

Complexities of Cost Overrun in Construction Projects

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Abstract:- The cost of construction projects right from the inception to completion stage is becoming a matter of great concern, recently, especially among clients and beneficiaries, because of the rising interest rates, scope change, among other factors responsible for cost overruns. Hence the need to understand the complexities of cost overrun in the construction sector has become more important. This study therefore aims to identify the major complexity attributes of cost overruns in construction projects to suggest practical solutions in addressing them. Literature study along with semi-structured interview is used to identify the complexities of cost overrun and on the basis of the self-assessment tool maturity level of the complexity attributes, the major attributes behind cost overrun are identified based on the results of the analysis and further suggestive measures are given.

Keywords:- Complexity, Cost Overrun, Self-Assessment Tool.

I. INTRODUCTION

A. Construction Industry in India

The construction industry plays a vital role in economic growth of a country, it is an important indicator of development as it creates investment opportunities across various sectors. As per the second advance estimates for the year 2017-18, the GVA added by construction sector stood at USD 140 billion. According to MoSPI, (Ministry of statistics and programme implementation) as on October, 2018 infrastructure projects in central Government sector costing INR 150 crore and above, are currently experiencing cumulative cost overruns of 8.41 percent of their planned cost.

Project complexity is a term which lacks a proper definition to be understood very well in the construction industry. It is a very critical factor that presents additional challenges to achieving project objectives (Bac Dao, 2016). Terry Williams (2002) suggested that impacts of project complexity can be negative if it is not assessed and managed appropriately. Project-based industries face major challenges in controlling project cost and completing within the budget. So, there is a need to identify the complexities of cost overrun.

The common definition of cost overrun given in most of the studies is a change in cost relative to the final estimate when project was approved. As said by T. Subramanian et. al, 2012, Cost overrun can occur at different stages of construction and it is important to understand the causes behind cost overrun and through which end they occur like owners side, contractors side, consultants side etc. Each construction project has its own complexities where different management and solutions are needed to manage them. There could be various reasons behind cost overrun and complexities of project which can be linked together like inexperienced contractors, dynamics of market, scope change, fiscal planning, legal issues etc, which are indicators of project complexity leading to cost overrun.

B. Need of the Study

The dimensions of complexities of cost overrun are not usually studied, so it is very important to identify the dimensions of complexities of cost overrun in construction projects in order to prevent the problems created by the same and thus minimise the effect of the same. The assessment of construction projects requires in depth understanding of its complexity on project progress and corresponding cash-flow. The need is to identify the level of importance given to different complexity dimensions in cost overruns and to recognise best practices to improve budgetary control of projects.

C. Aim

To identify the complexities of cost overrun in construction projects and suggest mitigation measures.

D. Research Objectives

- To develop an understanding of project complexity.
- To identify the dimensions of complexities of cost overrun in construction projects.
- To suggest mitigation measures that could be taken against the complexities of cost overrun.

E. Scope of Work

The scope of the study is to identify the various attributes of complexities behind cost overruns in construction projects at various stages of construction. An investigation is performed on the data collected through the literature study and discussion with industry experts. Further mitigation measures are suggested based on case study.

F. Future Significance

A comparative study of cost overrun on different types of construction projects can be conducted. Study on cost controlling techniques that can be implemented on the cost data of the projects can also be conducted.

II. METHODOLOGY

To carry out the study the following methodology has been adopted:-

- On the basis of the literature study and semi-structured interviews carried out the attributes of complexity have been determined and grouped under relevant heads to form a proposed self-assessment tool of project complexity and cost overrun. Empirical evidence of complexity attributes, cost overrun and its causes are to be studied.
- A literature matrix is developed based on the identified attributes of complexity (using the identified complexity indicators) and would be linked with identified causes of cost overrun, grouped under various subheads.
- Based on the study conducted a cost overrun complexity self- assessment tool is to be proposed and mitigation measures can be suggested.
- The above results been validated with case studies as example to validate the developed self- assessment tool.

III. LITERATURE REVIEW

A. General

A common statement that one comes across often while dealing with the construction industry is that construction is a complex process. According to Baccarani (1996), construction projects are invariably complex and since World war II have become progressively more. In fact the construction process may be considered as one of the most complex undertaking in any industry. Cost is one of the five main parameters that can sufficiently define a construction project.

B. Defining Complexity

Terry William(2002) defines the various types of projects through case studies and the need for modelling and how does modelling work in practice, how can we validate our models, what constitutes project complexity and what makes a project complex etc have been discussed.. Various author's have given different definitions of complexity, As (Sinha et al,2001) underline it, there is no single concept of complexity that can adequately capture our intuitive notion of what the word ought to mean. The study conducted by (Ivana Burcar Dunovi et al,2014) identifies elements of complexity identified with this research show that in addition to the two sources mentioned, structural complexity and uncertainty, there is another significant source of complexity – constraint.

C. Complexity and Cost overrun Measures

In construction field there have been several attempts to measure the complexity of construction projects. Giddado (1996) viewed project complexity in terms of

technical complexity, amount of overlap and interdependencies in constructions stages, organizational complexity, site layout, unpredictability. Though, studies identified project complexity as a cost escalation factor, no suggestions are proposed to improve the estimation process by addressing complexity issues. Therefore, examining the dimensions of project complexity for a more realistic estimation of cost is beneficial to avoid cost overruns. For example, complex construction projects are considered “one off” compared to the complex projects of most other industries, as they are location sensitive, material/labour sensitive, and often customer requirements are individualistic to every single project (Bertelsen & Koskela, 2005). Therefore, importance given to complexity dimensions in cost estimation is also expected to be different across industries. Though, studies have identified project complexity as a cost escalation factor, no suggestions are proposed to improve the cost management process by addressing complexity issues. Therefore, examining the dimensions of project complexity for a more realistic estimation of cost in current scenario is a need to avoid cost overruns. Based on the above studies, researchers have focused either on project complexity or cost overrun but the gap lies in linking the two contributors so that it provides a complexity model linked with cost management which enhances the process of cost estimation based on the study a complexity and cost overrun matrix is proposed. Total 11 categories have been proposed 1) Stakeholder management; 2) Governance; 3) Legal; 4) Fiscal planning; 5) Interfaces; 6) Scope definition; 7) Management; 8) Project resources; 9) Design and technology; 10) Location; 11) External. Table 1 represents an example of complexity attributes and cost overrun indicator matrix.

Complexity attribute	Cost overrun indicator
Stakeholder Management	Involvement of too many parties
	Inadequate project formulation
	Inadequate contractor's experience
	Public profile, social and cultural impact

Table 1:- Example for complexity and cost overrun matrix

IV. SELF-ASSESSMENT TOOL APPLICATION ON CASE STUDY

The self-assessment is proposed to be performed by site engineers and managers at different stages of the project to obtain an in-depth outline of the organization and its current level of performance. It allows you to identify strength and uncover gaps through mapping of present skill set, helps in planning ongoing growth and assists engineers, managers and organizations with talent acquisition, managing resources, and measuring skills and performance. This self-assessment tool uses five maturity levels, which can be used to analyse the level of each complexity of project indicator leading to cost overrun. A numeric value from 1 to 5 will be assigned to each measurement indicator with one being lowest through five

being highest maturity level of the indicator in terms of the respective project. Figure1 shows an example of the indicator with the measurement levels and other comments/suggestive measures. Based on the ranking as per the maturity levels marked by the construction professionals involved in the project it helps us in

identifying the potential attributes of the project’s complexity behind cost overrun. The tool comprises of 11 attributes linked with 20 cost overrun complexity indicators which are to be assessed and marked as per their maturity level in the project.

INDICATOR	LEVEL	DESCRIPTION	CONCLUSION	
			YES	RECOMMENDATION
STAKEHOLDER MANAGEMENT				
Inadequate project formulation	1	When there is lack of pre defined set of inputs required as per the feasibility study conducted. Processes for determining the project’s objectives are done in an informal or ad hoc manner. Short- term objectives are only defined.		
	2	Clearly pre defined set of inputs required and execution plan. The objectives are quantifiable, where possible, but are not clearly understood.		
	3	Clearly defined set of inputs required, project timeline, execution strategy. Objectives are well understood.		
	4	Clearly defined set of inputs required, project timeline, execution strategy, projects budget.		
	5	Clearly defined set of inputs required, project timeline, execution strategy, projects budget with proper project design and network analysis.		

Fig 1:- Maturity level for an indicator in self-assessment tool

V. DATA ANALYSIS

The following dataset was collected from the professionals involved in the project for each complexity and cost overrun indicator shown in the Table 2 –

Axes/Datasets	Dataset 1	Dataset 2
Stakeholder management	2	2.4
Governance	2.33	2.33
Legal	2.66	3
Interfaces	3.25	3.5
Fiscal planning	2	3.5
Management	1.83	1.83
Project resources	2.83	2.5
Design and technology	3.45	3.67

Table 2:- Data set collected through case study

The final outcomes of the case study analysis are shown in the spider-web diagram, fig2 below. The potential complexity attributes identified are the stakeholder management, management and fiscal planning attributes which are a major cause of concern for this case, this case study involves a hospital project, so management is very crucial in such projects.

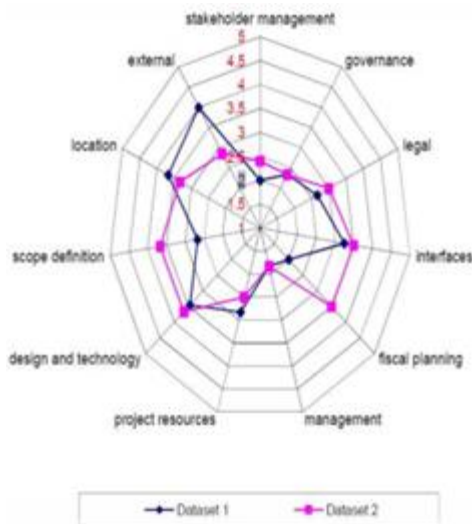


Fig 2:- Spider web diagram of the dataset

The most prominent indicators identified through literature study and case studies by the application of self-assessment tool are-

- Inadequate original estimating resulting into major variation in quantities.
- Cash flow of the project..
- Cost escalation of construction material.
- Procurement of specialized equipment.
- Poor site management due to lack of coordination between site and design office.
- Law and order problems(Multi window clearance from government authority).
- Geographical conditions

Preventive measures at the planning stage-

- Including cost escalation clause as a part of the contract agreement.
- Single window clearance from government authority.
- Proper project planning and scheduling.
- Proper soil investigation and other survey as per location of site.
- Enhancing cash flow of the project by taking up construction in phases.

VI. CONCLUSION

The research provides us with an easy way to analyse the complexities of cost overrun in a construction project. The potential attributes of project complexity responsible for project cost overrun were identified. In this way, the study contributes in handling project cost overrun in the field of construction project management. This process helps project participants to access the project by themselves. Further it provides project management researchers and professionals to grip the positive aspects and reduce negative aspects of project complexity leading to cost overruns, for effective management of a construction project.

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