

## Sensing early signals of variance between Standard cost and Actual cost of a Project

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The objective and target of achieving 7.4% economic growth rate and then improving the same progressively mandates that new projects need to be planned and implemented in all sectors to boost production, improve infrastructure and reduce reliance on imports in specific areas. However the experience of engaging with the projects by the banks over the last few years has not really been satisfactory as many projects were stalled, whereas other projects were impacted by time and cost overruns consequently impairing their ability to service the loans taken resulting in NPAs thus reducing the bank's ability to lend to other projects and affecting the overall growth of Indian economy. This was mainly due to the actual project cost far exceeding the Standard Project cost due to multitude of causes. There is an imperative need to prescribe a structure of developing Standard / base line cost of a project, its continuous monitoring including variance analysis, and effective implementation. This will throw up early warning signals enabling the banks to initiate timely recourse in the best interests of all stakeholders.

### Variance between Standard cost and actual cost of a project arises due to

1. Inappropriate approach in working out project cost
2. Inadequate consideration of the available standard project cost data
3. Ineffective project risk assessment and inadequate factoring of risks in project cost
4. Change in scope of the project midway
5. Delay in release of loan installments
6. Change in systemic factors such as inflation, government policies, and general economic conditions / environment in which the project was planned and implemented
7. Inefficient handling of the project

In this paper an attempt has been made to develop a framework for 'early warning system' for projects so as to be able to potentially prevent loans turning into stressed assets for the banks. A discussion on understanding of project life cycle, approaches for estimation of project costs, reasons for time and cost overrun, Checklist for appraisal of a project, and an approach to cost appraisal and monitoring follows.

### Key determinants of initial project costs

No two infrastructure projects will cost the same amount of

money no matter how similar they are. The key determinants of Project cost are: Project Specification, Location, Form of Procurement/Contract, Site Characteristics, New Build or Improvements, Timescale and Inflation.

There are two types of costs in a project, Direct costs: They are the costs that directly linked to item of work, include different resources: materials - labor - machinery and equipment - and the Subcontracting costs. Indirect costs: Are costs for resources that support more than one project but aren't readily identifiable with or chargeable to any of the projects individually. It includes: a) Indirect costs pertaining to work site such as; employee benefits, office space rent, general supplies, and the costs of furniture, and fixtures. b) Indirect costs pertaining to the company's management such as; salaries of your contracts department finance department, and top management as well as fees for general accounting and legal services,

The three major components of a Project Cost are:

- The base cost estimate
  - Contingency allowance
  - Management reserve
1. **The Base Cost** - best estimates of project costs at a specified date, assuming: Quantities of works, goods and services and relevant prices are accurately known, quantities and prices will not change during implementation, The project will be implemented exactly as planned. The base cost inter-alia include known costs such as: Civil, electrical, mechanical works, start up costs, building, facilities, land acquisition and resettlement, environmental mitigation, construction engineering, operation and maintenance costs, administration, consulting services, temporary facilities and transitional works, consumables, travel expenses, interest during construction, E-governance and project management.

### Estimation of project cost

Estimating project cost is a critical aspect of project planning. To prepare an accurate, thorough project plan, you'll need to estimate many things: how long it will take to do the work, how much the work will cost, how much money the project will save or make, the magnitude of the risk and uncertainty involved, and other aspects of the project. It becomes the baseline for subsequent cost control.

Cost estimation is the process of developing an approximation of

the monetary resources needed to complete project activities. This process involves estimating the costs of all of the resources that will be charged to the project.

### Potential Estimating Problems

The most important problems and challenges faced in the estimating process:

- a) Misinterpretation of scope-poorly defined requirements.
- b) Inaccurate Work Breakdown Structure of the project
- c) Failure to account for risks
- d) Poorly defined or overly optimistic schedule.
- e) Failure to recognize shortage of resources
- f) Failure to project for cost escalation and inflation
- g) Inaccurate pricing rates for overhead, general and administrative, and indirect costs
- h) Inexperienced project managers
- l) Failure to use the correct estimating techniques

### Estimating Methods

There are several methods to compute the cost of work (estimate), depending on several factors including: the quality and quantity of data available, the required accuracy, the time required to complete, and others. Following project cost estimation methods are commonly used:

- 1) Parametric:** Parametric modeling uses mathematical parameters to predict project costs. An example is building construction that is often estimated using a certain rupee amount per square meter of floor space, Clearly such estimates need to be qualified to enable external factors to be separately assessed and built into the estimates. This estimate relies on historical data-based on past jobs or experience.
- 2) Analogous:** The analogous estimating technique determines estimates for the current project based on the actual costs of previous projects that are similar in size and scope to the project in hand
- 3) Bottom-up :** A bottom-up approach estimates the cost of the individual work packages from the bottom row of activities of the work breakdown structure, then totals the amounts up each row until reaching an estimate for the total project.
- 4) Expert judgment:** Expert judgment is an estimating technique that relies on the experience of others to provide cost estimates. It involves consulting with experts who, based on their history of working on similar projects, know and understand the project and its application,
- (5) Probabilistic:** The deterministic cost estimating methods generally does not allow any flexibility in the estimating process, therefore, often the quantities and rates (and the

cost) are presented as a single value. However each cost element (quantity and/or rates) in the project schedule is subject to some level of variation over the project duration. This can be addressed by considering a range for cost elements rather than a single value in the estimate. The probabilistic estimating methods generate estimates taking into account that quantities measured (or allowed for) can change, rates assumed can vary and risks with a probable outcome can materialize. Probabilistic estimating methods involve running a large number of iterations of different combinations of cost contributions from each element to build up a probability distribution of overall project cost.

- (6) Unit rate estimating:** Unit rate estimating calculates the cost of each item of the project by multiplying the quantity of work by historical unit rates. The unit rates are normally determined from a careful analysis of unit costs from recently completed projects of same type, with appropriate corrections. It is important to remember that the historical rates may include indirect costs such as contractor's management, risk, overheads and margins, which must be adjusted before applying to cost estimates. It involves the following two aspects:

**Understand historical data:** Cost information and statistical databases of previous projects (Historical data )is analyzed to determine:

- Prevailing market conditions at the time when the data was collected
- Peculiarities of the project from which the data was collected
- Legal environment prevailing at the time the data was collected
- An approximate allowance for contractors on and off site overheads and profit (if available)
- The project delivery method.

**Adjust historical data:** Historical data must be adjusted for the following factors before using the same for developing baseline / standard cost of the proposed project

- Inflation or historical escalation rates
- Site conditions
- Site location
- Project variation
- Effects of government legislation
- Changes in policies and specifications at the time of project delivery
- Contractor's on-site/off-site overheads and profit margins
- Method of project delivery- BOT, PPP

- 2. Contingency :** Contingency is a financial reserve included in

the project's estimate to offset uncertain or unpredictable factors relating to the delivery of project objectives. In terms of managing risk on a project, it can take many forms - it may be a time allowance in the program of works for delay or a cost allowance in the project cost estimate to account for the residual risk. Contingency amounts are not meant to cover all eventualities. It is important, therefore, to understand the limitations imposed. Contingencies are only related to circumstances within the approved scope of the project. In the event that there are any changes to project scope during the process, the project intent will need to be re-justified.

- **Project cost Escalation:** Escalation is a provision in actual or estimated costs for an increase in the costs of equipment, material, and labor from a set point in time and is due to a continuing price change over time until the completion of the project. Escalation does not cover hyper-escalation, that is escalation which is over and above what is expected as per available / published indices, Hyper-escalation should be covered by contingency and allocated based on the perceived risk.
- **Managing Escalation:** As can be seen, cost escalation in projects is a cumulative effect of a number of different factors. While each of them may contribute only a small amount to the overall cost of a project, when combined they are a significant driving force behind the rising costs of building a new building. Because there are so many factors contributing to escalation, managing escalation requires a variety of strategies. The first step is to recognize that escalation is a real threat to construction programs and projects, and to acknowledge its existence. There is still a high degree of wishful thinking in project budgeting, hoping that it is not going to remain high.
- **How do we set Contingency?:** Contingency is only meant to cover the project development as it has been described in the scope and basis of design, which at the current state of project definition cannot be accurately quantified, but which history and experience show will be necessary to achieve the given project scope. Contingency Allowance - is money set aside for responding to identified risks in addition to the base cost estimate.
  - Physical contingencies – to cover physical uncertainties beyond the base case to complete the project. Often calculated and expressed as percentages of base costs.
  - Price contingencies – to cover inflation and price uncertainties. Some typical levels of Physical Contingencies:
    - 5% - standard equipment designs/definable civil work.
    - 10% - general civil works with routine and predictable uncertainties e.g, roads, buildings, pipelines, transmission lines
    - 15% - plant and civil works in difficult terrain.

### 3. Management reserve: covers things that could not have

been foreseen, such as changes to the scope of the work or unidentified risks. The more the uncertainty, the more management reserve is required. Highly innovative work will need a larger management reserve than routine work.

#### An Approach to Project Cost Appraisal

The following appraisal check (Project interrogation) is a useful framework for effective appraisal of a project. The purpose of this section is to provide a set of questions to the project appraiser and issues to consider when appraising project applications which have the potential of throwing up early warning signals.

#### Risk Issue 1: Project Specification & Feasibility

The key issues concerning the project's specification and feasibility relate to the need for the project which should be clear, consistent and achievable. Simple questions should be asked such as:

- Where is the project being undertaken?
- What exactly does the project comprise?
- Why is the project being undertaken?
- What previous phases have already been undertaken?
- Is this project directly dependent upon any other project?
- Who is undertaking the project and over what time period?

#### Risk Issue 2: Outline Design

At the outline design stage, the key issues are whether the size of the project matches the identified needs, or whether it is over-designed. If cost estimates are based on outline designs only, then the potential for costs to change is greater than if they had been finalized. It would also be appropriate for a Risk Assessment Study to have been undertaken by this stage. This would show that the project sponsor was aware that specific risks existed which could affect project costs

#### Risk Issue 3: Consents and Land Acquisition

The appraiser should be aware of what stage the project sponsor has reached with regard to consents and land acquisition. A project can experience considerable delays which may affect costs if the appropriate planning, environmental and other consent procedures have not been adhered to. As regards land acquisition it is important that the appraiser is aware of whether all claims have been settled or if there are any appeals over compensation. If appeals have not been settled then there is a high probability that any original land acquisition costs will be an underestimate.

#### Risk Issue 4: Detailed Design

At the detailed design stage the form of contract and the

respective roles of project sponsor and contractor in bearing risk for the ultimate project cost, are matters that appraiser should inquire about. Appraiser should check whether ground investigations have been undertaken. If these have not been done, then the risk of cost over-run increases and the contingency should reflect this.

### Risk Issue 5: Project Construction

During the construction phase, there needs to be a project management structure in place which allows frequent reporting of progress to be made between the contractor and the project sponsor. Most of the time and cost over-run factors that can occur, do so during the construction phase. The appraiser must therefore establish that the main risks taken into account in the contingency calculation are being managed on site

**Cost Risk Allocation**—The dominant escalator in the current market is poor cost risk allocation. This can be handled by:

- Pre-purchase materials, to limit the impact of future price fluctuations.
- Providing dedicated float for schedule slippage by understanding that, due to the current market and transient material shortages, some scheduling delays may be inevitable.
- Reducing the bid award period to accommodate shorter price locks.
- Delay the bidding of non-essential packages, so that when those items are bid, prices can be closer to actual costs at the time they are needed
- Negotiate subcontracts along with the contractors.

### Effective Project management and control

Rational contingency planning can never be a substitute for good project management. The essential elements of good project management are:

- **Time control:** managing the design and construction processes so that the project is completed on or before the agreed completion date.
- **Quality control:** ensuring that the quality and performance of the completed project meets the project sponsor's original objectives.
- **Change control:** ensuring that any changes that are necessary are achieved within the approved budget, that they represent good value for money and that authorization to proceed has been obtained from the project sponsor.
- **Cost control:** Project cost control is concerned with ensuring that projects stay within their budgets, while getting the work done on time and as per given quality specifications. Cost control has been a vital function of management, but only too frequently is the term confused with more cost reporting. The cost report is usually part of every manager's monthly report to his superiors, but an account of the past month's

expenditure is only stating historical facts. What the manager needs is a regular and up-to-date monitoring system which enables him to identify the expenditure with specific operations or stages, determine whether the expenditure was cost-effective, plot or calculate the trend, and then take immediate action if the trend is unacceptable.

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. The problems of project control are aptly summed up in an old definition of a project as "any collection of vaguely related activities that are ninety percent complete, over budget and late." The task of project control systems is to give a fair indication of the existence and the extent of such problems.

For cost control on a project, the construction plan and the associated cash flow estimates can provide the baseline reference for subsequent project monitoring and control. For schedules, progress on individual activities and the achievement of milestone completions can be compared with the project schedule to monitor the progress of activities. Contract and job specifications provide the criteria by which to assess and assure the required quality of construction. 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*. Overruns in particular cost categories signal the possibility of problems and give an indication of exactly what problems are being encountered. Expense oriented construction planning and control focuses upon the categories included in the final cost estimation.

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. 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. Alternatively, job cost accounts may be disaggregated or divided into *work elements* which are related both to particular scheduled activities and to particular cost accounts.

In addition to cost amounts, information on material quantities and labor inputs within each job account is also typically retained in the project budget. With this

information, actual materials usage and labor employed can be compared to the expected requirements. As a result, cost overruns or savings on particular items can be identified as due to changes in unit prices, labor productivity or in the amount of material consumed.

#### Forecasting for Activity Cost Control

For the purpose of project management and control, it is not sufficient to consider only the past record of costs and revenues incurred in a project. Good managers should focus upon future revenues, future costs. In forecasting of future costs, costs are reported in five categories, representing the sum of all the various cost accounts associated with each category:

- **Budgeted Cost:** The budgeted cost is derived from the detailed cost estimate prepared at the start of the project
- **Estimated total cost:** The estimated or forecast total cost in each category is the current best estimate of costs based on progress and any changes since the budget was formed. Estimated total costs are the sum of cost to date, commitments and exposure.
- **Cost Committed and Cost Exposure:** Estimated cost to completion in each category is divided into firm commitments and estimated additional cost or *exposure*. Commitments may represent material orders or subcontracts for which firm dollar amounts have been committed.
- **Cost to Date:** The actual cost incurred to date is recorded in column 6 and can be derived from the financial record keeping accounts.
- **Over or Under cost :** Indicates the amount over or under the budget for each category. This column is an indicator of the extent of variance from the project budget; items with unusually large overruns would represent a particular managerial concern.
- **Cost Overrun :** It is defined as excess of actual cost over budget. Cost overrun is also sometimes called "cost escalation," "cost increase," or "budget overrun". Cost overrun is defined as the change in contract amount divided by the original contract award amount This calculation can be converted to a percentage for ease of comparison.
- **Actual cost of work performed (ACWP):** is the actual cost expended to perform the work accomplished in a given period of time.

- **Budgeted cost of work performed (BCWP)** is the budgeted cost of the work *completed* in a given period of time.
- **Budgeted cost of work scheduled (BCWS)** is the budgeted cost of the work *scheduled* to be accomplished in a given period of time (if a baseline schedule were followed).

A next step would be to look in greater detail at the various components of these categories and carry out variance analysis periodically to identify potential or incipient warning signals. Overruns in cost might be due to lower than expected productivity, higher than expected wage rates, higher than expected material costs, or other factors. Even further, low productivity might be caused by inadequate training, lack of required resources such as equipment or tools, or inordinate amounts of re-work to correct quality problems.

#### Conclusion

Wide variance between standard and actual cost of installation of the project is a commonly observed phenomenon in projects. The major influencing factor are poor site management and supervision, problems with sub-contractors, inadequate planning and scheduling of project, problem associated with material management and lack of coordination among stakeholders. Other factors such as bad weather, scope of work, equipment cost and usage, cash flow management and decision making policy also affect the project schedule and cost up to a certain extent. These factors may vary for different projects, places and country. Project management techniques such as, fishbone diagram, effective material management, resource smoothing and leveling ,monitoring and scheduling, proper coordination between the parties can be effectively leveraged for attempting to keep the project on track.

The understanding and use of the project appraisal, monitoring and implementation framework and approach as explained in this paper would enable identification of stress, deficiencies, inherent and built up of vulnerabilities in the project which can act as an early warning signal for all stakeholders and provide an opportunity for a considered response to avoid the project getting stalled or become a non performing asset for the financiers.

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