Cost and Schedule Performance in Construction Projects – Case Study of Mumbai Region of India

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Abstract- *In construction industry time and cost performance are the fundamental criteria for success of any project. Unfortunately construction industry facing poor performance leading to failure in achieving effective time and cost performance. Therefore to complete the project on time it is necessary to reduce the causes which are responsible for time & cost overrun. The aim of the study is to analyze the construction projects to determine construction cost and schedule overrun in various types and size of the projects. Number of samples were collected and analyzed to find various factors responsible for the cost and schedule overrun. Result show that Financial problem, delay in contractor's payment, shortage of labor, slowness in decision making, effect of social and cultural factors are the most critical factors responsible for cost and schedule overrun in construction projects. This study will help stakeholders to implement the mitigation measure at planning stage in order to achieve successful construction project.*

Keywords:- Cost overrun, Schedule overrun, Construction Project, Analysis.

I. INTRODUCTION

The construction industry plays a central role in the creation of any nation's wealth. For developing economies, it forms the backbone of most industries. Cost escalation, schedule overruns in construction projects often offset the intended contribution of the industry to the economy. A commonality among construction industry is the inability to complete projects on time and within budget. This is a chronic problem for the construction industry due to factors such as design errors, unexpected site conditions, increases in project scope, weather conditions, and other project changes. As the construction industry continues to grow in size, so do planning and budgeting problems. This is because it is common for projects not to be completed on time and within the initial project budget. In fact, it is one of the most important challenges facing the construction industry today. An out of control construction cost adds to investment pressure, increases construction cost, affects investment decision-making and wastes the national finance. Cost overrun in construction is a worldwide phenomenon, and its effects are normally a source of friction between owners, project managers, and contractors. Hence, it is important to identify the factors that contribute to cost and time overrun and propose mechanisms that could be used to systematically address the causal factors to avoid and reduce the problems. The aim of the study is to establish significant causes of cost escalation, schedule overruns and propose mechanisms that could be used to systematically address the causal factors.

II. OBJECTIVE

1. The aim of the present study was to investigate the increasing frequency of cost overruns and time delays on construction projects, and to provide recommendations for addressing the situation.
2. Identification of the distribution and trends of the cost overruns and time delays of contracts.
3. Investigation of the reasons and the responsibilities for cost overruns and time delays by collecting, reviewing, processing and analyzing change order and contract information data.
4. To assess which causes need the most attention by stakeholders.
5. To assess how frequent each of these causes occur.
6. Analyses for identifying the factors that significantly influence cost overruns and time delays.
7. Development of a set of recommendations to help construction industry manage the problem of cost overruns time delays.

III. METHODOLOGY OF WORK

It was considered essential to obtain a full understanding of the study by setting out the various elements in a logical sequence, so as to avoid misunderstanding at any point in the research. The research was conducted using a questionnaire survey and a case study to validate the findings of the survey. Both the survey and the case study in this research were primarily quantitative. The study conducted through the following sequential steps.

1. A thorough literature review was done and also the expert opinions from industry experts were taken through which a number of causes of cost overrun and time overrun were identified in the local construction industry scenario.

2. Numbers of factors were finalized to made part of the survey questionnaire. Questionnaire was developed to obtain information about causes of time and cost overrun in construction projects.
3. These questionnaires were distributed and it was asked to rate those initially identified factors according to their frequency and severity.
4. Data receive from the survey was analyzed to find out the frequency, severity and important index of the significant factors which are responsible for cost and schedule overrun in construction projects.
5. Causes of overrun were raked according to their importance index.
6. Case study from construction industry to investigate real situation on site which are responsible for cost and schedule overrun of the project.
7. After analysis conclusion and recommendation were given to systematically address the causal factors to avoid and reduce the problems.

IV. DATA COLLECTION

There are various techniques for data collection. In this study questionnaire survey was used for collection of data. In order to achieve objective questionnaire survey was conducted in two stages. In first stage, questionnaire was designed based on literature review and experts view, personal experience and current scenario in Indian construction industry. These questionnaires were distributed to various top and middle management of the private and government sector of construction industry. Factor distributions of the 54 factors identified are distributed into 8 groups. Percentage distribution of the factor is also shown below in the form of pie chart in Fig 1.

A five point scale of 1 to 5 is adopted for evaluating the effect of each factor. These numerical values are assigned to respondent rating, 1= very low, 2 = low, 3 = medium, 4 = high, 5= very high for severity and 1 = Never, 2 = Rarely, 3 = Occasionally, 4 = Almost every time, 5 = Every time for frequency was considered.

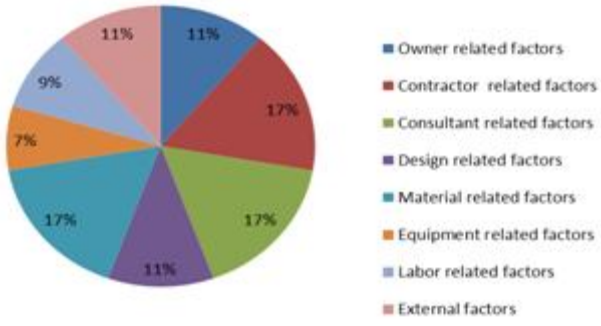

Fig1 Percentage of factor distribution

The questionnaire was distributed to the 70 members of top and middle management of private and government construction firm. The respondent involved in this survey is civil engineers, architects contractors, owners, practitioners who are working in construction industry. Out of 70 questionnaires 52 responses were received. The reliability of survey is high as all respondents are well experienced professionals in construction industry. Fig2 shows the percentage of respond received during survey.

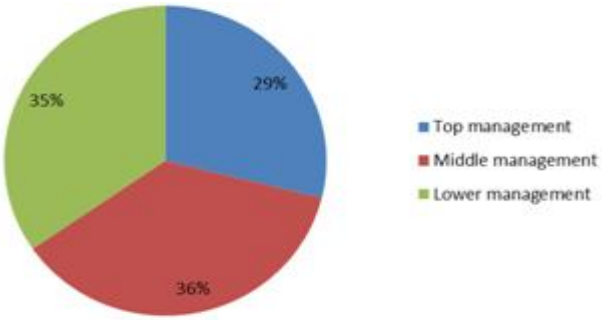

Fig2 Percentage distribution of respondent

V. ANALYSIS OF DATA

Data collected was analyzed using important index analysis method. The data are processed through three types of indices as follows:

a) Frequency index (F.I.):

This index expresses occurrence frequency of factor responsible for delay and cost overruns. It is computed as per following formula.

$$F.I = \frac{\sum a \times n}{N} \qquad (1)$$

b) Severity index (S.I.):

This index expresses severity of factor that caused delay and cost overruns. It is computed as per following formula

$$S.I = \frac{\sum a \times n}{N} \qquad (2)$$

Where,
a = constant expressing the weight assigned to each responses (ranges from 1 for very low to 5 for very high),
n = frequency of each response
N = Total score

c) Important index (Imp. I.**):**

This index expresses the overview of factor based on both their frequency and severity. It is computed as per following formula:

Imp. I. = F.I. × S.I. (3)

The importance index of each cause is calculated as a function of both frequency and severity indices. The 10 most critical causes for time and cost overrun are summarized in table1.

Table 1 Factors of overrun

Sr No	Causes of overrun	Imp.I	Rank
1	Slowness in decision making	0.50	4
2	Financial problem	0.66	1
3	Delay in contractors payment	0.63	2
4	Inaccurate BOQ	0.46	6
5	Delay in material delivery	0.45	9
6	Late procurement of material	0.45	7
7	Shortage of equipment	0.42	10
8	Shortage of labors	0.53	3
9	Effect of social and cultural factors	0.50	5
10	Accident during construction	0.45	8

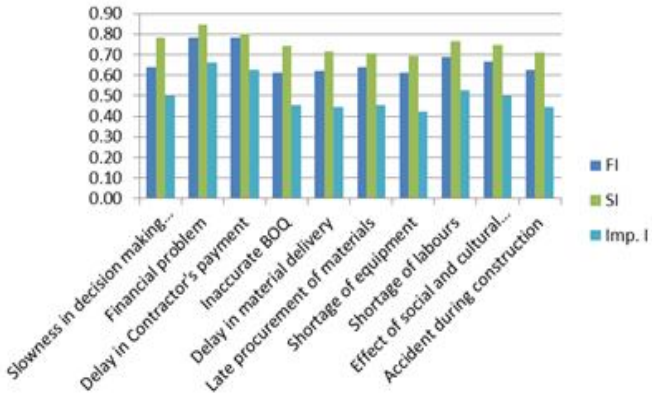

Fig3 Most critical factors of overrun as per importance index technique

In order to test the relative agreement between the responses from different groups, the ranks of the calculated Imp. I weights corresponding to the causes of delay were analyzed using the Spearman's rank correlation method. It was worked out by following equation:

$$\rho = 1 - \frac{6\sum d^2}{n^3 - 1} \qquad (4)$$

Where,

ρ = spearman's rank correlation coefficient between two parties,

d = difference between ranks assigned to variables for each cause,

n = number of parameter being rank.

The value of Spearman's correlation coefficient between top and middle management is 0.97, between middle and lower management is 0.93, between top and lower management is 0.93. This shows strong positive correlation between respondents,

VI. CASE STUDY

Case studies are detailed and thorough investigation of a few real life situations. They provide a way of organizing data and looking at the objects to be studied as a whole. All aspects are considered, which means that the development over time of the event constitutes an important dimension. Thus a case study offers advantages of acquiring detailed information about the subject through an in-depth study. On the other hand, the data obtained would be more or less reliable depending on the objectivity of the researcher (Achola and Bless 1988). Therefore related case study has been selected which will help to investigate actual causes on site responsible for cost and schedule overrun in construction projects.

Project title: Expansion of Factory Building.

Brief description:

Expansion of Factory Building (PEB) is an industrial plant building project which includes various services like civil, plumbing, electrical, HVAC, firefighting, telecommunication and landscape. The plant area and building area of the project was 19368 square feet and 17754 square feet respectively.

Project details:

- Type of building - Industrial plant building:
- Location - Mumbai
- Type of contract - Item rate contract
- Contract actual start date - August 2010
- Contract planned completion date - August 2012
- Contract actual completion date - December 2014
- Contract cost - 26.54 Cr
- Actual cost - 32.86 Cr

Estimated cost of this project was Rs26.52 cr. But due to delay in project, escalation for the project was approved by the client which was nearly about 6 cr. This escalation was carried for labor, material and lubricants by using the related formulas. Causes of cost and schedule overrun of the project are as follows

- Slow in making decisions.
- Unclear site drawings supplied.
- Slow drawing revision and distribution.
- Design changes.
- Frequently change in PMC.
- Incomplete design at the time of tender.
- Additional work at owner's request.
- Lack of cost planning/monitoring during pre-and-post contract stages.
- Delays in issuing information to the contractor during construction.
- Contractual claims, such as, extension of time with cost claims.
- Improvements to standard drawings during construction stage.
- Delays in costing variations and additional works.
- Inaccurate BOQ.

VII. CONCLUSION

1. Time and cost overruns is a severe problems faced by large construction industries in India. It is resulted from various factors which had been identified in this study.
2. It was found that most significant factors causing time and cost overruns in Indian construction are funding problem, delay in contractor's payment, shortage of labor, slow decision making, and effect of social and cultural factor.
3. Spearman's rank correlation coefficient method shows strong positive correlation between respondents.
4. It has been observed from case study that the reasons for overrun for these projects were mostly of the similar nature as stated elsewhere in this study. This validates that the study has been meticulously planned and properly organized.

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