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Analysis the Severity Factors of Time and Cost Overrun in Construction Projects

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Abstract: ***Most of the construction project is successful only if the missions are achieved as per planned schedule and minimum cost i.e. without time and cost overrun. The main purpose of research which has categorized the causes responsible for time and cost overruns in projects. Investigation was carried out with quantitative approach of questionnaire survey to understand the perception of practitioners involved in construction industry towards various factors in causing time and cost overrun. A valid questionnaire for the survey was developed based on factors for time overruns and factors for cost overruns identified from literature review. The targeted respondents were client, contractor, owner and consultant representative involved in handling construction projects. 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: Time overrun, Cost overrun, SPSS software

1. Introduction

Most construction projects in developing countries are characterized by overruns in cost and time. In today's economic boom times and highly competitive business environment, the need for completing construction projects within the stipulated cost, time frame and performance expectations is becoming increasingly important. Delays and cost overruns extend the duration of a project, inflate the budget, reduce revenues, and degrade productivity. Through this study 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. The project consists of three phases; The first phase for collecting literature review and find out the already identified risk factors. The second phase includes the questionnaire design for the identified risk factors and distribution of questionnaire to local contractors, consultants, owners and all stake holders of construction industry. The third phase of these focused on the data analysis and result discussion.

2. Objectives

The objectives of this study are,

- In the construction industry there are so many activities including mobilization, logistics, time management and material management etc.
- It is understood that each and every activity needs to be clearly monitored and should not allow lag at any point of time But in the current scenario, lot of studies need to be done to streamline the activities to make the profitable project.
- In this study, risk factors associated with construction projects have been identified and also the severity of the parameters will be analyzed and to rectify the problems of time and cost overrun in projects.

Need for construction management

The construction industry is the largest industry in the world. It is more of a service than a manufacturing industry. Growth in this industry in fact is an indicator of the economic conditions of a country. This is because the construction industry consumes a wide employment circle of labour. While the manufacturing industry exhibit high-quality products, timelines of service delivery, reasonable cost of service, and low failure rates, the construction industry, on the other hand, is generally the opposite. Most projects exhibit cost overruns, time extensions, and conflicts among parties.

Cost overrun and time overrun

Cost overrun is defined as the actual budget is more than the planning budget. More than that, it is an unexpected cost incurred in excess of a budgeted amount due to an under-estimation of the actual cost during budgeting.

The problem of cost overrun in the construction industry is a worldwide phenomenon, and its effects are normally a source of friction between owners especially government owners, project managers, and contractors.

Time overrun is defined as the difference between the estimated project duration and actual time taken to complete the project. 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.

Causes of time and cost overrun

Basic cause of time and cost overrun in construction projects that are given below;

1. Scope changes

2. Inappropriate and Inadequate procurement
3. Complexity
4. Inadequate site condition survey/data for finalizing Scope of Work
5. Improper Design & Drawings
6. Unrealistic Time Period fixed for Completion
7. Delay in Environmental Clearance
8. Non-availability of complete land/site free from encumbrances
9. Non-availability of construction material
10. Inadequate monitoring system
11. Shortage of manpower
12. Changing orders
13. Poor site management

Likert scale

A psychometric response scale primarily used in questionnaire to obtain participant's preferences or degree of agreement with a statement or set of statement. Likert scales are a non-comparative scaling technique and are unidimensional in nature.

Named after Dr. Rensis Likert, a sociologist at the University of Michigan. "A technique for the measurement of attitudes" was published in the archives of psychology in 1932.

Likert scale strength

1. Simple to Construct
2. Likely to produce a highly reliable scale
3. Easy to read and complete for participants.

Reasons for cost overruns and time overrun

One major factor that has been identified as reasons for cost overrun in most projects in design errors. It is important to note that proper representation of client's requirement and the blue print to achieving good technical input to project execution are usually mapped out base on project designs.

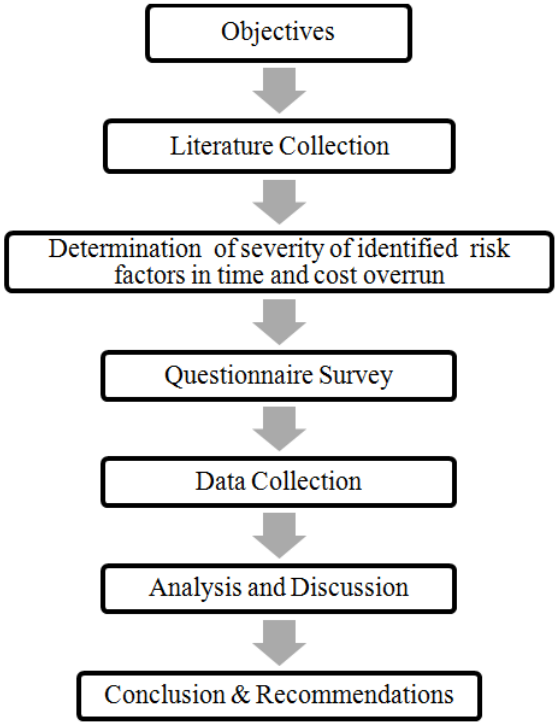
3. Methodology

The methodology for the present project is to develop questionnaires considering all the attributes related to cost and time overrun of the construction projects, to conduct the survey among all the stakeholders of different projects. This methodology brings in identifying the risk severity factors influencing time overruns and cost overruns in construction projects. To identify time overruns and cost overruns factors, literature reviews, books, conference and discussion with practitioners involved in construction industry(Site Engineers ,Contractors ,owners, Labours) were carried out in construction projects. In this study, Questionnaire survey was developed based on 10 factors of time overruns and cost overruns. For each factor the respondents scale of importance rate using five point scale of 1 to 5 is adopted. It is rated as follows 5=very poor; 4=poor; 3=fair; 2=good; and 1=very good. From questionnaire survey, a field study was carried out to get feedback from experts in construction industry on the factors identified from literature reviews.

3.1 Scale of Importance

Scale of Importance	*Scale Value*
1	Very good
2	Good
3	Fair
4	Poor
5	Very poor

3.1 Methodology Flow Chart



Questionnaire Structure

Risk factors for this study are classified into ten categories namely,

1. Client related
2. Contractor related
3. Project planning and control related
4. Consultant related
5. Material related
6. Labour related
7. Equipment related
8. Contract related
9. Force majeure/climatic conditions
10. Economic related

4. Result and Discussion

Statistical Package for the Social Sciences (SPSS)

"SPSS is a comprehensive system for analyzing data. SPSS can take data from almost any type of file and use them to generate tabulated reports, charts, and plots of

distributions and trends, descriptive statistics, and complex statistical analysis."
The following is a brief overview of some of the functionalities of SPSS:

- Data transformations
- Data Examination
- Means, test, ANOVA, Correlation,
- Nonparametric tests Regression
- Nonlinear Regression
- Nonparametric analysis
- Graphics and graphical interface.

SPSS is an integrated collection of quantitative analysis software that is particularly popular with social science researchers. SPSS is a desktop and larger computer based quantitative analysis package produced by SPSS Inc. Using SPSS performs many data management and statistical analysis tasks. Statistical analysis tasks that can be performed with the base package include the generation of descriptive statistics, prediction of numerical outcomes, and prediction of identifying groups. Although SPSS is very popular with social science researchers, its ease of use and add on modules allows it to operate as a cross-disciplinary software package.

It is used by market researchers, health researchers, and survey companies, government, education researchers, and others. The benefit of SPSS is effective data management, wide range of options, better output organization. In Civil Engineering field, Statistical package for the social science (SPSS) software is mainly used for analyzing the questionnaires.

Features of SPSS

- It is easy to learn
- It includes a full range of data management system and editing tools
- It provides in-depth statistical capabilities
- It offers complete plotting, reporting, and presentation features.

All the questionnaires have been distributed and collected from project manager of the project or engineer at the site or various contractors, clients and consultants. In some cases, consultant gave answer on the behaviour of their clients, both from the owner and the contractor side.

Questionnaires were distributed and collected from various companies as follows,

- Owner
- Contractors
- Clients
- Consultants
- Engineers
- Project Manager
- Workers

Details of questionnaire collection

This analysis is used for identifying the major factors that affect the construction equipment and improved efficiency of construction project.

Number of questionnaire distributed: 100
Number of response: 75

Mean values of projects

Parameters	*Mean*
Nominated subcontractors by owner	2.90
Improper site coordination	2.83
Mistakes/rework during the construction stage	2.83
Inadequate contractor experience	2.93
Lack of proper qualified and experienced members among the contractor's team	2.87
Inappropriate organizational structure of the company linking to the project	2.70
Lack of communication between different subcontractor trades involved in construction	3.10
Conflicts between different subcontractors schedules during project execution	2.77
Absence of frequent site meetings chaired by higher officials to have better coordination between engineers	2.97
No financial incentives for the sub-contractors to finish ahead of schedule	2.80
Deficiencies in initial planning and scheduling schemes made	2.97
Change in the construction methods followed from the actual plan	2.63
Lack of database in estimating activity duration and resources	3.07
Poor judgment and experience of involved people in estimating time and resources	2.80
Non-availability of professional construction management experts	3.03
Inadequate early/primary planning of the project	2.77
Unrealistic schedules for construction	2.93
Accidents occurred during construction	2.67
Traffic control regulations practiced at the construction site	3.13
Lack of training people and management support in the client project team	2.57
Inefficient in handling the conflicts between the contractor and consultant	2.67
Slow decision making	2.67
Payment: delay in making payment to the contractor after the completion of milestones	2.97
Absence of strong administrative will to complete the project as per the planned time and budget	2.73
Design changes by owner or agent during construction	2.97
Payment: delay in making monthly payment	2.93
Site clearance for the work to proceed	3.17

Project delivery systems used (design-bid-build, design-build, cost plus, lump sum, etc.)	3.00
Obtaining permits from concerned authorities to start work	3.17
Change in BOQ's or scope of work during construction	2.57
Lack of adequate man power at construction site as expected/planned	2.80
Decline in labour productivity	2.90
Lack of skilled manpower	3.03
Delay due to waiting time for approval of sample materials	2.77
Revisions in designs during the time of construction	2.83
Waiting time for approval of tests and quality-control inspections	2.83
Delay in preparation and approval of shop drawings	2.97
Ambiguity in the specification written or conflicts in interpretation by owner and contractor	2.70
Negotiations on cost and durations of the project for securing contracts	2.83
Contract management/disputes between owner and contractor	3.10
Differential site condition clauses written in contract	2.90
Site closure issues between client and contractor	3.00
Joint ventures in a project	2.67
Lack of quality material/material not matching the required specification	4.35
Damage to materials during storage at the construction site	4
Delay in the delivery of special manufactured materials	3.6
Shortage in the availability of material	3.4
Equipment availability as planned	2.53
Unskilled equipment operators	2.63
Equipment breakdown/maintenance	3.00
Extreme weather conditions	2.27
Unfavourable/unexpected weather conditions	2.80
Problems with the neighbours around the site	2.67
Unforeseen site conditions	2.70
Insufficient utilities available on site	2.63
Inflation: escalation of material prices	2.63
Increase in labour wages	3.17
Absence of proper cash flow (working capital) during construction	3.20

Project rank

S. No	*Delay Factors*	*Rank*
1	Material related	1
2	Economic related	2
3	Labor related	3
4	Project planning and control related	4
5	Contractor related	5
6	Contract related	6
7	Client related	7
8	Consultant related	8
9	Equipment related	9
10	climatic conditions	10

Frequency Tables for Material Related Factors

1. Lack of quality material/material not matching the required specification

	Frequency	Percent	Valid Percent	Cumulative Percent
1	3	5.0	5.0	5.0
2	7	15.0	15.0	20.0
3	16	20.0	20.0	40.0
4	4	60.0	60.0	100.0
Total	30	100.0	100.0	

Inference

The inference made from response of construction employees and owners 5% are poor Severity rating of time and cost overrun in construction projects are due to "Lack of quality material/material not matching the required specification", 15.0% 0f the respondent says fair, 20.2 % of the respondent says good,60% of the respondent says Very good

2. Damage to materials during storage at the construction site

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1	2	5.0	5.0	5.0
2	9	10.0	10.0	15.0
3	11	15.0	15.0	30.0
4	7	20.0	20.0	50.0
5	1	50.0	50.0	100.0
Total	30	100.0	100.0	

Inference

The inference made from response of construction employees and owners 5% are Very poor Severity rating of time and cost overrun in construction projects are due to "Damage to materials during storage at the construction site", 10% 0f the respondent says poor,15 % of the respondent says fair,20% of the respondent says good, 50% of the respondent says Very good.

3. Delay in the delivery of special manufactured materials

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1	3	9.7	10.0	10.0
2	3	9.7	10.0	20.0
3	20	64.5	66.7	86.7
4	2	6.5	6.7	93.3
5	2	6.5	6.7	100.0
Total	30	96.8	100.0	

Inference

The inference made from response of construction employees and owners 9.7% are Very poor Severity rating of time and cost overrun in construction projects are due to "Delay in the delivery of special manufactured materials", 9.7% 0f the respondent says poor,64.5 % of the respondent says fair, 6.5% of the respondent says good,6.5% of the respondent says Very good.

4. Shortage in the availability of material

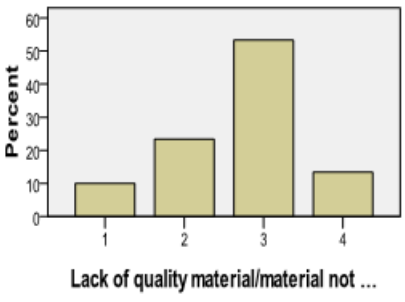
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1	4	15.0	15.0	15.0
2	10	10.0	10.0	25.0
3	5	20.0	20.0	45.0
4	10	30.0	30.0	75.0
5	1	25.0	25.0	100.0
Total	30	100.0	100.0	

Inference

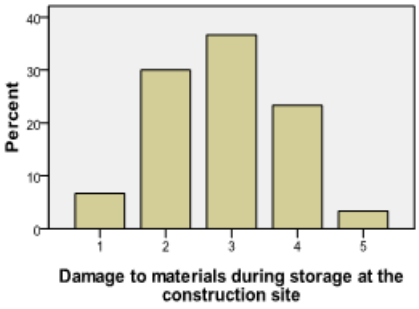
The inference made from response of construction employees and owners 15% are Very poor Severity rating of time and cost overrun in construction projects are due to "Shortage in the availability of material", 10% 0f the respondent says poor,20 % of the respondent says fair ,30% of the respondent says good,25% of the respondent says Very good

Bar Charts for Material Related Factors

1. Lack of quality material/material not matching the required specification

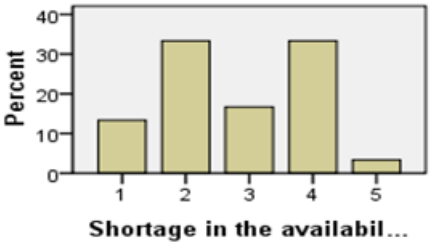


2. Damage to materials during storage at the construction site



3. Delay in the delivery of special manufactured materials

4. Shortage in the availability of material



5. Conclusion

General

Efficient and effective management of a project is the key attribute towards successful, timely and profitable completion of the project. Planning, monitoring, controlling cost and Quality are the major components of project management and intelligent use of these tools gives a cutting edge to the execution of projects– whether of similar type or different. In this study, it was understood that the risk severity varied in construction projects. In construction project, top risk attributable to material mobilization.

Conclusion

In this study we found that the organization deploys separate teams for planning, accounting, procuring and other servicing works. But it was found that several factors have direct impact on the unsuccessful completion of the project due to lack of control on certain parameters. In our study, it was found that the top most risk factor attributable to time and cost overrun of the project is material

management. Handling of materials at site and timely mobilization of materials play a vital role in successful completion of the project. The current market prices of the bulk materials and escalation prices for the total project duration to be predicted and materials to be procured based on the project requirement. If the inventory is maintained properly and proper stock management will have a good result in terms of timely completion of the project which mainly drives the cost of the project.

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