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ANALYSIS OF TIME AND COST OVERRUN IN BUILDING CONSTRUCTION

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ABSTRACT

A construction project is successful only if the targets are achieved as per planned schedule and minimum cost i.e. without time delay and cost overrun. Delay of a construction project is defined as late completion of the project as compared to the planned schedule. Cost overrun is observed as the most frequently occurring issue in construction projects worldwide and this trend is more severe in developing countries. Cost overrun were identified as the most critical effects of time delay followed by dispute and arbitration. This scenario grabs more attention in the case of high rise buildings. Our study focuses on analyzing the time and cost overrun in a high rise building. Detailed study on time overrun which leads to cost overrun is conducted . The most critical factors are identified using questionnaire survey and analyzed the interrelationship and frequency of those factors using SPSS (Statistical Package for Social Sciences) Software Version 20. The study will helps to identify the critical factors for time and cost overrun and can find out the solutions and recommendations which can be considered to control those factors.

Keywords: Causes of Time and Cost Overrun, Questionnaire Survey, Statistical Analysis, Ranking of Factors

I. INTRODUCTION

Our Indian Economy has been showing great resilience in the present global scenario and the growth trajectory and emerge as a key economic player, thus construction industry is going to be the key. The thrust of the Government in the 12th Five Year Plan is on infrastructure and Planning Commission estimated about Rs.45 lakh Crores for the infrastructure development which can support other sectors also like manufacturing, agriculture etc. to promote growth. The successful delivery of a construction project is a difficult task to accomplish, due to time and cost overrun, which would be a drag on our economy.

Today India is one of the leading outsourcing hubs in the world. However, the developed as well as developing countries judge us not just by the talent we have, but also on the basis of our infrastructure capabilities. The successful execution of construction projects and keeping them within estimated cost and prescribed schedules depend on a methodology that requires sound judgment. To the dislike of owners, contractors and consultants many projects experience extensive delays thereby exceed initial time and cost overrun. Thus the delay of project and cost overrun is considered as the most crucial problems in the construction industry.

Despite of importance and significance of construction sector in developing countries, it's noted that the parties of project(owner, consultant & contractor) don't give the time and cost overrun much importance for the evaluation of the project which will result in uncertainties. Therefore efforts have been directed to cost and time effectiveness by managing time and cost, in which we have conducted a study to analyse cost and time overrun by considering the most affected one, high rise buildings. Through this research statistical analysis for time and cost overrun were done using SPSS Version 20. To achieve this goal, first reviews of the past literatures were studied. A questionnaire survey was conducted to identify the most important time and cost overrun factors. The study explorers the important causes for time and cost overruns. Then a high rise building is considered as a case study. By utilizing the details collected from questionnaire survey and case study, statistical analysis is conducted to assess the future cost and time overruns in construction projects.

II. TIME AND COST OVERRUN IN CONSTRUCTION INDUSTRY

One of the main objectives and policies of any public or private sectors dealing with the execution of projects is to upgrade project performance through the minimization of costs, completion of projects within their assigned budget and time constraints and improve quality. The lost of control on time and cost leads to failure of projects and the shortage of control may be caused as a result of lack of knowledge and awareness. So it's essential to identify the meaning of time and cost performance in the study.

2.1 Cost Overrun

Cost overrun occurs when the final cost of the project exceeds the initial estimate or budget. Yehen Rosenfield[1] considers cost overrun as a universal problem which can be resolved by identifying the root cause. Shreenaath, Arunmozhi and Sivagamasundari [2] states that cost is an important parameter for success of any project and suggested that cost performance results in serious sequences of projects like abandonment of project etc. the main causes of cost overrun had been analyzed through the research.

2.2 Time Overrun

Construction industry handles many resources such as Men, Materials etc. When these resources are not properly utilized, it leads to time as well as cost overrun. Time overrun is the slipping over its planned schedule and is considered as a common problem in construction industry. Hannah and Srinivasan[3] suggested that time overrun in Indian construction industry has a major effect on its economy. Dolage and Rathnamali[4]defines time overrun as the non-completion of the project within the original or stipulated or agreed contract period. The trend of overruns is more severe in developing countries, so it becomes our necessity to found solutions to overcome the overruns.

III. LITERATURE REVIEW

Several studies have addressed many different factors that cause time and cost overruns in different types of construction projects. Aditi Dinakar (2014) had focused on study of core factors that causes delay in construction projects and analyzed the day-to-day records to minimize delays. He had found out that almost all parties included in a project holds equal responsibility for the delays in projects. Abdul Azis et al., (2011) aimed to identify various factors responsible for construction cost overrun. Their studies identified that poor design &

delays in Design, inadequate planning, scheduling, poor site management and supervision, mistakes during construction were most common and significant factors causing cost overrun. Sreekumar et al.,(2014) had tried to identify the various factors attributed to delay of high rise building construction and its effects. From their analysis they had concluded that the most agreeable practical factors affecting the delay of high rise construction are improper follow of schedule, improper work methodology, lack of qualified personnel, shortage of labours, type of equipment & machinery used and the corrective measures required for reducing the delay. MirHashemi et al.,(2014) had conducted study to identify the delay causing factors and determined their role and also found out contribution to delays is extremely important in reducing delays and eliminating redundant expenditures. Braimah (2013) focused on developing knowledge and understanding in a wider way for research via: an evaluation of the most common DATs, Delay Analysis Techniques can be considered as, a review of the key relevant issues often not addressed by the techniques, and the necessary improvements needs. Orozco et al., (2013) focused on activity delays which increases project schedule and costs. They had proposed two indicators as reason for non compliance as an indicator that characterizes scheduling failures and delay index as a time-performance indicator that describes the impacts of delay on critical as well as noncritical activities. They had concluded that planning was the most harmful delay cause on time performance.

IV. RESEARCH METHODOLOGY

From the previous studies done, regarding time and cost overruns, a questionnaire survey method was adopted for the analysis. About 41 factors affecting cost overrun and 46 factors affecting time overrun on construction projects were selected. These factors were grouped based on literature review. For the survey a questionnaire was prepared as three sections. First section contains the details of the respondent, second and third comprises factors affecting time and cost overruns respectively.

The reliability of the survey was checked using Cronbach's alpha using SPSS 20.In this study Relative Important Index (RII)have been employed as an index to rank the factors. These rankings helps to cross compare the importance of factors of overruns. All perceptions are analyzed and ranked using the RII to give an overall picture of the cause of overruns. All the numerical scores of respondents are converted to important indices to determine the relative ranking of the factors .Higher the value of RII, more important is the factor.

The ranked factors are analyzed using SPSS Software. A high rise building is considered as case study. Analysis of factors which causes time and cost overrun in high rise building has been done. Correlation between the factors had been identified and the ranking of factors were done.

V. QUESTIONNAIRE SURVEY

Structured questionnaire survey was carried out to collect the data. Scale assigned for level of significance instead of abbreviation i.e. very often =5; often = 4; sometimes = 3; rare = 2; very rare = 1. Prior to data collection, preliminary study was conducted by reviewing previous literatures and from experienced personnel in the construction industry to validate the contents of questionnaire and confirming the relevancy of the contents related to high rise building.

VI. DATA ANALYSIS AND RESULTS

The reliability analysis of the questionnaire analysis was tested so as to find out whether it was capable of yielding similar score if the respondent uses it twice. The Cronbach's alpha was used to measure the reliability of the questionnaire. For ease of work SPSS 20 was used to compute the data for each set of variables. A summary of test is given in Table.1.

According to Reynold and Santos(1999),alpha greater than 0.7 implifies that the instrument is acceptable. Therefore according to the results, the instrument found to be reliable. Frequency and severity of time as well as cost has been identified as greater than 0.7 as found to be reliable.

Table.1 Reults of Reliabilty Analysis

Variables	Alpha
Time frequency	0.937
Time severity	0.958
Cost frequency	0.982
Cost severity	0963

The frequency, severity and importance of the survey was calculated. The summary of time and cost overrun factors which are ranked are given in Table II and Table III. RII value was calculated using the following expression.

$$\text{Frequency Index (F.I)} = \sum_{i=1}^{5} \frac{a_{if} * n_{if}}{5 * N}$$

$$\text{Severity Index (S.I)} = \sum_{i=1}^{5} \frac{a_{is} * n_{is}}{5 * N}$$

Relative Important Index (%) [7] = F.I * S.I

Where a_{if} and a_{is} are numbers of respondents who choose certain frequency and severity degree respectively, n_{is} and n_{if} are degrees of frequency and severity respectively (1, 2, 3, 4 or 5), N is total number of respondents.

Table. II helps to show the ranking of first ten factors from 46 factors we have identified. The groups which contributed the factors have also been identified. The respondents identify the labour shortage as the critical factors affecting time overrun. We are now facing the serious problem of shortage of laborers in our construction sites. In that also there is lack of experienced and technical hands in the industry, these can lead to a critical issue of overrun of time. Poor communication between various parties in a project make the project slow down or sometimes it leads to dispute and arbitration which all tends to increase the time.

The ranking of prior ten factors from identified 41 factors are given in Table III. Change orders contributed by owner are identified as a major factor for cost overrun. Change in scope by the owner when the works proceeds will lead to total confusion and cause the need for more money than calculated will leads to cost overrun. Escalation of price of materials as well as fluctuation in money exchange rate is a day to day occurring matter in the current economy.

Table II Ranking Of Factors Of Time Overrun

Factors of Time Overrun	Overall Rank		Group
	RII	*RANK*	
Low productivity level of labours	40.48	1	Labour contributed
High labor wages	38.45	2	Labour contributed
Shortage of labours	36.23	3	Labour contributed
Change orders by owners during construction	36.14	4	Owner contributed
Change in architectural plans	35.92	5	Owner contributed
Difficulties in financing project	35.84	6	Contractor contributed
Shortage of construction materials at site	35.55	7	Material contributed factors
Weather effect on construction activities	35.36	8	External factors
Labour strikes at site	35.27	9	Labour contributed
Ineffective planning and scheduling of project	35.13	10	Contractor contributed

Table III Ranking Of Factors Of Cost Overrun

Factors of Time Overrun	Overall Rank		Group
	RII	*RANK*	
Escalation of price of materials	36.76	1	Material related
Inaccurate quantity take-off	36.55	2	Project management & administration related
Fluctuation in money exchage rate	36.41	3	Financial management related
Poor financial control on site	36.20	4	Financial management related
Lack of cost planning/monitoring during pre and post contract stages	35.92	5	Project mangement & administration related
Poor project management	35.84	6	Project mangement & administration related
Lack of experience of project parties	35.67	7	Project mangement & administration related
Late delivery of materials & equipments	35.43	8	Material related
Changes in architectural plans	35.12	9	Owner related
Schedule delay	35.07	10	Contractor related

So the improper planning and lack of noticing foreseen changes lead to a huge increase in cost and affects the total economy of the project. All the identified matters in one way or another way lead to major fluctuations in the estimated amount and results in cost overrun. The identified main three factors of time and cost overrun have been considered for analysis using SPSS. Pearson Correlation Analysis has been done using SPSS for the first three rankings of time and cost overrun. We have considered null hypothesis as there is interrelationship between the factors. As the correlations between the factors were more than the correlation significance level of 0.05, we can accept our hypothesis. The more agreement is between contractor related and owner related factors. This shows that reasonably a strong correlation exists between the factors and time and cost overrun.

VII. CASE STUDY

A high rise building located at Kottayam, Kerala was considered for the case study to analyse time and cost overrun. The plan and details of the building was studied. The results from the study identified that the main cause for cost overrun was due to the elapsed time than the planned schedule. The main factors which lead to the overrun are changes in architectural plan, fluctuation in money exchange rate, increased rate of materials, high transportation rate etc. the work was started in 2011,planned all its estimate by calculating the cost of materials and all at that time. The work was delayed unexpectedly due to unforeseen matters and lead to a major time delay. At the time period from 2011 to at present there caused a major variation in rates of materials, transportation, laborers etc. Government introduced several rules and regulations for building rules especially affected high rise building. Changes in architectural plans became a major reason for this high rise building to increase the cost. As the time elapsed, rate of materials, transportation etc had changed leads to larger variation in the cost than planned. So all of these factors lead to time and cost overrun analysis in the high rise building. So this implifies that a need of urgent attention is to be put on these factors to avoid time and cost overruns.

VIII. CONCLUSION

Time and cost overrun is a serious problem in construction industries in India. It is resulted from various factors which have been identified in this study. From the 46 and 41 factors of time and cost overrun respectively using important index it has been identified the main ten factors which have been ranked. It was found that the first three factors of time and cost overrun are shortage of laborers, lack of qualified personnel, poor communication and co-ordination between parties, change orders, escalation of material price and fluctuation in money exchange rate respectively. So these implifies that urgent attention is to be put on these factors to avoid time and cost overrun. Most of the construction works in India had never given much importance to time overrun which directly affects cost overrun. There are several factors to be identified in the industry. By eradicating some of the identified factors itself can cause greater influence in reducing the time and cost overrun in our construction industry.

IX. RECOMMENDATIONS

From the study and the analyzed results here are some recommendations to control time and cost overrun in building construction. The estimate should be based on actual site drawings/specifications, there should be proper co-ordination between the parties, there should be regular monitoring of project etc. we can control time as well

as cost in building construction as far as possible by carefully considering each and every stages and by well planned procedures so that future projects can control the overruns.

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