Factors Affecting Cost Overrun in Kerala Based Construction Project

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Abstract- *Construction cost overrun in construction projects which leads to deliver projects within time and cost. In order to find mitigation measures of cost overruns, the first step is to identify the causes of these overruns. This paper assesses the causes leads to cost overruns in Kerala based construction industry. Framework consisting of two phases: a qualitative phase and a quantitative phase. In phase one factors leads to cost overrun are determined and ranked them based on the proyority.In second phase cause- effect relationship are determined using Bayesian Belief network. Factors were identified from the published literature and brainstorming sessions with experts. Two set of questionnaire was distributed all over Kerala in order to identify the cause and relationship between the factors. Data received from the questionnaires was analysed using SPSS and Bayesian lab. Findings from the study revealed that material price escalation, improper planning and scheduling, change in material specification and type, fluctuation in price of labour etc were the major factor leads to cost overruns in Kerala.*

Keywords- Cost overrun, Bayesian belief network

I. INTRODUCTION

A cost overrun, also known as a cost increase, underrated or budget overrun, involves unexpected costs incurred in excess of budgeted amounts due to an underestimation of the actual cost during budgeting. Cost overrun reduces the profit leading to enormous losses, and leaving the project in great troubles. Construction cost is one of the peak criteria of success of a project throughout its lifecycle and is of high concern to those who are involved in the construction industry. Cost overrun is common in infrastructure, building, and technology projects all over world. Cost overrun should be distinguished from cost escalation, which is used to express an anticipated growth in a budgeted cost due to factors such as inflation. BayesiaLab is a graphical user interface, which provides an environment for machine learning, knowledge modelling, analysis, diagnosis, optimization and simulation. Bayesian networks have become practical for gaining deep insights into problem domains. BayesiaLab supports the research process from model generation to analysis, simulation, and optimization. The entire process is fully contained in a uniform environment, which provides flexibility in moving back and forth between different elements of the research task. Bayesian networks can serve as predictive model and also it can represent causal relationships.

II. METHODOLOGY

The study was conducted in Kerala based construction project. Framework consisting of two phases: a qualitative phase and a quantitative phase. In phase one factors leads to cost overrun are determined and ranked them based on the proyority.In second phase cause- effect relationship are determined using Bayesian Belief network.

Phase 1: Qualitative analysis

The purpose of this phase was to identify significant factors lead to cost overrun that are applicable to the context of construction projects in Kerala. A set of factors is identified from the published literature and brainstorming sessions with experts. The study comprises two types of questionnaires.

(1) Questionnaire 1 -for evaluating the influence level of factors on the construction Cost overrun.

(2) Questionnaire 2- for identifying cause-effect relationships among the factor identified.

A questionnaire (type 1) incorporating factors and then carefully designed to evaluate the relative importance of cost overrun. Factors are identified and ranked using SPSS

Phase 2: Quantitative analysis

The purposes of this phase are to determine the cause and- effect relationships among factors identified in the qualitative phase. Questionnaire 2 was to determine the cause-effect relationships among the factors

2.1 IDENTIFICATION OF FACTORS

The major factors causing delays on construction projects have been reviewed and critically appraised in many scientific journals and reports. Through literature study, factors affecting cost overrun are identified. Out of 60 factor identified from literature review ,it is prioritized to 20 factors through the opinion from experts through an online survey with the help of Google form.

2.2. QUESTIONNARE PREPARATION

A questionnaire (type 1) incorporating 20 factors was then carefully designed to evaluate the relative importance of cost overrun factors. To facilitate the answers, a five-point Likert- type scale (from 1 = ''not prominent'' to 5 = ''always prominent'') was adopted for rating by the respondents. Both online and Offline surveys were carried out. Online survey was carried out with the help of Google form. One hundred and twenty copies of the questionnaire(online and offline) were distributed to a random sample of construction personnel involved in construction projects in Kerala based construction projects. Responses were received from 100 professionals. To elicit the relative importance of factors, mean value method was used with the help of SPSS software.

Questionnaire 2 determine the cause-effect relationships among the 20 identified factors. For that questionnaire was designed in matrix form, in which the left column presented 20 identified factors as causes and the top row presented those factors as effects. Participants were asked to rate the factors using the following number values: 'very strong relationship' = 4, 'strong relationship' = 3, 'somewhat relationship' = 2, 'weak relationship' = 1, 'no relationship' = 0. Fifty five responses were received and the data received is converted to .csv (Comma separated value)format in order to generate relationship using BayesiaLab software.

2.3 QUESTIONNAIRE SURVEY

Questionnaire survey was conducted in Kerala based construction project by dividing into 3 region-Northern ,Central, Southern Kerala.

Table 2.1 List of places where survey was conducted

Northern kerala	Central kerala	Southern kerala
Kasargod	Palakad	Thiruvanathapuram
Kannur	Thrissur	Kollam
Wayanad	Ernakulam	Alappuzha
Kozhikode	Idukki	Pathanamthitta
	Malappuram	
	Kottayam	

Two set of questionnaire was prepared and distributed all over Kerala. Both online and offline survey were conducted . One hundred and twenty copies of the questionnaire 1(online and offline) were distributed to a random sample of construction personal involved in construction projects in Kerala based construction projects. Responses were received from 100 professionals.

III. RESULT AND DISCUSSION

Factors are identified through literature study and prioritized using relative importance based on the opinion. Factors were identified and ranked based on the priority using SPSS. Through the second set of questionnaire cause effect relationship among the factors are identified using BayesiaLab software. As a result of survey more than seventy six percent of response was from central region and seventy percent of response from southern Kerala. About sixty five percent of response was from northern part of Kerala.

Survey was carried out with the help of online and offline survey. Out of one hundred twenty responses ,one hundred responses are responded from both online and offline survey.

3.1 FACTORS INFLUENCING COST OVERRUN

The collected data were statistically analysed and Table 3.1 shows the 20 most significant factors influencing cost overrun. The results revealed that the top main causes for cost overrun in construction of building projects includes material price escalation, improper planning and scheduling, change in material specification and type, fluctuation in price of labour etc. It is noticeable that contractors, site engineer and project manager rated the factor ''material price escalation'' as very important, whereas the engineering consultant rated 'improper planning and scheduling' as the important factor. Increased material cost is primarily due to increased transport charges such as when distance for haulage from the depot to a remote job site is longer than the haulage associated with other construction projects the estimator has previously worked on. Material transport costs fluctuated widely depending on distance. Bulk materials with low initial cost, such as sand and gravel, tend to be the most adversely affected by distance and difficult transport conditions. Ferry crossing or bridges with tolls increase the basic cost of materials. But an individual consumer building a house is more affected by retail prices, rather than a person buying a home from within large residential complexes.

Table 3.1 –Ranked factors that leads to cost overrun based on the analysis

CAUSES	Representation	Rank
Unexpected inflation/Material price escalation	X2	1
Improper planning and scheduling	X3	2
Changes in material specification and type	X15	3
Fluctuation in prices of labour	X6	4
Design risk/Frequent design changes	X4	5
Inadequate monitoring and control	X10	6
Inaccurate estimates	X1	7
Inadequate labour/skill availability	X8	8
Delay in inspection and approval of completed works	X11	9
Insufficient numbers of equipment, tools and plant	X13	10
Poor contract documentation and management	X5	11
Delay in issuing EOT and TOC	X19	12
Work suspension because of litigation	X12	13
Bureaucracy and political interference in tendering method.	X14	14
Additional work/Direct change orders by client	X9	15
Long project maintenance period	X18	16
Omission and error in the bill of quantities	X20	17
Rework due to poor work/wrong materials by the contractor	X17	18
Project material monopoly by some suppliers	X16	19
Change in the scope of the project	X7	20

3.2 CAUSE-EFFECT RELATIONSHIP AMONG VARIABLES

The purposes of this phase are to determine the cause and- effect relationships among factors identified in the qualitative phase, to develop the BBN-based model, and to estimate the probability of delays in construction. Firstly, the study used questionnaire 2 to determine the cause-effect relationships among the 20 identified factors.. The questionnaire was designed in matrix form, in which the left column presented 20 identified factors as causes and the top row presented those factors as effects. Table 3.2 shows the
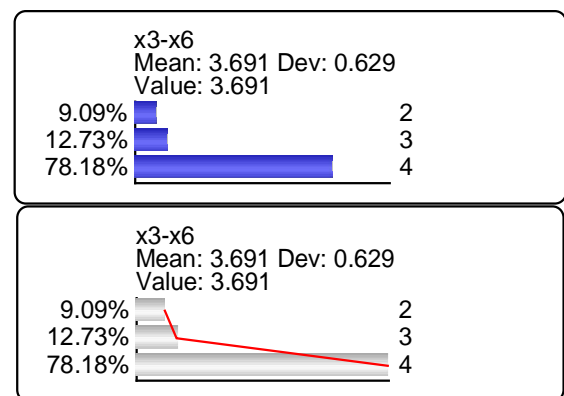
cause – effect relationship generated using Bayesian lab software. Sample out of the analysis was represented in fig 3.1.

Table 3.2 Cause-effect relationship with mean values

Descriptive Statistics		
Relationship	N	Mean
x18-x2	55	3.964
x20-x8	55	3.945
x12-x17	55	3.945
x5-x16	55	3.935
x11-x6	55	3.927
x6-x16	55	3.926
x3-x2	55	3.926
x10-x2	55	3.908
x9-x3	55	3.907
x7-x4	55	3.907
x16-x2	55	3.906
x8-x2	55	3.905
x4-x8	55	3.853
x2-x10	55	3.799
x15-x16	55	3.782
X2-x3	55	3.709
X2-x6	55	3.709
X3-x6	55	3.691
X3-x16	55	3.6.91
x1-x15	55	3.272
X17-x5	55	3.109
X14-x3	55	3.091
X13-x16	55	3.073
X19-x5	55	3.055

Fig 4.6 Sample output from the relationship

(source:bayesialab)

Delay in inspection and approval of completed work have definite relationship between design risk or frequent design change. The mean value obtained from the relationship was 3.691.About 78.18% response shows very strong relationship between two factors. Relative curve shows the variation of response rate in the form a curve. Frequent design change in construction will cause delay in inspection of work. It has been suggested that a major cause of rework relates to the quality of contract documentation that is produced by design consultants and that higher fees paid to consultants would result in improved contract documentation quality. Material price escalation have relationship toward material monopoly by some suppliers. Different type of taxes exhibit of materials increases the price of the material to a great extend .This will increases the monopoly among suppliers.

IV. CONCLUSION

A cost overrun, involves unexpected costs incurred in excess of budgeted amounts due to an underestimation of the actual cost during budgeting. Factors affecting cost overrun in Kerala based construction project are identified and cause-effect relationship was developed using Bayesian network. Cost overrun should be distinguished from cost escalation, which is used to express an anticipated growth in a budgeted cost due to factors such as inflation of material price, improper planning and scheduling etc were analysed from the study. Factors leads to cost overrun are identified and ranked based on there priority. Using Bayesian networking cause-effect relationship between the factors are identified.

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