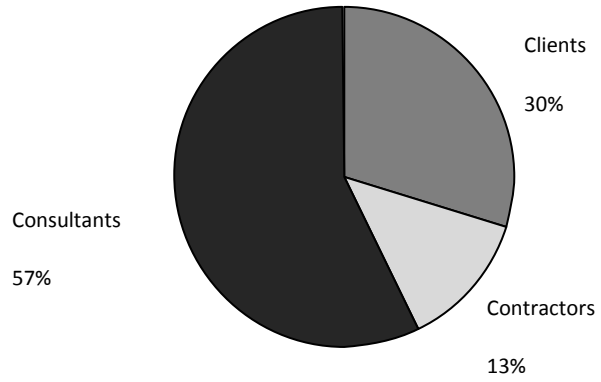

Figure 2. Distribution of the Respondents by Stakeholder Category

The majority of the respondents, 57%, had acted as consultants and the smallest per centage of the respondents, 13%, were contractors.

The case study was based on construction projects completed between 1 January 2003 and 31 December 2008. According to the Public Procurement and Disposal of Public Assets Act (PPDA, 2003), Procuring and Disposing Entities (PDEs) are supposed to keep their procuring and disposal records for up to six years. This period was selected to analyse projects that were completed within the seven-year period after the PPDA Act (2003) came into force. Data on project start dates, expected completion dates, initial project estimates and final project costs were extracted for CAA projects.

RESULTS AND DISCUSSION

Reliability of the Questionnaire

The reliability of the questionnaire was analysed to find out whether it was capable of yielding similar scores if respondents used it twice. Cronbach's alpha was used to measure the reliability of the questionnaire. Cronbach's alpha is usually computed from the following formula:

$$\text{Alpha} = \frac{Nc}{v + (N-1)*c}$$

where N = the number of items, v = the average variance and C = the average inter-item covariance. SPSS 10.0 was used to compute alpha for all four sets of 22 items in the questionnaire. The entire set of 88 items in the questionnaire was also analysed. A summary of the tests is found in Table 3.

Table 3. Results of Reliability Analysis

Variables	Alpha	Standardised Item Alpha
Frequency of occurrence of factors in causing delays	0.8679	0.8633
Frequency of occurrence of factors in causing cost overruns	0.8539	0.8543
Impact of factors on project time	0.8390	0.8374
Impact of factors on project costs	0.8439	0.8466

According to Reynold and Santos (1999), a Cronbach's alpha value greater than 0.7 implies that the instrument is acceptable. Therefore, based on the results, the questionnaire was judged to be reliable.

Survey Response

The frequency, impact and importance of the various factors that influence cost and time overruns were calculated using equations adapted from Al-Khalil and Al Ghafly (1999: 645).

$$F.I = \sum_{0}^{3} (a_i f_i / N) \quad \text{Eq. 1}$$

$$S.I = \sum_{0}^{3} (a_i s_i / N) \quad \text{Eq. 2}$$

$$IMP.I = F.I \times S.I. / 9 \ (\%) \quad \text{Eq. 3}$$

where a_i = weights assigned to the responses (ranging from 0 for Never to 3 for Always), f_i = frequencies of the responses, s_i = severities of the impact and N = the total number of responses.

The rationale for the importance index is that the importance of a cause of a delay or cost overrun is the result of the combined effect of the frequency and severity of the factor. Thus, two delay or cost overrun factors with the same frequency of occurrence would have the same importance if they have the same scores for the severity of their impact, but if one of the causes has a more severe impact, then it would be considered more important.

As Table 3 shows, the five most frequent causes of delays were identified as delayed payments, inadequate or inefficient equipment, the need to repeat work due to poor-quality work, bureaucracy and changes in the work scope. The five most frequent causes of cost overruns were identified as changes in the work scope (SN 7), high inflation and interest rates, poor monitoring and control, delayed payments to contractors and fuel shortages.

The five factors that were ranked the highest in terms of their impact on delays were delayed payments to contractors, political insecurity and instability, inadequate or inefficient equipment, changes in the work scope and disputes among the parties involved in the project. The five factors that were ranked the highest in terms of their impact on cost overruns were changes in the work scope, high inflation and interest rates, fuel shortages, poor monitoring and control and delayed payments to contractors.

The five factors that were ranked the highest in terms of their importance to delays were changes of the work scope, delayed payments to contractors, poor monitoring and control, high inflation and interest rates and political insecurity and instability. The five factors that were ranked the highest in terms of their importance to cost overruns were changes in the work scope, high inflation and interest rates, poor monitoring and control, delayed payments to contractors and deficiencies in contract documents.

The four factors that were ranked as very important in terms of their effects on delays and cost overruns were changes in the work scope, delayed payments to contractors, poor monitoring and control and high inflation and interest rates. These findings are consistent with those obtained by Azhar and Farouqi (2008) in their study of cost overrun factors in Pakistan and those obtained by Sweiss et al. (2008) in Jordan.

Table 4. Frequency of Occurrence

Factor SN	Frequency of Occurrence				Impact				Importance			
	In Causing Delays		In Causing Cost Overruns		On Project Time		On Cost Overruns		In Delays		In Cost Overruns	
	FI (Max = 3)	Ranking (Max = 22)	FI (Max = 3)	Ranking	SI (Max = 3)	Ranking	SI (Max = 3)	Ranking	II (Max = 100)	Ranking	II (Max = 100)	Ranking
1	2.06	2	1.34	17	1.98	3	1.38	17	29.48	9	20.55	16
2	1.85	6	1.56	8	1.84	6	1.71	9	31.89	6	29.64	8
3	1.57	17	0.98	22	1.43	20	1.05	22	15.57	21	11.43	22
4	1.73	11	1.48	11	1.59	18	1.23	18	26.15	16	20.23	17
5	2.19	1	1.66	4	2.06	1	1.88	5	38.00	2	34.68	4
6	1.92	3	1.44	13	1.79	8	1.40	15	28.64	11	22.40	14
7	1.86	5	2.07	1	1.96	4	2.23	1	45.08	1	51.29	1
8	1.80	10	1.54	10	1.68	13	1.61	12	28.75	10	27.55	11
9	1.84	8	1.47	12	1.67	14	1.48	13	27.28	14	24.17	13
10	1.81	9	1.74	3	1.76	9	1.94	3	34.03	3	37.51	3
11	1.68	14	1.56	8	1.65	15	1.84	7	28.60	13	31.89	6
12	1.70	13	1.37	15	1.88	5	1.65	11	28.62	12	25.12	12
13	1.47	20	1.86	2	1.63	17	2.07	2	33.69	4	42.78	2
14	1.52	18	1.59	5	1.80	7	1.94	3	31.80	7	34.27	5
15	1.59	16	1.43	14	2.03	2	1.86	6	32.25	5	29.55	9
16	1.73	11	1.22	20	1.72	11	1.39	16	23.32	18	18.84	18
17	1.68	14	1.57	6	1.74	10	1.78	8	30.35	8	31.05	7
18	1.21	22	1.07	21	1.20	22	1.21	19	14.27	22	14.39	21
19	1.48	19	1.57	6	1.51	19	1.68	10	26.34	15	29.31	10
20	1.37	21	1.28	18	1.33	21	1.19	20	18.92	20	16.92	19
21	1.88	4	1.35	16	1.69	12	1.43	14	25.35	17	21.45	15
22	1.85	6	1.26	19	1.65	15	1.19	20	23.10	19	16.66	20

Spearman's coefficient of rank correlation was determined for the importance of factors causing delays and those causing cost overruns. Spearman's correlation coefficient was calculated using the equation below, in which n is the number of pairs (in this case, 22) and *d* is the difference between the ranks.

$$\rho = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

The calculated value of the correlation coefficient was 0.9. Because this value is greater than 0.7, a very strong positive correlation was judged to exist between the causes of delays and the causes of cost overruns (Benoit, 2009).

Changes in the scope of work appeared at the top of both lists of factors that cause delays. Therefore, there is need to keep scope changes to a minimum. This finding is in agreement with PPDA (2004), PPDA (2006) and PPDA (2009), in which it was reported that audited projects experienced cost overruns due to changes in the work scope. A change in scope may be due to execution of incomplete designs, which leads to variations (Alinaitwe, 2008). Among the other causes of change of scope are clients that may not be well informed and consequent delays in decisions about designs.

The other factor of great importance is delayed payments to contractors. Delayed payments to contractors have knock-on effects on many activities of contractors, subcontractors and suppliers. Contractors tend to transfer the burden of accumulated interest to the client, causing cost overruns. Payment delays are usually caused by bureaucracy in the public sector, a lack of proper documentation and at times, a lack of transparency.

Inflation usually leads to the escalation of prices of materials, equipment and other inputs to the projects. Because the project parties have no control over this factor, they can only minimise delays in the project so that cost overruns due to this factor are minimised (because inflation is a time-bound factor). This factor was ranked highly because of the current economic condition in the world economy. Prior to the current economic crisis, it would not have been a major factor.

Poor monitoring and control was ranked as the third most frequent cause of cost overruns. Poor monitoring and control result in poor workmanship and schedule creep, which in turn lead to cost overruns.

Civil Aviation Authority (CAA) Case study

A case study was carried out with a focus on the CAA, one of the major public enterprises. A total of 30 projects conducted in the previous six years were reviewed. By law, government departments are required to keep documents about projects for six years. SPSS was used to analyse the results in terms of frequency and percentage. Fifty-three per cent of the projects analysed had cost overruns and 40% had no changes in their contract costs. There were cost savings for 7% of the projects, which were completed at costs below the initial contract costs. Eighty-four per cent of the cost overruns were caused by change in work scopes. The remainder of the cost overruns were attributed primarily to inflation.

In the CAA projects analysed, delays were most frequently caused by changes in the work scope (46%). The second most frequent cause was delayed payments (21%). Fifteen per cent of the delays were due to the remote locations of the projects. Poor communication was the fourth most frequent cause of delays (6%). Bad weather, land disputes, rework and disputes among the project parties were the least common causes, at 3% each. The most frequent causes of delays were found to be similar to those most highly rated in the questionnaire responses.

All of the initial project durations for all the projects were taken to be one (01) equivalent project day. The differences between the initial project duration and the final project duration were then taken as a fraction of one equivalent project day. Likewise, the initial project cost for any one project reviewed was taken to be one (01) equivalent million Ugandan shillings. The difference between the initial contract sum and the final sum (in millions of Ugandan shillings) was taken as a fraction of the equivalent contract sum. These fractions were added and averaged.

An average of 0.465 days per day of the initial contract, with a standard deviation of 0.662, was obtained. This implies that on average, for every day of a CAA construction project, one should expect a delay of 0.465 days. For example, if the initial project duration is 60 days, then the delay on such a project is likely to be 60 x 0.465 = 27.9 days by the end of the project.

In terms of cost performance, the average cost overrun rate was found to be 0.162 million Ushs per million Ushs of the original contract sum, with a standard deviation of 0.297. For example, if the original contract sum of a project is Ushs 300 (in millions), then one should expect a cost overrun of 0.162 x 300 = 48.6 million Ushs by the end of the project.

CONCLUSION AND RECOMMENDATIONS

This study investigated the causes of delays and cost overruns in construction projects in Uganda's public sector. The five most important causes of delays and cost overruns were found to be changes in the work scope, delayed payments to contractors, poor monitoring and control and high inflation and interest rates. These results were confirmed by the results of an analysis of CAA projects.

Stakeholders in the construction industry are advised to minimise changes in work scopes, as this has the greatest impact on cost and time overruns. It is recommended that project management be improved, with a shift in emphasis towards more collaborative relationships, which would reduce payment delays by improving cash flow on the part of the client and thereby reduce overall project costs.

Reducing project cost and time overruns would improve the effectiveness and efficiency of the public sector in Uganda. More projects would be delivered as there would be increased throughput. This would make construction more affordable and the public sector would be able to deliver more in terms of construction volume. The results of this research should be of great significance to construction practitioners, policy makers and researchers in the field of construction management.

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