Redefining cost control framework for construction budgetary management

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Abstract
Construction projects are regarded as successful if they are delivered at the right time, at an appropriate cost and to quality standard. Among these success factors, the issue of cost is very significant. The purpose of this paper is to propose a framework for redefining cost control procedure in construction budget management. This is with a view to addressing the incessant problem of cost overrun of construction projects. A review of the conventional cost control techniques and their appropriateness to the modern construction cost management process was carried out. Findings from the review of major projects around the world, using the conventional cost control methods revealed a significant cost overruns ranging up to 70% of the initial budget estimate. This signals the shortcomings of the existing cost control theories and procedures. A framework which provides an opportunity for taking proactive measures, at various stages of construction processes, is therefore proposed. The framework could serve as a basis for keeping the cost of construction projects within the estimated budget and checking the hitherto construction budget escalation.

Keywords: Framework, construction budget, cost control, cost overrun, redefining

Introduction
Historically, building projects are regarded as successful if they are delivered at the right time, at an appropriate price (cost) and to quality standard desired by the client (Chua et al., 1999; Ogunsemi, 2006; Yaman, 2007). This means that the projects have accomplished its technical performance, maintained its schedule, and remained within budgetary costs (Frimpong et al., 2003).

Construction budget is an approximation of project cost target which is refined throughout the cycle (from inception to completion). The Association of Project Managers (APM) (2006) defined budgeting as the process of estimating the cost of a proposed project and setting an agreed target. The Aqua Group (2003) defined cost control as all means of controlling the cost of construction projects within the limit of a pre-determined sum throughout the design and construction stages. It consists of all the controlling measures necessary to ensure that the authorized maximum expenditure on a project is not exceeded.

The purpose of cost control is to enable the employer to satisfactorily fund their project; limit the expenditure to the agreed budget, achieve balanced design expenditure between the various elements of a building and ultimately provide the employer with value for money (Ashworth, 2010).

The importance of cost control to construction budget cannot be overemphasized. According to Siyanbola and Raji (2013), budget is a basic tool for the achievement of effective cost control. This is because the first step in cost control is to set up the target to be achieved and then use the cost control system to guide the achievement of the target (Sikka, 2003). William et al., (2000) cited in Siyanbola and Raji (2013) posited that cost control is a continuous process that begins with the budget. Similarly, Lockyer (2000) regarded cost control as the practice of comparing the cost of a business activity with the original cost (budget) in order to ascertain if the cost is as planned.

Ashworth (2010) affirmed that the “RIBA Plan of Works” described the activities required in a construction project starting from the beginning of the process, when the client’s requirements are appraised by the project team, through to the post construction stage, when the facility is in the operation by the end-user. The plan of work was developed with the traditional procurement route in mind with the architect taking full charge and other
consultants making subservient contributions to project design. In this arrangement, the contractor was kept very much out of picture because he was not allowed to contribute to the design. However, considerable progress in attitude has been made since the plan of work was first published in line with the requirements of key tasks within each stage together with the list of possible contributors to the stage. Thus, there is the need to update the cost control framework to take account of modern procurement requirements like the early involvement of the contractor. It was against this background, therefore, that the paper was written to redefine and document the cost control framework.

**Budgeting for construction projects**

Budget is a formal statement of the financial resources set aside for carrying out specific activities in a given period of time. Ferry *et al.*, (1999) and Hendrickson (2008) opined that the initial budget estimate and all subsequent budget estimates should allow for all capital, life cycle and whole life costs in connection with the project, e.g. in-house costs, consultancy costs, land costs, legal costs, design and construction costs, fit-out costs, concession payments, decommissioning costs, Value Added Tax (VAT), loan charges and, depending on the procurement route, operation and maintenance costs.

A primary measure of success in preparing budget estimates is predicting the project outcome accurately at project inception. Without the ability to predict the outcome of a project with some degree of accuracy, it is not possible to determine which solution offers the best value for money. Anigbogu *et al.* (2007) contended that the first step toward ensuring that problems are avoided in construction process is the production of accurate cost estimates. The consequence of bad estimate at the early stage of a construction project according to Ashworth (2010), Ibrahim (2003) and Lowe *et al.* (2006) includes embarking on an infeasible project and rejecting hitherto feasible project. It has been suggested by Ogunsemi (2006) that a difference of 10% between tender sum and final account is considered an excellent performance. Unfortunately this contention cannot be said to be realistic going by the various studies (Le-Hoai *et al.*, 2008; Flyvbjerg *et al.*, 2009; Nkado, 2010) carried out so far on the subject matter especially in the developing countries where construction project budgets have increased astronomically.

A budget is about a future event and therefore involves uncertainty. As such, a good budget usually has a contingency associated with it to cover risks and uncertainties. One particular problem in forming a project budget in terms of cost account is the treatment of contingency amounts. These allowances are included in project cost estimates to accommodate unforeseen events and the resulting costs. Realistically, a budget accounting item for contingency allowance should be established whenever a contingency amount is included in the final cost estimate. The challenge here is that in most cases the amount included is often set by using arbitrarily chosen percentage of capital expenditure (Chapman, 1990). A percentage inclusion may not be appropriate for all projects. In an attempt to correct this, Dada and Jagboro (2007), in their study, proposed a framework for determining contingency additions different from the arbitrary traditional approach. This involved the approach of using the procurement method used as a basis for contingency addition. For traditional procurement method, which was found to be the most commonly used in Nigeria, sixteen percent (16%) was suggested. Others include design and build—nine percent (9%), management contracting—twenty five percent (25%) and direct labour thirteen percent (13%).

**Escalation of construction budgets**

In the execution of any construction project, cost of the project is an important factor in terms of the success of the project. Even though contract sums are based on estimates, this does not represent what the final cost would be. It has been shown in recent times that these figures differ considerably and in some cases very high (Le-Hoai *et al.*, 2008; Flyvbjerg *et al.*, 2009; Nkado, 2010). The incessant increase in the cost of construction projects over and above what is budgeted for in the contract has been a major concern to the construction industry as a whole.

Delay and cost increase are common phenomena in construction projects worldwide. Major projects, around the world, have consistently presented immense challenges, particularly on cost overruns (Nkado, 2010). Flyvbjerg *et al.* (2009) in their study of major projects in 20 countries showed that nine out of ten projects had significant cost overruns of up to 70% of initial estimate. Famous examples include the Sydney Opera House which was completed ten years later than scheduled at 1,400% higher than initially budgeted (AUS$7 million AUS$102 million), a world record. In South Africa, the Gautrain project commenced at an initial estimate of
R7 billion and is projected to be completed at R25.4 billion (US$3.3 billion).

Construction cost escalation is especially severe in developing countries (Le-Hoai et al., 2008). In Nigeria, it has almost become a norm that a project cannot be completed at the agreed contract sum going by the myriad of major and notable projects with more than 50% cost overruns. Omoregie (2006) revealed that the minimum average percentage of escalation cost of projects in Nigeria was 14%. Ayodele and Alabi (2014)’s study of the effects of cost control on public and private developer’s cost performance revealed that 89% and 100% of the eighty nine (89) assessed projects for public and private project respectively in Nigeria experienced cost overrun. The Federal Executive Council of Nigeria put the cost of construction and procurement of contracts in Nigeria at between 20 to 30 per cent higher than what is obtainable in other parts of the world (Nigeria Exchange News, 2010). Take for example; the Escravos Gas-to-Liquids Project in Niger Delta had escalated to $5.9bn from the initial $1.7bn (Global hydrocarbon Industry, 2012). The way billions of naira are mentioned in construction project values in Nigeria has become so banal that very soon, experts believe, they are likely to escalate to trillions of naira, even though the values do not appear realistic in relation to the contracts in question. Thought the problem, which is rooted in multifaceted factors, may well be beyond the industry but it can also be traceable to improper cost control and management.

Concept of construction cost control
The concept of cost control has to do with the application of measures necessary to ensure that the authorized maximum cost of the project is not exceeded. This is to enable the employer to satisfactorily fund their desired building project by knowing how much it is going to cost them and when they will have to pay. The objective of cost control is not only the determination of probable cost of construction works but also to closely relate the cost to operation on site and to ensure that the client’s budget is not in any way exceeded.

Most clients prepare work limits for their works and it is always arrived at by the amount of money the client has for the project. The cost limit must be a realistic figure and the architect must also be determined to produce a design within the cost limit for cost control to be properly carried out in any proposed project. Since the main aim of cost control of construction project is to keep the total expenditure within the amount agreed by the client; there is therefore the need for strict cost discipline throughout all stages of design and execution to ensure that the initial estimate, tender figure and final account sum are all closely related. For control and monitoring purposes, the original detailed cost estimate is typically converted to a project budget, and the project budget is used subsequently as a guide for management.

Existing framework for construction cost control
Cost control procedures covers the methods and procedures used in budgeting, procuring, and controlling the cost of construction projects, as well as forecasting, monitoring, and appraising project cost performance. The Aqua Group (2003) regarded it as a continuous process from inception to the completion of a project. According to (Seeley, 1996), this process is often separated into pre-contract and post contract control. The pre contract control can be summarized as approximate/preliminary cost estimation and cost planning (which incorporates cost check and cost reconciliation). The post contract control involves cost monitoring, cost checking, cost reporting and cash flow analysis. The sequential approach to construction cost control procedure is as highlighted in Figure 1.

Pre - contract cost control
The necessary first step is to operate an effective cost control procedure during the design stage of a project to keep the total cost of the job within the client’s budget. The implementation of effective cost control procedures enables the architect to be kept fully informed of the cost implications of all his design decisions. It necessitates close collaboration between the architect and the quantity surveyors throughout the design stage (Seeley, 1996).

Approximate/ preliminary estimating
The object of approximate or preliminary estimating is to produce a forecast of the probable cost of a proposed project before the project has been designed in details (Harris and MacCaffer, 2001). A preliminary estimate is often required when there is little or no information, as such; it is usually based on unit cost, floor area cost or volume cost. The primary function of approximate or preliminary estimate is to produce a forecast of the probable cost of a future project before the building is design in detail. This
can be regarded as the bases for which construction budgets are normally based. The detailed procedure to be adopted in pre contract cost control will be governed, among other things, by way in which the initial budget is established (The Aqua Group, 2003).

**Cost planning**

Cost planning is concerned with planning and monitoring costs during the investigation, planning and design stages, and finishes at the point where tenders are received, or a contract entered into. During this stage nothing is irrevocable, drawings can be redone, the scheme can be reduced in size or its configuration altered, the whole process can be started again from scratch or postponed or even totally abandoned at what will be negligible cost (from the point of view of the total project) for abortive professional works (Ferry et al., 1999)

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**Figure 1:** Sequence of cost control procedures
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Source: Seeley (1996)
Post - contract cost control

During the execution of a project, procedures for project control and record keeping become indispensable tools to managers and other participants in the construction process. These tools serve the dual purpose of recording the financial transactions that occur as well as giving managers an indication of the progress and problems associated with a project.

Cost is controlled during the execution of the construction contract and it is as important as the pre-contract stage. The basis of post contract cost control is to report at regular intervals or occasionally so as to set out clients likely final cost commitment in some detail and also the cost consequences of any remaining major options. To exercise cost control, project manager need to review and act on the best and most appropriate cost information. This means that they should receive regular, consistent and accurate cost reports that are both comprehensive in detail and presented in a manner that permits easy understanding of both status and trends. Reports need to be tailored to suit the individual needs of each project and should always be presented to give a comparison of the present position with the control estimate.

Real time cost control

To control cost is an obvious objective of project managers, but it should be recognised that no amount of paper work achieves this control (Harris and MacCaffer, 2001). The decision of manager that something must be done differently, and the translations of that decision into practice are the actions that achieve control. According to Ferry et al., (1999), it is important that the cost control process continues to the point of completion and hand over of the project. This differs from design cost planning in that the major expenditure is currently being incurred. The purpose of this is to properly assess the cost implication of any change during the construction stage in order to avoid undue escalation on the cost of such project.

The final or detailed cost estimate provides a baseline for the assessment of financial performance during the project. To the extent that costs are within the detailed cost estimate, then the project is thought to be under financial control. Specific items in the detailed cost estimate become job cost elements. Expenses incurred during the course of a project are recorded in specific job cost accounts to be compared with the original cost estimates in each category. Thus, individual job cost accounts generally represent the basic unit for cost control. Hendrickson (2008) illustrated the application or real time cost control. The author gave one possible non-linear relationships derived from experience in some particular activity (Figure 2). The progress on a new job can be compared to this historical record. For example, at 40% completion in Figure 2 suggests a higher expenditure than is normal for the completion proportion. This point represents 40% of work completed with an expenditure of 60% of the budget. Since the historical record suggests only 50% of the budget should be expended at time of 40% completion, a 60 - 50 = 10% overrun in costs is expected even if work efficiency can be increased to historical averages. If comparable cost overruns continue to accumulate, then the cost-to-complete will even be higher.

Budget update

Cost control is an activity that continues throughout the lifetime of a project. Periodic updating of future activity durations and budgets is especially important to avoid excessive optimism in projects experiencing problems. For cash flow planning purposes, a graph or report similar to that shown in Figure 3 can be constructed to compare actual expenditure to planned expenditure at any time. This process of re-scheduling to indicate the schedule adherence is only one of many instances in which schedule and budget updating may be appropriate. Expected cost changes should be propagated throughout a project plan. In essence, cost estimates for future activities should be revised in light of the actual experience on the job (Hendrickson, 2008).

Unfortunately, most project cost control and scheduling systems do not provide many aids for such updating. What is required is a means of identifying discrepancies, diagnosing the cause, forecasting the effect, and propagating this effect to all related activities. While these steps can be undertaken manually, computer aids to support interactive updating or even automatic updating would be helpful (Levitt and Kunz, 1985). Beyond the direct updating of cost estimates, project managers should have mechanisms available for evaluating any type of schedule change. Updating activity duration estimations, changing scheduled start times, modifying the estimates of resources required for each activity, and even changing the project network logic (by inserting new activities or other changes) should all be easily accomplished.
Conceptual framework to redefining cost control procedures

Following the review of various literature on cost control procedures, a conceptual framework - redefining the cost control procedures for cost management systems of modern construction is proposed. This is presented in Figure 4. The framework leverages cost management procedure as the overarching process which coordinates the underlying varying cost control tasks at pre and post contract stages. At different stages in the cycle, each of the underlying tasks may occur and overlap with each other based on a variety of factors which may relate to project and stakeholder specifics. These varying tasks, while discrete, are often intertwined due to certain dependencies on each other. The proposed framework provides an opportunity for pro-active measures to be taken at various stage of construction process which will go a long way to impacting, positively, the issue of cost and budget monitoring. This is with a view to checking the hitherto construction budget escalation, especially, in the developing economies.

Preconstruction stage (pre - contract cost control)

Project Team Initial Meeting (PTIM)
The Project Team Initial Meeting (PTIM) includes all the activities necessary for the project to take off. This meeting would follow definition of the base elements for the project and other project planning activities. TutorialsPoint (2014) called it a project kick-off meeting and described it as the best opportunity for a project manager to energise his or her team. During this meeting, the project management can establish a sense of common goal and start understanding each individual. This meeting introduces the members of the project team and the client and provides the opportunity to discuss the role of each team member. Other base elements in the project that involve the client may also be discussed at this meeting (schedule, status reporting, etc.). This will afford the design team and the owner to obtaining an understanding the concept of the project particularly as it affects cost. During this phase, the project management team will review all production drawings; discuss contractor/sub-contractor pre-qualification and bid solicitation and award requirements; evaluate initial guaranteed price proposals (as design progresses); establish final guaranteed price proposal (based on complete designs and specifications); detailed cost estimation; and budgetary analysis of cost estimate.

Figure 2: Illustration of Proportion Completion versus Expenditure for an Activity.
Source: Hendrickson (2008)

Figure 3: Illustration of Planned versus Actual Expenditures on a Project.
Source: Hendrickson (2008)
The summary of this phase is to establish the business case for the investment of resources in the project and to analyze and justify its costs and benefits. At the end of the PTIM, a review is conducted and summary of resolutions are documented for future consideration.

**Project Team Progress Meetings (PTPMs)**

The Project Team Progress Meetings (PTPMs) are status meetings where the project management team is able to gather project performance information about the activities that are underway. Key tasks here are: review of project drawings and specification; ongoing design suggestions; ongoing value engineering cost analysis and preliminary/budget estimation at specified intervals.

**Construction stage (post-contract cost control)**

Construction or project execution consists of the processes used to complete the work defined in the project plan to accomplish the project’s requirements. The process involves coordinating people and resources, as well as integrating and performing the activities of the project in accordance with the project budgetary plan. At this point, the task is to put in place a structure or technique that is focused on identifying and managing events and
event chains that affect project schedules. This helps to mitigate the negative impact of psychological heuristics and biases, as well as to allow for easy modeling of uncertainties in the project schedules. This will involve Stakeholders Regular Meetings (SRMs) (which will involve the owners, consultants and sub-contractors/suppliers) and Stakeholders Periodic Evaluation and Assessment (SPEA).

**Stakeholders Regular Meetings (SRMs)**

The SRMs provide the platform for problems, clarifications and conflicts to be discussed. These meeting serve as a venue to review project progress and to assist with resolving outstanding issues encountered since the last meeting. Additionally, these meetings provide another venue for client and project management team to review current and projected needs. As the work develops and tasks are introduced, necessary adjustment are made on resources and field inspection forces accordingly in order to achieve the proper cost-effective level of construction management and inspection. These are necessary to see to effective monitoring and management of cost as the work progresses. SRMs are also very important simply because we know that things don’t always go according to plan (no matter how much we prepare). The essence of this is to detect and react appropriately to deviations and changes to plans. At this phase, the beginning and completion of project activities is reported. In addition, the status of any activities that are underway is communicated to the rest of the project management team. Key tasks at this stage are: submit and evaluate updated schedules; submit change order logs; management of project risk including the development of contingency plan and management of resources utilization and initiating corrective action when necessary.

**Stakeholders Periodic Evaluation and Assessment (SPEA)**

As part of monitoring, the performance of a project is reviewed at regular interval (APM, 2006). SPEA is a task which is necessary to identifying and taking corrective measures for any eventualities that can have negative impact on the planned budget. Over the course of any construction project, the work scope may change. Changes is a normal and expected part of the construction process. Changes can be the result of necessary design modifications, differing site conditions, material availability, contractor- requested changes, value engineering and impacts from third parties (PMI, 2010). When changes are introduced to the project, the viability of the project has to be assessed. It is important not to lose sight of the initial goals and targets of the projects. When the changes accumulate, the forecasted result may not justify the original proposed investment in the project.

The process oversees all the tasks and metrics necessary to ensure that the approved and authorized project is within the budget scope. This process involves comparing actual cost performance with planned cost performance and taking corrective action to yield the desired outcome when significant differences exist. The actual cost performance achieved on a project activity seldom precisely matches the estimated cost performance set at the time of project planning (Project Management Guru, 2013). As such, it is imperative for the project management team to identify the variances in order to know what is actually happening on the project. This process is continuously performed throughout the life of the project.

The specific tasks here will include submission and evaluation of periodic pay applications; establishment of budgetary control outlines based on conceptual estimates; establishment of value engineering alternatives and options; provision of periodic estimates update to check budget compliance.

**Conclusion and recommendations**

This paper has critically reviewed the various cost control measures and their application to modern construction management process. Several attempts have been made to proffer solution to the problem of cost overrun of construction projects. The existing theories and techniques seem not to have offered a satisfactory solution to the problem. From the findings of a review of the existing theories of cost control procedures; a conceptual framework, redefining and summarizing cost control procedures that can meet the modern construction cost management system, is proposed. The proposed framework provides an opportunity for pro-active measures to be taken at various stages of construction processes and can go a long way to impacting, positively, the issue of cost and budget monitoring. This could serve as a basis for keeping the cost of construction projects within the estimated budget and checking the hitherto construction budget escalation.
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