

Factors Affecting Cost and Inflation of a Project

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Abstract - Cost estimation is an assessment of the expected cost of any construction project. The accuracy of such estimate has a serious effect on the expected profit of the construction contractor. Hence, a certain contingency premium should be added to the base estimate to increase the level of confidence. Such premium is materially affected by many factors. Maintaining steady cost projection on construction projects had been until recently an issue of serious concern, both to the clients and project contractors. Cost deviation from initial cost plan, had been prevalent on construction sites. This study therefore assesses the major factors affecting construction project cost with a view to enhancing construction project procurement and delivery. Related literature were reviewed to aids the direction of this study.

Key Words: Construction Project Cost, Construction Industry, Client, Project Procurement.

1. INTRODUCTION

Many factors affect the accuracy of building construction projects cost estimating which should be considered in the early stage of the estimating process. Some factors can incorrectly increase the estimated costs and the possibility of contractual disputes between the various parties involved. Other factors can help the estimator to decrease the unnecessary cost of an item and hence lead to successful tendering in a very competitive market.

Construction industry is very important in the economic development of any nation especially in expanding economy like India. It controls the capital flow, as well as labour resources, which had cost implications. As a result of this, proper management of these resources is considered an important aspect of project works. Likewise if the resources are adequately harnessed, issues that relate to cost overrun would not arise which could result to variations and claims. Some firms rely on claims as a result of variation incurred during the course of the project execution and afterward evaluate their profit after incurring necessary and unnecessary costs on a project.

Therefore, accurate estimating requires detailed study of the bidding documents and the environmental situation. It also involves a careful analysis of all projects' data in order to arrive to the most accurate estimate of the probable cost consistent with the bidding time available and the accuracy and completeness of the information submitted.

The purpose is to test whether the project as specified will be economically viable or whether it will generate good value for money. Leaving such feasibility studies until after a project has started, may mean that potential problems are not revealed in time to influence project planning. Although the economic and financial evaluation of the project is probably the most obvious element of the feasibility stage, external factors can play a major role in determining whether a project will proceed. The project's political context, its relationship with the local community, the general economic environment, its location and the physical conditions in which it will be built, are the most important external factors.

2. LITERATURE REVIEW

It is expected that the accuracy of cost estimating has a significant effect on construction industry. For instance, it may have a serious effect on contractor ability to compete successfully with other contractors. It also has an important effect on contractor's profit. Therefore, this research is an attempt to identify the most important factors affecting the accuracy of cost estimating in building construction projects. Such factors should be taken into consideration when preparing cost estimating for any future project. This chapter represents some cost estimating definitions. It also gives some details about cost estimating types, and finally it mentions previous work in order to get a predetermined list of factors that may affect building construction projects cost estimating.

2.1 Elements of Cost Estimating

1) Direct Cost:

Costs of completing work that are directly attributable to its performance and are necessary for its completion. In construction, the cost of installed equipment, material, labor and supervision directly or immediately involved in the physical construction of the permanent facility (AACE 2013).

2) Indirect Cost:

Costs not directly attributable to the completion of an activity which are typically allocated or spread across all activities on a predetermined basis. In construction it is costs which do not become a final part of the installation, but which are required for the orderly completion of the installation and may include, but are not limited to, field administration,

direct supervision, capital tools, start-up costs, contractor's fees, insurance, taxes, etc. (AACE 2013).

3) Markup:

As variously used in construction estimating, includes such percentage applications as general overhead, profit, and other indirect costs. (AACE2013).

2.2 Types of Cost Estimating

A project goes through different levels of estimates based on its development stage. Estimates are performed throughout the life of the project (Peurifoy and Oberlender 1989). As shown in Fig. (1) and beginning with the first estimate and extending to the various phases of design and into construction it is important to note that there are different types of cost estimating as the construction project advance. Detailed estimate cannot be made based on computed quantities at the concept, preliminary design stage, since the project is not yet defined. On the other hand, the estimates process will be more expensive as more detailed and accurate techniques are implementing.

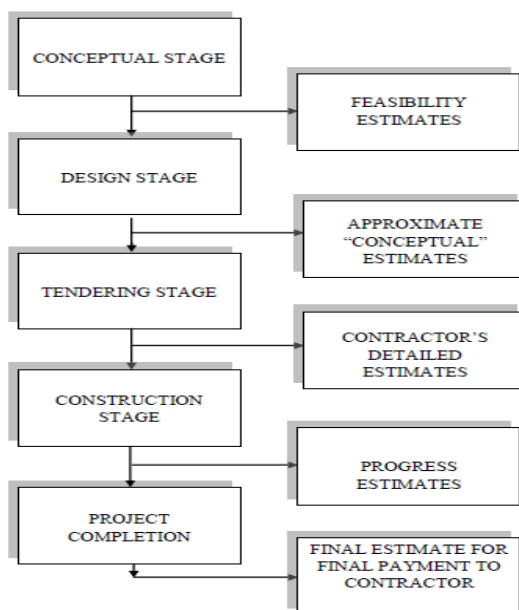


Figure -1: Types of Cost Estimating

2.3 Financial Issues

“One of the primary factors resulting in accurate estimates is the change of resource prices due to variation of economic conditions in time” (Hwang 2009).

Neufville et al. (1977) stated that estimating bias changes from year to year. These changes seem to coincide with what these authors term "good" and "bad" years (good and bad being defined as years with the greatest and least activity for contractors).

Collier (1987) emphasized the importance of the demand for construction works. He stated that: "It would be wrong to give the impression that all estimates and bids for construction work are made up of costs of labors, materials, equipment, job overhead costs, and operating overhead costs. All estimated from determined facts and calculated probabilities, and with a profit margin precisely computed according to current economic indicators".

Liu and Wang (2010) focused in their research on punctuality of cash flow. They stated: "The concern focuses not just on the amount of cash flow but also on its timing, which is critical to effective budget management during construction."

2.4 Project Characteristics

Smith and Jolly (1985) examined the factors that should be taken into account in estimating the cost and tendering for buildings and civil engineering works. These involve the following factors:

1. The output of mechanical plant is variable, for some plant operators are more efficient than others. This is particularly applicable to plant where the operator is himself chiefly responsible for the output concerned, such as mechanical excavating plant of the skimmer, shovel, tractor and scraper type.
2. The output of labour, both skilled and unskilled, is variable, for one man produces more of a similar kind in a given time than another.
3. Weather conditions have a marked effect upon output. Under wet weather conditions, the output of excavation in particular is reduced. For site conditions become soft and heavy, excavating plant tends to become clogged, while internal transport on open sites becomes energetic.

Strandell (1978) emphasized the importance of productivity in construction. He stated that: "There is general agreement by owners, engineers and contractors that productivity in the construction industry is a problem worthy of serious study. There is no question as to its effect on the cost and time involved in completing a constructed facility."

Inessa Lukmanova, Natalia Yaskova, Authors believe that shocks from crises in any national economy in general and construction industry in particular promote the development of construction companies upon condition that they use all visible and hidden opportunities to full extent, opportunities that fully develop the potential of economically effective transformations of internal and external environment of investment and construction industry.

Koehn (1985) emphasized climatic effects on construction. The relationship between overall construction productivity, and temperature and humidity are presented in his paper.

2.5 Factors Which Change Cost Overtime

Once implementation begins, a project's costs rarely remain static. As further information becomes available the costs may be further defined. Yet, even when a cost has become firmly fixed, there are numerous factors that can lead to the cost increasing. Delays are a major factor. In the funding, time and cost over-runs have obvious implications for the number of projects that can be funded within a period, and for the scale of the outputs and impacts generated. Research carried has found that many ERDF projects experience a range of problems in both the pre-construction and implementation stages. These lead to projects overrunning either in time or costs. As indicated above, delays generally translate into higher project costs. A key consideration in the funding is the time at which an application for funding is actually made. Applications can be made at three main points in time:

- Very early in the construction cycle when broad cost estimates only are available.
- On the basis of tender prices for the work to be undertaken.
- Retrospective bids where the project has been completed but grant is still required.

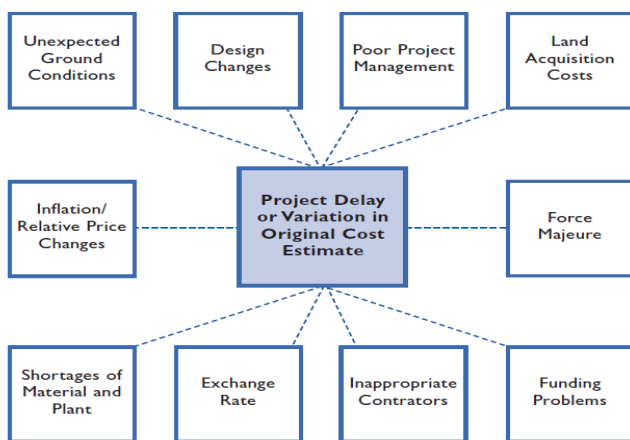


Figure -2: Cost Changing Factors

3. METHODOLOGY

This section presents the research methodology which will be employed in the development and execution of this research study. Data collection survey will be carried out to collect the data that is required, and then data analysis will be performed in subsequent stages of project.

3.1 Data Required

Data collection will be carried out on ongoing government projects to identify the most important cost estimating factors in the construction market.

Data will be collected in particular format where all the relevant data required for analysis will be mentioned in tabular format.

Analysis of relevant data of a selected sample of building construction projects will help to show how the previously identified cost estimating factors can affect the accuracy of the cost estimating process. Cost variance is an indicator for the accuracy of the cost estimating process.

Finally, based on this analysis, some recommendations will be provided to improve the accuracy of the cost estimating process.

3.2 Cost Monitoring and Control Techniques

The techniques of cost monitoring and control broadly fall into the following two categories:

- a) Direct cost control of resource utilizations, and
- b) Measurement of cost performance through earned value management (EVM).

Direct Cost Control

In this approach, the total project cost shall be divided into the following cost elements and control is exercised on these elements individually on each major items/subheads of the work:

- a) Physical progress
- b) Manpower control
- c) Material control
- d) Equipment control
- e) Sub-contractor control
- f) Cost of changes
- g) Consultants
- h) Other costs

Earned Value Management (EVM)

Earned value management (EVM) is a valuable tool for the cost and schedule monitoring and control of the construction projects. The technique is used as a tool for the measurement of current time and cost performance and forecast the future outcomes. Implementation of Earned value methodology provides the following information and enable managerial actions in situations of unfavourable cost and time performance.

- a) Adherences of the actual costs incurred to the budgeted costs and identify the cost over-run or under-run.
- b) Adherence of the time progress to the as planned schedule and identify the time over-runs.
- c) Over or under utilization of resources.

d) Forecasting likely completion cost based on observed cost trend.

3.3 Performance Parameters of Earned Value Management (EVM) Techniques:

The parameters of EVM that are used to measure the project cost & schedule performance are categorized into four groups: basic elements, measurement of variance, efficiency indices and forecasting parameters. Individual parameters are defined and explained in the following sections and illustrated graphically.

3.3.1 Planned Value (PV):

The first step in the application of EVM methodology is to develop the project baseline cost curve called planned value curve. It is the plot of cumulative budgeted cost of activities (defined in the project work breakdown structure) at the periodic intervals (for example, monthly) of the project duration. The cumulative costs at various project intervals are obtained from the month-wise summary of cost incurred on the activities. Since this baseline cost curve is obtained based on the 'budgeted cost of activities and as per planned' project schedule, this planned value curve is also termed as budgeted cost of work as scheduled (BCWS)

3.3.2 Earned Value (EV):

The term earned value (EV) indicates the value of work earned and this is obtained as the cumulative values of the quantum of the work actually executed in the activities multiplied by the corresponding budgeted unit costs of the respective activities. The quantum of the work executed in the activities at any given point of time (review date) could be as per planned quantity or at variance from the planned quantity. The earned value increases cumulatively as the activities gets completed along the project duration.

3.3.3 Actual Cost (AC):

The actual cumulative cost of activities at any given point of time (review date) is obtained from the quantum of work actually executed in the activities multiplied by the actual unit costs of the work in respective activities.

3.3.4 Cost Variance (CV):

The cost performance of the project is measured in terms of cost variance which is the difference between the earned value and the actual cost of the work carried out.

$$CV = EV - AC$$

$$CV$$

$$\text{Cost variance percentage} = \left(\frac{CV}{EV} \right) \times 100$$

$$EV$$

When EV and AC are equal, the project is on the budgeted cost. A negative and positive value of CV indicates the project cost over-run and cost under-run respectively. The cost overrun could be on account of lower productivity of labour and equipment and over consumption or wastage of materials. Negative CV could also be attributed to the inaccuracy of the original budget costs. Cost variance percentage indicates the cost over-run and cost under-run as the percentage of earned value. Negative and Positive cost variance % indicates percentage cost over-run and cost under-run respectively.

3.3.5 Cost Performance Index (CPI):

Cost performance index (CPI) measures the value of work completed compared to the actual cost incurred on the project. It measures the cost efficiency of the work completed.

$$\text{Cost performance index (CPI)} = EV/AC$$

CPI less than one and more than one indicates cost over-run and cost under-run respectively.

3.3.6 Forecasting Parameters:

There are three basic forecasting parameters in the EVM relating to completion costs. These are budget at completion (BAC), estimate to complete (ETC) and estimate at completion (EAC).

The other parameters are variance at completion (VAC), planned percentage complete (PPC), actual percentage complete (APC), to complete cost performance index (TCPI) and to complete schedule performance index (TSPI).

4. CONCLUSION

- i. Cost escalation factors were identified through a comprehensive literature review and will be analysed in detail through ongoing projects of public importance.
- ii. Identification of these cost escalation factors supports efforts to understand the causes of project cost escalation. This understanding permits the development of strategies, methods, and tools for better cost estimation and cost estimating management.
- iii. The cost analysis of projects will be computed using modern method of construction management i.e. by Earned Value Method (EVM) which was explained above.
- iv. Computation of cost analysis and understanding these factors will allow for appropriate actions to mitigate factor impacts.

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