INVESTIGATING EXTENT AND EVENTS LEADING TO COST AND TIME OVERRUNS OF PUBLIC BUILDING PROJECTS

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Abstract- Extant literature reveals abundance of studies to establish causes of overruns using a questionnaire approach. This approach has been observed to be fraught with limitations. The authors contend that the circle of investigation into identifying the causes of cost and time overruns can only be complete when the views of practitioners are complemented with investigations into the extent and events that trigger the overruns. This research assesses the antecedents of 321 completed school projects to understand the root causes of overruns. In all, 72% and 87% of the projects evaluated overran their initial budget and duration respectively. The mean cost and time overrun is also 9.6% and 106% respectively. It has been observed that any attempt to reduce the effect of change orders on only external works by 75% through proper pre-contract planning would reduce the change orders by 56%. The deduction from the investigations conducted revealed endogenous factors within the public sector system - poor project planning, payment delays, lack of enforcement of contract provisions and political interference. Similarly, excessive payment of price fluctuations resulting from project delays and uncertainties in material and labour prices, and variations are responsible for cost overruns. The findings of the research therefore present a unique opportunity in understanding the fundamental causes of overruns within public sector building projects. Knowledge of the extent of overruns is also expected to prompt policy makers and project managers on the pervasiveness of overruns.

Keywords- Cost Overrun; Payment Delays; School Projects; Time Overrun;

I. INTRODUCTION

The risk posed by cost and time overruns to construction projects is not in contention. In fact, delays and their attendant cost overruns have become an innate feature within the construction industry (Love et al., 2012). The question no longer is whether there will be cost and time overruns but what will trigger it and to what extent. Overruns do not only increase the capital-output ratio of projects through excessive claims but also have the potential to create adversarial relations amongst the contractual parties engendering litigation and eventual project abandonment.

Performance within the Ghanaian Construction Industry (GCI) has been observed to be generally poor and many have decried the public sector’s lack of commercial edge in the exercise of its procurement functions (Anvuur et al., 2006). Within the public sector, government’s fiscal constraints have resulted in constant payment default to contractors, creating a constant spectre of excessive time and cost overruns. Notwithstanding, deficiencies such as project delays in infrastructure development in Ghana remain a major concern and obstacle for growth and competitiveness due to high inflation. The World Bank (2011) has pointed out that 2.3 billion dollars annual investment is required over a 10 year period in order to bridge the infrastructure gap which is expected to raise the annual growth rate by 2.7 percentage points. As a developing country, Ghana is currently faced with the task of optimising and managing its debt stock. This has not only provided little space for the government to continue financing infrastructure projects but also intensified the need to identify and forecast the likelihood of project delays in order to recommend the necessary mitigating measures to avert them.

Notwithstanding, literature is currently replete with factors that are believed to be responsible for causing cost and time overruns (Doloi, 2013). The conventional approach for identifying the factors by researchers worldwide has often been to list all possible causes available in literature and administer them through a survey for rating. This certainly does not reveal the exact root causes considering the approach is fraught with several limitations. The constraint is the lack of justification and overreliance on the perception of the respondents. These results in generic factors that are often biased depending on the experiences of the respondents, personal views, clarity and understanding of the factors presented for rating. Besides, the rating of the factors based on the Likert scale is often predisposed to subjectivity and the mood of respondents (De Vaux, 2013) resulting in factors that are not representative of what pertains in practice.

As a first step towards improving contract planning is the need for an ex-post assessment of completed projects to establish the extent of the divergence between the actual and planned budget and schedule. This is critical in prompting the attention of policy makers and project managers on the pervasiveness of overruns. It is further contended that the circle of investigation into causes of cost and time overruns cannot be completed by only relying on the opinions of project participants unless completed projects are examined to trace and assess the events leading to overruns or otherwise. This study is aimed at arriving at a ballpark estimate of the extent of delays and cost...
overruns. It further interrogates the antecedents of the projects to establish the fundamental causes that provoke overruns.

II. DATA COMPILATION

Data for this study consisted of public school projects completed between 2010 and 2013 following the government of Ghana’s initiative to embark on massive construction and refurbishment of several school buildings in the year 2009. This was aimed at abolishing the shift system and replacing all dilapidated public school structures (Budget Statement, 2009; 2010). The projects compiled can generally be divided into two main categories – regular and emergency depending on the sense of urgency attached to the delivery of the project. Besides availability and the fact that about 25% of all government expenditure goes into the educational sector, school projects were selected because their planning, award, construction and funding arrangements are just analogous to the procurement process of construction within the public sector.

The projects were funded with statutory allocations to the GETFund. The GETFund is a public trust that was established by an Act of parliament in the year 2000. Its principal mandate is to provide funding to complement government’s effort towards the provision of educational infrastructure and facilities within the public sector. The GETFund derives its funding from the value added tax (VAT) paid on all goods and services – i.e. 2.5% out of the 17.5% VAT is supposed to be set aside by the ministry of finance and paid into the GETFund. About 75% of all GETFund allocations end up in infrastructure development. Besides availability, the selection of educational building projects was principally justified by the fact that their procurement process is analogous to the award of most public building projects in Ghana. The project data were compiled from archival records from several consultants (quantity surveyors) from several sources such as bills of quantities, interim payment certificates, final accounts, contract drawings and programme of works.

In all, a total of 321 projects with a total initial cost of Gh¢ 110,421,051.21 (€1,668,321.21) compiled. The school projects assessed for this research comprised of classroom blocks, dormitories, dining halls and science laboratories with similar levels of complexities. The following information were compiled on each project - project name, initial contract sum (IC), actual cost of construction, contingency allowance, initial contract commencement and expected completion dates, actual completion date, material and labour price fluctuations over the project duration, gross floor area, the inclusion of a liquidated ascertained damages (LAD) clause and advance mobilisation. Additionally, details on the initial and actual cost of the building sections of all the projects were recorded to enhance better understanding of the susceptibility and distribution of change orders and cost overruns within each section. Beyond the data compilation, five contractors, three representatives from the client’s outfit, and five consultants from whom the projects were compiled were interviewed on the events leading to the award of the projects and the general reasons underlying the overruns.

III. ANALYSIS

1.1 Background Assessment of Regular Projects

The idea by government to replace all dilapidated school structures and remove schools under trees commenced around April 2010. The consultants were selected based on their technical and financial proposals albeit the financial proposals of the consultants were later replaced with a uniform 6% of the contract sum of the cost of each project. Some firms were eventually selected for both precontract and post-contract services and the idea was to maintain these firms nationwide for all future projects under this scheme. All the firms with the exception of the firm that were awarded projects in the three northern regions had their offices located in the national capital, Accra. The consultants involved were awarded more projects as and when approvals for more schools were granted with special consideration on their performance.

The client presented the selected consultants with model designs it had worked on in the past to modify and replicate across the country. Several school projects including classrooms, dormitories, dining halls and science laboratories were developed for construction. There were virtually no feasibility studies considering the magnitude of projects. Instead, several range of designs had to be developed for each type of project; for instance there was a “U-shaped”, “L-shaped” and “long-stretched” design for each of the classroom blocks built. This was to ensure that an appropriate design was available at the time of construction depending on the shape of the site. Modifications (variations) therefore occurred during the execution of works contracts. In all, about fourteen different facility designs had to be modified for construction.

The consultants and contractors interviewed cite several instances where the public procurement process was circumvented. For example, the interviewees cite several instances when politicians recommended their preferred contractors to be awarded the project. In such instances even though the project had been advertised, all the contract documents were sold to the preferred contractor who often submitted the necessary attachments to cover up. Additionally, it is reported that most of these contractors paid de facto 10% of the contract sum to the politicians or authorities that aided them to
acquire the projects. According to Adams (1997) this phenomenon makes it difficult for project managers to effectively manage the contractor on site.

The consultants were however hesitant to associate all the shortcomings of the programme to the calibre of contractors selected. In their view, the politicians were equally interested in the success of the projects as they were in the kickbacks and therefore often ensured more experienced contractors were selected. Another significant feature of these set of projects is the fact that the tender figures of the contractors were not renegotiated except in instances when it exceeded an approved threshold set by the client. On the other hand, the project duration were set by the client upon advice from the consultants. According to the consultants’ interviewed, the selection of the project completion date was fundamentally guided by the anticipation of payment delays based on previous experiences. For example the project duration for the single-storey six unit classroom blocks, two storey classroom blocks and dormitory blocks were awarded for 8 months, 12 months and 18 months respectively - far more than the duration it would require if all resources were readily available. The explanation offered was that the projects commenced without any secured funds except the assurance that government would certainly make payment into the GETFund. Unfortunately, the statutory payments delayed as a result of the huge budget deficits and imbalances within the economy. The excessive payment largely accounted for the project delays.

The interviewees confirmed that project performance with respect to time was far better when the programme began in the year 2000. At the initial stages, contractors received prompt payment with a maximum of two months time lag between submission of certificate and payment. This was consistent with the then provisions of the government of Ghana conditions of contract (GoGCC) subclause 43.1 which indicated that “the client shall pay the contractor the amounts certified by the project manager within 56 days of the date of each certificate”. Review of the contract reports however revealed that the payment delays increased to between 12 to 18 months after the year 2012 when many more projects were awarded beyond what the funding available could actually support. At a point, some contractors had to threaten to demonstrate because government had failed to honour interim payments for more than one year (See for instance - The New Statesman, 2012). Subsequently, consultants varied the acceptable time lag in the contract from 56 days to 365 days – more than the contract duration of most of the projects. This was done to appropriately inform the contractors of the client’s payment period and to enable the contractors factor the risk of payment delays into their bids. Notwithstanding, more projects keep on being awarded in spite of the backlog of projects that have been suspended because of payment delays – a phenomenon many view as a deliberate attempt by successive governments to ensure their campaign promises are honoured irrespective of the consequences.

Frequent suspensions as a result of payment default by the client made it difficult for the consultants to evaluate concurrent delays. Besides failure for government to pay the contractors’ interest on their delayed payments also made it unjustifyable for the consultants to enforce the penalty clause creating time at large scenarios. Notwithstanding, the contractors were also hesitant to enforce their right to claim interest on delayed payments for fear of being blacklisted for future jobs. Considering that the projects were awarded with a fluctuation clause, the frequent project suspension coupled with the high uncertainties in material and labour prices resulted in the payment of huge cost escalations resulting in cost overruns.

1.1.1 Emergency Projects
The emergency projects compiled which in all number 42. The award of these projects became necessary when the senior high school duration was extended from 3 to 4 years. A change of government in January 2009 meant that not much attention had been given to the development of the needed infrastructure to absorb students moving to the fourth year in September, 2010. Detailed standard designs and contract documentation were quickly put together and completed between April/May 2010 before project commencement. Hence government had to urgently pre-select contractors to commence construction of a number of 6 to 12-unit classroom blocks in almost all senior high schools across the country based on need assessment. Contractors were selected through restrictive tender to ensure the contractors selected had the necessary experience to deliver within the tight schedule of 4 to 6 months. A special fund was also set aside to ensure prompt payment of interim certificates. Because of the vested interest of all stakeholders involved towards a successful completion, the consultants offered close monitoring, supervision and a prompt response to queries. As an extra source of motivation, all the contractors were offered a uniform contract amount with very attractive rates in addition to a 30% advance mobilisation. The projects were awarded as lump sum fixed contract with a penalty clause which were strictly enforced. As an extra incentive, very attractive contract rates were offered to the contractors who received a uniform contract sum.

1.2 Assessment of the Sizes of Cost and Time Overruns
Table 1 displays a comparison of the time performance between the regular and emergency projects.
Investigating Extent And Events Leading To Cost And Time Overruns Of Public Building Projects

About 94% of the regular projects delayed at a mean value of 136.72%. Only 3% were completed before schedule at a mean value of -23.20% while about 3% of the projects were completed on schedule. Conversely, the projects that were specially awarded as emergency projects predominantly succeeded in terms of time performance. For instance about 62% of the projects were completed within schedule. Only 38% of the projects were completed beyond the planned completion date with a mean of 68.90% time overrun. Now, the average delays experienced on the emergency projects could be seen as a far more improvement than the regular projects when it is benchmarked against it’s initial duration of 4-6 months.

Table 2 compares the difference between the cost overruns of the regular and emergency projects.

The regular projects are largely skewed towards overruns. In all, 82% of the projects overran their initial contract sum by an average of 10.87% while 17% experienced underruns of 4.63%. Only 1% of the projects were completed within budget. Additionally, the share of fluctuations to contract sum for the GETFund projects has a mean of 11.73%. This suggests that payment of price fluctuations may have largely accounted for the cost overruns. Meanwhile the emergency projects were largely successful in terms of cost. About 95% of all the projects were completed below the initial budget at a mean of -2.22%. Only 2 projects (5%) out of the total of 42 projects overran their initial budget by 2.96%.

The poor cost performance of the regular projects is largely accounted for by payment of excessive price fluctuations resulting from the time at large scenarios created on many on many of the projects. Conversely, the impressive performance of the emergency projects can fundamentally be explained by two reasons - prompt payment and strict adherence to the contract provisions.

1.3 Impact of Change Orders on Various Sections of the Building

Figure 3 displays the percentage of change orders within each building section based on the severity and frequency.
It is observed that external works (67%), substructure works (35%) and electrical works (29%) are three sections most susceptible to change orders. Likewise, external works (73%), electrical works (18%), concrete works (8%) experience the highest share of overruns with respect to change orders. This confirms the poor planning and lack of detailed design before contract award. A consultant interviewed during a follow up on why the external works experienced very high cost overruns intimated that "naturally for a client who wants to cover the entire country with projects, external works is always least on their minds". Additionally, the electrical works is part of specialist works which falls under the category of mechanical, electrical and plumbing (MEP) and hence its estimation and pricing best done by services engineers rather than quantity surveyors whose professional expertise lie with the measurement of the building works. The lacuna within the industry is filled by electrical and mechanical engineers whose core training does not include measurement and pricing. Besides, the low scale of fees offered to consultants makes it difficult for the consortium awarded the contract to engage all specialists to handle the project. Hence, it is not uncommon to see the architect and quantity surveyors playing multiple roles such as plumbing, electrical, mechanical and/or structural engineers on less complex projects. Even when a services engineer is engaged, it is rare for such a person to have knowledge in both plumbing and electrical works. The normal practice is for consultants to insert provisional sums. The resultant effect according to Adams (1997) is underestimation or overestimation of the provisional sums.

1.3.1 Adequacy of Cost Contingency

The contingency allowance which is a risk premium meant to hedge against cost overruns is responsible for the payment of material and labour price fluctuations as well as change orders related to the physical design. Table 3 presents a breakdown and assessment of the average share of change orders and fluctuations within the planned and expected contingency allowance and the percentage of cost overrun experienced on the projects.

Table 3: Assessment of Share of Fluctuation, Change Orders within Contingency

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<tr>
<th>Projects</th>
<th>Average cost of works Ghs</th>
<th>Average planned contingency allowance</th>
<th>Average contract sum Ghs</th>
<th>Average final cost fluctuation Ghs</th>
<th>Average final cost including fluctuation Ghs</th>
<th>Average % change order</th>
<th>Average % of fluctuation</th>
<th>Average % of cost overrun</th>
<th>Average expected contingency allowance</th>
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<tr>
<td>No</td>
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The breakdown of the project cost components in table 3 reveal an average initial contingency allowance of 9.05%. This corroborates earlier studies by Buenter et al. (2012) which posited that 90% and 8% of Ghanaian consultants apply 10% and 5% contingency allowance respectively on contractor’s estimate. It has been established that beyond the average contingency sum of 9.05%, the projects experienced a cost overrun of 9.64%. From the deductions, the expected contingency sum should have been 19.57%. Out of the expected contingency allowance of 19.57%, the share for price escalations and change orders would be 12.40% and 7.17% respectively. At best, the planned contingency allowance of 9.05% can only absorb the risk of change orders which is 7.17% of the initial cost of works. Further analysis shows that the average share of the price fluctuations and change orders is 63% and 37% of the total expected contingency respectively.

Secondly, it is argued that whereas change orders may not be “entirely bad” per se because they often end up adding value to the project, they can be described as “avoidable cost”. On the other hand, it is argued that the payment of excessive material and labour price fluctuations do not add value to the project and can best be described as “wasted money”. Hence the margin of 12.40% “waste” on every project executed is alarming considering the huge infrastructure gap facing the nation vis-à-vis the huge financial constraint on government to continue financing infrastructure projects in the midst of a daunting task of optimising and managing its debt stock. Although fundamentally, cost overruns resulting from material and labour price fluctuations are directly engendered by exogenous factors such as high and uncertain inflation, currency depreciation and import taxes, in reality it can indeed be assuaged by addressing the root causes of poor project planning and fiscal constraints.

However, from the foregoing, it has been observed that any attempt to reduce the effect of change orders on only external works by 75% through proper pre-contract planning would reduce the change orders by 55.96% or the proposed contingency by 20.50%.

IV. SUMMARY AND RECOMMENDATIONS

The research has investigated the antecedents of some completed projects in Ghana to establish the fundamental causes of overruns. It compared and contrasted regular projects whose feasibility, planning and design, contract letting and bidding, contract award and construction are analogous to how most public projects are executed with emergency projects which largely succeeded because prompt payment. The reasons behind overruns based on the investigations conducted were endogenous factors within the public sector system - poor project planning, payment delays, lack of enforcement of
contract provisions and political interference account for the overbearing time overruns within the regular projects. Similarly, excessive payment of price fluctuations resulting from time at large scenarios vis-à-vis uncertainties in material and labour prices and change orders are primarily responsible for cost overruns. The findings of the research have been observed to corroborate earlier findings by Frimpong et al. (2003), Fugar and Ayarkwah-Baah (2010) and Asiedu and Allen (2014) who identified financial constraints and poor project planning as the fundamental causes of cost and time overruns based on a questionnaire approach. This paper makes some propositions to avert the vicious cycle of overruns. It recommends that government secures funding before contracts are awarded to guarantee a smooth run of the project. The adoption of the integrated procurement strategy is also seen as a phenomenal approach capable of alleviating the knock-on effect of project delays whiles enhancing communication and team buildings amongst the various project participants. Despite the increasing awareness of this strategy in developing countries such as Ghana and Nigeria, the highly fragmented nature of the GCI coupled with the public sectors lack of professional expertise has slowed the public sectors leadership role in the development of innovative procurement methods. The establishment of construction industry development authority through a legislative instrument akin what currently exist in Malaysia (Construction Industry Development Board), Singapore (Building and Construction Development Authority and later Construction 21 steering committee), South Africa (Construction Industry Development Board), Tanzania (National Construction Council) and Australia (Australian Procurement and Construction Council) etc. to coordinate the activities within the industry will enhance the facilitation of the innovative management approach. This research further recommends that clients and consultants place much emphasis on contractor’s financial ability to prefinance a project to ensure projects are not stalled in the event that interim payments are delayed. This will ensure value for money and guarantee early returns on the client’s investments. Additionally, this research has also re-echoed the debate of establishing a special bank for construction. This has become necessary considering contractor’s little access to credit facilities as a result of the high risk and uncertainties associated with construction projects and the high default rate by contractors. Besides, this paper advocates for the re-establishment a special bank to meet the needs of contractors akin the defunct Bank for Housing and Construction (BHC) to enhance the chances of contractors receiving loans when payments delay. Meanwhile, its implementation is likely to hit a snag unless government carefully considers the numerous challenges that confronted the defunct BHC.

Although only school projects were investigated, the findings can be applied to other sectors considering their procurement arrangements are akin to how projects within the public sector are planned and executed. The findings of the research therefore present a unique opportunity in understanding the fundamental causes of overruns within public sector building projects. Knowledge of the extent of overruns is also expected to prompt the policy makers and project managers on the pervasiveness of overruns. As a recommendation for future research, projects executed within other sectors could be investigated and the results compared with the current findings. Besides, this research only investigated school projects which are not too complex. Further studies could be conducted to interrogate the reasons why complex projects overrun their duration and budget.

REFERENCES


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