International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 07 | July 2019 www.irjet.net p-ISSN: 2395-0072

PREDICTION MODEL OF FACTORS CAUSING INCREASE IN OVERHEAD COST IN CONSTRUCTON

Vivek S[1], Shibi Varghese[2]

[1]PG Student, Structural Engineering and Construction Management, Dept. of Civil Engineering, Mar Athanasius College of Engineering, Kothamangalam P.O, Ernakulam, Kerala, India

[2]Professor, Dept. of Civil Engineering, Mar Athanasius College of Engineering, Kothamangalam P.O, Ernakulam, Kerala, India

---

Abstract - *General overhead costs are those costs that cannot be identified readily with a specific project. General overhead costs are items that represent the cost of doing business and often are considered as fixed expenses that must be paid by the constructor (firm). General overhead expenses include the general business expenses that are included by the home-office in support of the company's construction program (main-office or home office expenses). Office running cost (office rental, clerical, utilities…etc.). Therefore, these cost items are distributed over all the company projects by some basis.*

The main factors that cause variations in overhead cost in the Indian building construction industry is identified and investigated. Relative Important index is find by using SPSS Software. The reliable prediction of overhead cost percentage decreases time, effort and economy for construction firms.

***Key Words*: Construction, Overhead cost, Relative Important Index, Factors, SPSS**

1. INTRODUCTION

Contractors doing specialised works are important in the construction industry. In such an altered environment, a general contractor or construction firm overhead cost continuously increases. The total cost of a construction firm can be classified in to direct and indirect costs. Direct costs which are directly attribute to project work items E.g. labour, materials, production equipment, and supplies that must be incorporated into a distinct future in order to complete the work. Indirect costs include other items that are not made a part of the completed work such as contractor's overheads, contingencies, escalation, risk, and interest during the construction period. Overhead costs are generally divided into two categories: general overhead costs and job overhead costs. General overhead costs are those costs that cannot be identified readily with a specific project. General overhead costs are items that represent the cost of doing business and often are considered as fixed expenses that must be paid by the constructor. General overhead expenses include the general business expenses that are included by the home-office in support of the company's construction program (main office or home-office expenses). They are intended to include all those expenses (items) incurred by the home-office that cannot be tied directly to a given project such as,

1. Office Secretary
2. Office Engineers
3. Office running cost (office rental, clerical, utilities…etc.). These costs are included in the total cost on some basis.

Site overhead costs (project overhead costs) are similar to general overhead cost but it must be distributed over the project, since it cannot be allocated to specific work item. Site overhead costs include expenses that cannot be charged directly to a particular type of work, but are essential to construct the project, such as:

- Site accommodation
- Temporary services
- Site staff
- Clearing and levelling the site
- Mechanical plant not previously included in the item rates
- Welfare, first-aid and safety provisions
- Final clearance and handover
- Defects liability

These above-mentioned factors if not accounted for in the total bid price then the competitiveness, success, profitability of the construction firm will be affected badly.

However, the construction industry has not changed the method of controlling overhead costs in construction companies. Traditionally, a construction company uses resource-based costing and volume-based allocation. Resources-based costing is the method in which costs are allocated to object cost in accordance with the volume of direct labour hours, direct labour costs or contract amount.

The Indian construction industry is in need of a financial engineered estimating methodology (Model) that can assess project site overhead cost prior to the submission of the bid documents. In order to achieve such a model it is imperative that different techniques to be evaluated. This model will consider all the impacts of site overhead costs on both the general contractor/firm and client, through examining all the previous research and studies performed and focusing on the fact that accurate cost categorization, cost reporting, and profit calculation are the heart of the construction business.

When a construction company decide to bid which implies that the direct and indirect costs that the project will consume have to be estimated. Numerous factors are involved in this highly unstructured process. Thus, the need for automated systems (Models) to assist construction firms during the project phase is essential.

Overhead cost constitutes a major cost element for any construction project. Identifying the expected overhead cost is an important issue that can materially help construction contractors to arrive at a reliable assessment for the expected tender price of their projects. Many different factors make the detailed calculation of overhead cost a more difficult and tedious task. For example, some items of overhead cost are directly related to the project time. Such cost items greatly increase with any extension in the project's time. Another overhead cost elements are more difficult to be accurately estimated, although they can be nominated and identified in advance. In addition, many small items of overhead cost are very difficult to be identified or estimated. However, overhead costs are greatly affected by many factors. Among these factors come project type, size, location, client nature, and the project site conditions. All of these factors make the detailed estimation of such overhead costs a more difficult task. Hence it is expected that a lump-sum assessment for such cost items will be a more convenience, easy, highly accurate, and quick approach. Such approach should take into consideration the different factors that affect overhead cost. It is expected that a Regression Analysis based Model would be a suitable tool for building projects overhead cost assessment.

1.1 RESEARCH OBJECTIVES

The main objective of this research is to identify and investigate the main factors that affect overhead cost in the Kerala building construction market, and develop an Regression Analysis based model that will help the construction firms in assessing/predicting their projects overhead cost. Such a model should account for the most important factors which are dependent on time. This would improve the existing construction industry performance and ability to overcome the market competitiveness and enhance the company's international reputation. Through improving the bids accuracy and it also leads to:

Decrease the time, effort and money spent during the overhead cost prediction phase;

Improving the ability to provide a reliable prediction of the overhead cost percentage;

Summing up all the governing overhead cost parameters in one well defined technique;

Reducing the probability that unanticipated overhead costs that causes difficulties during the completion of the project in-hand, thus gaining the client's confidence and enhancing the company's reputation;

1.2 STUDY METHODOLOGY

The overhead cost estimating model for buildings construction projects is a prediction technique for any building project, in order to assess its overhead cost as a percentage from the total projects contract value. The model will be developed for the identification or anticipation of all overhead cost factors for building projects in India for various categories of construction companies. Hence, predicting the potential consequences of those items leading to an adequate and exact estimate of the expected overhead cost as a percentage from the total project contract value.

This research study will be performed in the following sequence:

1 Review of all previous studies performed;

2 Identifying the list of overhead cost factors for building projects from the previous studies;

3 Comparison will be made between that generated list and the factors that contribute to overhead costs in India from the expert's opinions (with the aid of a factors identification and verification questionnaire);

4 The collection of real-life building projects from the various selected construction companies.

Impact analysis to understand the effect that each overhead factor has on the percentage of overhead costs for building projects and also to understand whether a weighting of the factors is needed or not before the program is designed

2. LITERATURE REVIEW

Swapnil and Gauravdobariy (2016) Common phenomenon that affects construction industry in the world are cost overrun and delay. It mostly affects developing countries like India. In India as per MOSPI report, 235 projects out of 410 were severely affected cost overrun due to certain factors. A questionnaire was conducted with 15 prominent factors responsible for cost overrun and forwarded to 190 constructional professionals across India. Analysis was done using analysis of variance (ANOVA) and factor analysis tool using SPSS. Price escalation of raw material, project size, project duration, and lack of co-ordination between constructions parties are the top factors affecting cost overruns.

Subramani et.al. (2014) Causes of Cost Overrun in Construction. Cost overrun put massive burden on client and owners. Methods used are Desk study along with questionnaire survey for finding the causes of cost overrun. 30 filled questionnaires were collected from clients, consultants and contractors. As on March 31, 2012, 555 projects (with a budget of over Rs. 150crore and above) were on-going out of which 179 projects reports cost overruns. The results showed that, slow decision making, poor contract management, poor design/ delay in providing design, rework due to wrong work, problems in land acquisition, wrong estimation/ estimation method, and long period between design and time of bidding/tendering are the major causes of cost overrun.

Mulenga et al. (2015) deals with the effect of construction schedule overrun in Gauteng construction projects in South Africa. The data was obtained from well prepared questionnaire and detailed literature survey. MIS method was used for data analysis. The study concluded that type of project, claims, loss of time, loss of profit, extension of time, disputes and project size are the major criteria for project schedule overrun. Extension of time ranked 1(SD=0.829) and the last rank goes to loss of skilled employees (SD=1.077)

Ala Siskinaet.al (2009) A statistical analysis of a homogenous group of construction companies reveals the company's overhead costs value distribution function, which can be used to evaluate the competitive advantages and disadvantages of a specific construction company. Survey conducted among contractors which influenced principal parameters of the company's activity that depends the overhead costs. The size of a construction company, field of its activities and its regional location are the 3 essential competitiveness attributes which determine the positioning of Construction Company in the market. The selection of strategies aimed to increase the company's competitiveness is determined by the overhead costs dependence on business infrastructure and management system elements of the company.

Rahman et al. (2013) was focused on factors that's causing overhead cost in construction projects in Malaysia. A questionnaire was prepared for the study. In this a quantitative method is used for data collection using structured questionnaire survey amongst contractors, consultant and clients. The data was analysed with an advanced multivariate method of structural equation modelling with PLS approach using Smart PLS software. The analysis showed that all the constructs in model contributes significantly to budget overrun with R2 value of 0.623.

Trefor et al. (2014) has worked Predicting construction cost overruns using text mining, numerical data and ensemble classifiers. This paper discusses how text can be combined with numerical data to produce a prediction of cost overrun using data mining classification algorithms. The stacking model had an average accuracy of 43.72% for five model runs. It was found that a stacking model that used only numerical data produced predictions with lower precision and recall. A potential application of this research is to budget sufficient amount to complete a construction project. 2.C.G. Wilmot.

Peter et.al. (2013) explained the probability of project cost overrun in 276 Australian construction projects. The Kolmogorov-Smirnov, Anderson-Darling, and chi squared nonparametric tests were used to determine the goodness of fit of the selected probability distributions. The skewness and kurtosis values of the cost overruns are computed to determine if the empirical distribution of the data follows a normal distribution. The contract award as the reference point, cost overruns from 276 construction and engineering projects were calculated and revealed a mean cost overrun of 12.22%.

Aziz (2013) identified and grouped factors significantly related to time and cost performance and then developed the time and cost overrun models found that cost was one of the major considerations throughout out the project management life cycle for

waste management project in India. It was discovered the factors such as lowest bidding procurement method, bureaucracy in bidding/tendering method, additional work; wrong method of cost estimation; funding problems were critical for enhancing cost variation.

Jefferey and Jack (2014) discussed the quantification of a contractor's home office overhead costs (HOOH) in real-time. The owner needs to select the best technologies to equitably quantify HOOH and resolve HOOH claims prior to project completion. It was found that extended overhead costs occur when extension of the performance period of a construction contract leading to an increase in the overhead costs for the project.

Niazi et al. (2015) identified the significant factors that lead to construction cost overruns in Afghanistan. The questionnaire was circulated to 75 construction practitioners, including clients, consultants and contractors. Causes are determined based on different categories such as contractor, client, labour, material and equipment's and external things. RII (Relative Importance Index) method was used for analysis. According to them Corruption was ranked as first major contributor of cost overrun with a RII value of 0.89. Corruption constitutes a serious threat to the Afghanistan Construction Industry being able to improve because it has a serious effect on construction cost growth. Delay in progress payment by the client, this factor was ranked the 2nd most significant contributor of cost overrun with a RII value of 0.82

Zayyana et al. (2014) A questionnaire survey of Malaysian quantity-surveying consultants was undertaken to obtain project characteristics and cost performance data, in relation to a sample of 359 recently completed construction projects. Questionnaire survey was used for collecting information. First part of questionnaire includes general data of respondent company and the second part contain data such as project sector, contract values, type of project, procurement route, and nature of projects and tendering method used for analysis. The findings offer stakeholders descriptive statistical cost performance information in relation to these characteristics. The data was analysed through regression and descriptive analysis.

Table -2.1: Factors Contributing to Construction Overhead Cost Percentage In Kerala

SI.No.	FACTORS
1	The need for specialty contractors
2	Percentage of sub-contracted works
3	Projects size
4	Projects location
5	Firms need for work
6	Site preparation needs
7	Type of owner/client
8	Projects tight time schedule
9	The need for extra man power special construction equipments
10	The delay in projects duration
11	The firm's previous expertise with the same projects type
12	Contract type
13	The projects cash-flow plan
14	Consultancy and supervision

3.2 RELATIVE IMPORTANCE INDEX

The causes were examined and the ranking of their attributes was done using the Relative Importance Index (RII). The relative importance index is given as:

$$RII = \frac{\sum W}{A \times N} \quad \ldots\ldots\ldots\ldots \{2\}$$

Where,

RII = Relative Important Index

W = Weighting given to each factor by the respondents (ranging from 1 to 5)
A = Highest weight (here 5)
N = Total number of respondents

The collected data is given in Relative Important Index and raked according to the important index given

3.1 Likert scale

The Likert scale was named after its originator, Rennis Likert. The Likert Scale is an ordered, one- dimensional scale from which respondents choose one option that best aligns with their view. There are typically between four and seven options. Five is very common. All options usually have labels, although sometimes only a few are offered and the others are implied. A common form is an assertion, with which the person may agree or disagree to the varying degrees. In scoring, numbers are usually assigned to each option (such as 1 to 5). A benefit is that questions used are usually easy to understand and so lead to consistent answers by Bishop et al (2016). A disadvantage is that only a few options are offered, with which respondents may not fully agree. As with any other measurement, the options should be carefully selected from set of questions or statements that act together to give a useful and coherent picture. A problem can occur where people may become influenced by the way they have answered previous questions.

Table -3.1 Likert's scale

1 No effect at all	2 Fairly important	3 Important	4 Very Important	5 Critically Important

Table -3.2 Ranking

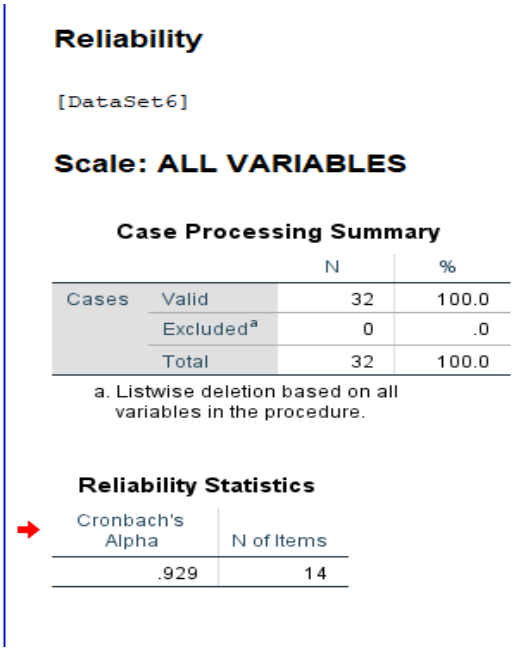
SI. No.	FACTORS	Importance					RII	Ranking
		1	2	3	4	5		
1	Type-Nature of Client	1	4	3	6	6	0.675	6
2	Contract Type	2	3	5	4	6	0.687	5
3	Special Site Preparation Requirements	5	4	6	2	3	0.73	1
4	Project Location	2	5	5	3	5	0.625	9
5	Project Duration	4	6	5	3	2	0.702	3
6	The need for specialty contractors.	6	8	3	1	2	0.58	12
7	Project Location	8	6	4	1	1	0.667	7
8	The projects cash-flow plan.	3	3	5	4	5	0.606	11
9	Projects tight time schedule	4	6	3	3	4	0.52	14
10	Projects size	3	3	6	4	4	0.693	4
11	Firms needed for sub-contracted works.	4	6	4	3	1	0.562	13
12	Consultancy and supervision.	6	8	3	1	2	0.718	2
13	Need for extra man power	8	6	4	1	1	0.65	8
14	Firms previous experience	3	3	5	4	5	0.618	10

3.3 RELIABILITY TESTING

The term reliability means the degree to which the result of a measurement, calculation can be depended on to be accurate. The reliability is measured by means of Cronbach's alpha value. The Cronbach's alpha value should be greater than 0.6 for reliable data set. If not eliminate the variable which contains a greater value in the 'Cronbach alpha if item deleted'

Table 3.3. Cronbach's Alpha

Cronbach's Alpha	N of items
0.929	14



Reliability

[DataSet6]

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	32	100.0
	Excluded[a]	0	.0
	Total	32	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.929	14

Fig -3.1: Reliability Result

4. CONCLUSION

The factors that influence the percentage of overhead costs for building construction projects were identified through literature review. Fourteen factors were identified. The collected data is analysed and ranked by using Relative Importance Index. Relative Testing is done by using SPSS Software. Cronbach's Alpha value got is 0.929. So it is consistent.

5. REFERENCES

[1]. Rahman, I.A., Aftab H. M and Ahmad, T. A. K. (2013). "Examining factors affecting budget overrun of construction projects undertaken through management procurement method using PLSSEM approach procedia-social and behavioural science". 107,120 – 128.

[2]. SWAPNIL P WANJARI* and GAURAV DOBARIYA, identifying factors causing cost overrun of the construction projects in India (2016) Sadhana ¯ Vol. 41, No. 6, June 2016.

[3]. Trefor P. William S. Jie Gong (2014), Predicting construction cost overruns using text mining, numerical data and ensemble classifiers, automation in construction,43,23-29

[4]. Touran, A. 2013. "Probabilistic Model for Cost Contingency", Journal of Construction Engineering and Management. 129(3).

[5]. T. Subramani, P S Sruthi, M. Kavitha (2014), —Causes of Cost Overrun in Construction‖ 1 Professor & Dean, Department of Civil Engineering, VMKV Eng. College, Vinayaka Missions University, Salem, India 2 PG Student of Construction Engineering and management, Department of Civil Engineering

[6]. Zayyana Shehu and Intan Rohani Endut (2014), Cost overrun in the Malaysian construction industry projects: A deeper insight, International journal for project management.

[7]. Peter E. D. Love, Chun-Pong Sing, Brad Carey, and Jeong Tai Kim, (2015), Estimating Construction Contingency: Accommodating the Potential for Cost Overruns in Road Construction Projects, ASCE Journal of infrastructure system,130,1-10

[8]. Mulenga, M., Clinton, A., Wellington. T. (2015) "Effects of construction projects schedule overruns: A case of the Gauteng Province, South Africa". *Procedia Manufacturing*, 3,1690 – 1695