

# Analysing the causes of cost overrun in life cycle of construction projects: Contractor's Perception

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**Abstract** - Cost is an important parameter and driving force for evaluating the success of any construction project. Worldwide the construction projects are not successful due to the problem of cost overrun. Indian construction industry is also suffering from the problem of cost overrun. Many researchers have studied the cost overrun problem regarding quantifying, managing, planning and preventing but the studies for the issue of cost overrun from the project life cycle perspective are found very few. Therefore the purpose of this study is to analyse the causes of cost overrun in Indian construction industry for effective management of cost overrun from project life cycle perspective from the contractor's point of view. Therefore the factors causing cost overrun are allocated into different phases of life cycle of project. A literature review is deployed to generate a set of cost overrun factors and a questionnaire survey has been conducted for assessing the relative importance index for these factors. The top ten most important causes of cost overruns in construction projects of India as perceived by the contractors included fluctuation in price material, inappropriate govt. Policy, inflation, mistakes and discrepancies in contract document, financial difficulty faced by the contractor, frequent design change, high cost of machineries, lowest bid procurement policy, inaccurate time and cost estimate and additional work. This research also found that these causes of cost overrun spread through the whole project life cycle and many causes occur at more than one phase.

**Key words:** Construction industry, India, Cost overrun, Project life cycle

## I. INTRODUCTION

Cost is an important parameter and driving force for evaluating the success of any construction project [1-5] and it is the important responsibility of the project manager to make sure that the project cost does not exceed its original estimates to avoid or minimize the cost overrun. cost overrun in construction is expressed as the excess of actual project costs over estimated costs [6-7]. The problem of cost overrun frequents the construction industries of many countries and is found crucial both for developed and developing countries [3, 8-16]. Therefore it has become a widely researched topic for the last couple of decades. Many researchers have studied the cost overrun problem regarding quantifying, managing, planning and preventing [17-25] but the studies for the issue of cost overrun from the project life cycle perspective are found very few in the literature. It is suggested that to overcome the negative outcomes created by the risks of cost overrun, they should be managed earlier in the project life cycle rather than later [26-27].

The factors causing cost overrun should be allocated in different phases of life cycle of the project for making appropriate action for preventing and minimising the cost

overrun. The common phases in project life cycle consists of conceptual planning and feasibility studies, engineering design, execution, and project closeout[28] as shown in fig.1. **Conceptual Planning and Feasibility:** The aim is to make certain that the project implementation is in a plan, schedule and budget. This phase of the project involves the scope of project, purpose, objectives, resources, time and cost estimation, and deliverables.

**Engineering Design:** The activities in this phase are carried out by an engineering organization. During this phase detailed plan and drawings are prepared for whole project. Designers are accountable for providing drawings according to owner requirements and any changes can be made before it is approved.

**Execution:** This is a very important phase of the project life cycle as the major activities of the project occur during this phase of the project life cycle. This phase consist the execution of project plan, regularly monitoring of work progress, communication between other parties and controlling the time, cost and quality of work.

**Operation and maintenance phase:** Operation and maintenance phase is the final stage of a construction work.

Here at this stage more stress is given on the finishing work for the entire project. The construction facilities are handed over to the clients for use. Work approval and completion

certificate is then issued by the client after all the work has been verified and founded to be in order.

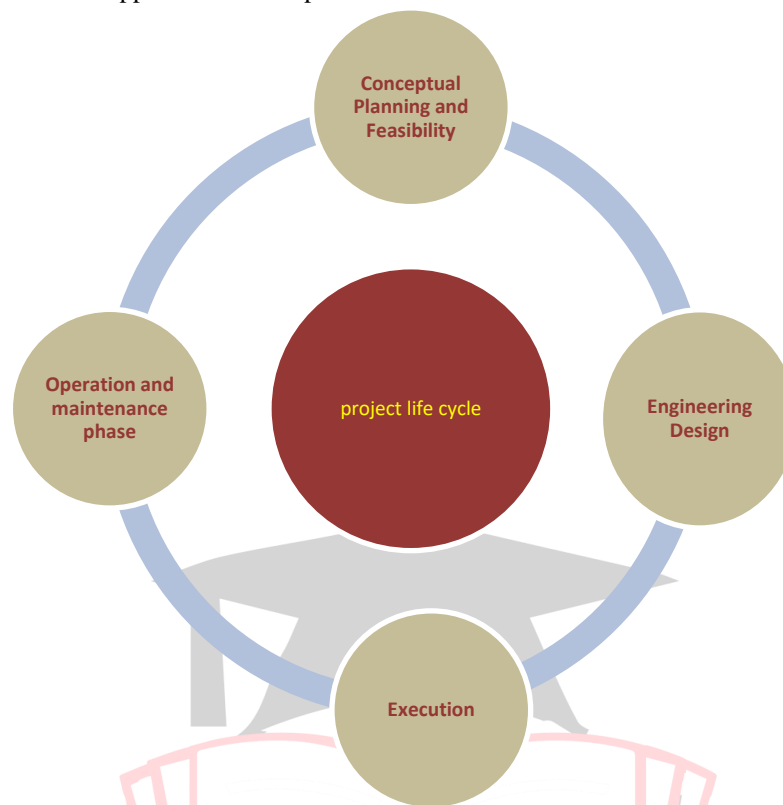


Fig.1 - Life cycle of the project

Hence it is a matter of great concern to identify the causes of cost overrun to alleviate this issue of cost overrun. The main objective of this study is to analyse the causes of cost overrun from the view point of contractor's. These factors are then allocated in the different phases of life cycle of the project for effective and timely management of these factors.

## II. LITERATURE REVIEW FOR FACTORS CAUSING COST OVERRUN

The literature from different part of the world is reviewed for identifying the common factors causing cost overrun. The project cost overrun depends upon many factors which are related to risk and uncertainties involve in the project. Many case studies are available in the literature related to cost overrun in the construction projects worldwide. Some of the important case studies have been discussed here.

Arditi, et al. [29] investigated the factors causing cost overrun in public projects in Turkey and found that the main causes of cost overrun were increase in materials' prices due to the fast growth of inflation, delay caused by shortages in resources, changes in design, specifications, financial problems and underestimation of cost at the time of preparing the budget of the project. Okpala and Aniekwu[30] identified the cause of cost overrun in Nigeria Construction projects, These include: the price fluctuations, additional works, delays, fraudulent practices,

shortening of contract period, inaccurate estimates. Mansfield et al. [31] carried out a questionnaire survey among key stakeholders. The analysis of survey showed that poor planning, shortage in materials, imported materials, and changes in site conditions, design changes were the major sources of construction delays and cost overrun. Poor project planning and management, unexpected ground condition, design development, lack of information, estimating method, time limit, commercial pressure, procurement route and external factor were identified as the most important factors causing cost overrun in building construction projects in UK by Jackson [10]

To identify the prevailing cost overrun factors in Indian construction industry, literature and case studies from Indian construction [32, 33, 34, 35] are also being analysed and discussion with experts from Indian construction industry is carried out.

## III. METHODOLOGY

A questionnaire survey was carried out in Indian construction industry to rank the important causes of cost overrun in construction project and to allocate these cost overrun factors in different phases of life cycle. The questionnaire was distributed among the construction practitioner such as owner, contractor and consultants. Total 47 responses from 100 sets were collected for

allocating the cost overrun factors in different phases of life cycle. The respondents were asked for judging the importance level of identified cost overrun factors. A five-point likert scale of 1 to 5 was used to judge the importance level of each factor. These numerical values were assigned to the respondents' rating: '1 = very likely; 2=likely; 3=moderate; 4=severe; 5=very severe'. For ranking these cost overrun factors, Relative importance index (RII) is calculated, using the following relation

$$RII = \sum W / (A * N) \dots\dots\dots (1)$$

Where W is the weighting given to each factor by the respondent (ranging from 1 to 5), A is the highest weight and N is the total number of respondents. The RII and rank calculated for different factors causing cost overrun is presented in table 1.

Table 1: RII of the cost overrun factor

FACTOR NAME	CONTRACTOR	
	RII	RANK
FLUCTUATION IN PRICE MATERIALS	0.83	1
LOWEST BID PROCUREMENT POLICY	0.714	8
INFLATION	0.804	3
INAPPROPRIATE GOVTPOLICY	0.81	2
INACCURATE TIME AND COST ESTIMATE	0.693	9
MISTAKES AND DISCREPANCIES IN CONTRACT DOCUMENT	0.774	4
ADDITIONAL WORK	0.676	10
FREQUENT DESIGN CHANGE	0.74	6
UNREALISTIC CONTRACT DURATION	0.604	15
HIGH COST OF LABOUR	0.544	20
FINANCIAL DIFFICULTY FACED BY CONTRACTOR	0.753	5
POOR PLANNING AND SCHEDULING	0.621	13
DIFFERING SITE CONDITION	0.608	14
POOR COORDINATION BETWEEN PARTIES	0.663	11
EXCHANGE RATE	0.655	12
CONTRACT MANAGEMENT	0.595	Sixteen
COST OF MATERIAL	0.557	18
HIGH INTEREST RATE CHARGED BY BANK&LOAN	0.553	19
CHANGE IN THE SCOPE OF THE PROJECT	0.519	22
DISPUTES ON SITES	0.468	26
FRADULENT PRACTICEES & KICKBACKS	0.536	21

INSURANCE COST	0.587	17
HIGH COST OF MACHINERIES	0.723	7
CLIMATIC CONDITION	0.497	23
REWORK DUE TO ERROR	0.489	24
IMPROPER DESIGN & DELAY IN PRODUCING DESIGN DOCUMENT	0.37	44
SLOW PAYMENT OF COMPLETE WORK BY OWNER	0.485	25
SLOW DECISION MAKING	0.442	30
INADEQUATE EXPERIENCE OF TECHNICAL CONSULTANT	0.455	27
LACK OF COMMUNICATION BETWEEN PARTIES	0.438	31
CHANGE IN MATERIAL SPECIFICATION	0.412	36
WASTES ON SITE	0.446	29
DELAY IN APPROVAL OF DESIGN	0.404	37
SLOW INFORMATION FLOW IN BETWEEN PARTIES	0.434	32
MODE OF FINANCE & PAYMENT	0.425	34
SOCIAL & CULTURAL FACTOR	0.429	33
QUALITY ASSURANCE & QUALITY CONTROL	0.421	35
POOR SITE MANAGEMENT	0.378	Fourty Two
CONTRACTUAL PROCEDURE & TYPE OF CONTRACT	0.348	48
SHORTAGE OF LABOUR	0.438	38
SHORTAGE OF CONSTRUCTION MATERIAL	0.391	40
ACCIDENT DURING CONSTRUCTION	0.387	41
LOW LEVEL PRODUCTIVITY OF LABOUR	0.353	46
INTERFERENCE BY OWNER	0.395	39
CONTRACTOR LACK OF EXPERIENCE	0.361	45
LATE MATERIAL DELIVERY	0.319	54
INCOMPETENT SUB CONTRACTOR	0.374	43
DELAY IN PERFORMING INSPECTION	0.451	28
UNQUALIFIED LABOUR	0.344	49
LABOUR DISPUTES AND STRIKES	0.331	52
ACTS OF GOD	0.351	47
OBSOLETE AND IMPROPER CONSTRUCTION TECHNIQUE	0.336	51
DELAY IN PROCUREMENT OF MATERIAL	0.314	55
SHORTAGE OF EQUIPMENT	0.34	50
EQUIPMENT AVAILABILITY & FAILURE	0.327	53

#### IV. IMPORTANT CAUSES OF COST OVERRUN IN INDIAN CONSTRUCTION PROJECTS

Fig 2 shows the ranks for the top ten most important causes of cost overruns from the contractor’s point of view. The top ten most important causes of cost overruns in construction projects of India as perceived by the

respondents included fluctuation in price material, inappropriate govt. Policy, inflation, mistakes and discrepancies in contract document, financial difficulty faced by the contractor, frequent design change, high cost of machineries, lowest bid procurement policy, inaccurate time and cost estimate and additional work.

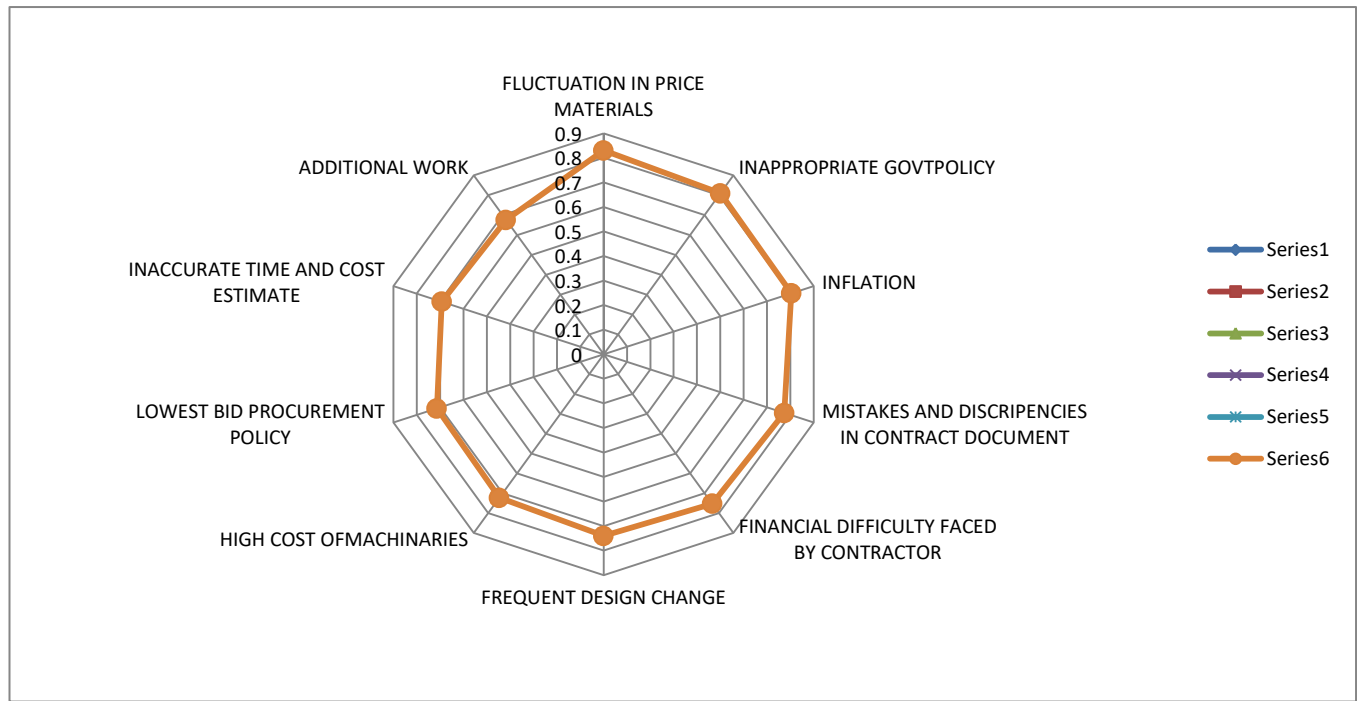


Fig. 2 - Ranking of top ten factors by contractors

#### 4.1 Fluctuation in price material

“Fluctuation in price material” has been ranked first by the contractors’ respondents with RII=0.83. This factor has been ranked as number one because it is directly related with the cost of the project. India, being the fast developing country, has witnessed the volatilities in the price of material chiefly employed in the projects. Ironically, such volatilities in the price of material are beyond the control of all concerned to the extent that it is very difficult to calculate the impact of price variation precisely over the cost overrun at stipulated completion date of the project.

#### 4.2 Inappropriate govt policy

“Inappropriate govt policy” has been rated as the second important factor with RII 0.81. according to respondents. This factor is the cause of difficulty with the employer for arranging funds in order to maintain the progress of works at the committed contract amount and the delay caused by client ultimately leads to cost overruns. In developing nations like India govt. policies influence the price of the contract. Small contractors, who have weak financial positions, out-dated labour-intensive technology and poor organizational structures and vision for growth and development, are highly vulnerable to government policies and changes in government policies.

#### 4.3 Inflation

“Inflation” is a significant factor and has been ranked third with RII 0.804. Inflation has profound impact over the cost overrun for those projects where in price variation clause has not been considered. Thus the inflation factor is required to be considered in accurate manner before quoting the bid price particularly focusing over the commodities of cyclic tendency in price variation.

#### 4.4 Mistakes and discrepancies in contract document

“Mistakes and discrepancies in contract document” has been ranked fourth from responses. Few mistakes and discrepancies in contract document have significant impact on the cost and consequently on the completion period of the project. This ought to be the fundamental and foremost requirement of the project to describe the scope or work precisely, delineating and encompassing the entire requirement along with clear description of “what is to be done by whom”. Any task which is either vaguely described or not described at all in terms of “what is to be done by whom” shall certainly attract unwarranted delays and dispute.

#### 4.5 Financial difficulty faced by the contractor

“Financial difficulty faced by the contractor “has been ranked at fifth position with RII=0.753. Impediment in circulation of money some time causes financial difficulty faced by the contractor and thus payment of all bills raised by the contractor should be disbursed with in prescribed time frame. Financial mismanagement on the part of contractor is responsible for generation of adequate amount of money at right time. Self sustainable project have always been profitable as the money generated by the project is again infused in that project.

#### 4.6 Frequent design change

“Frequent design change” has been ranked at sixth position. It has RII = 0.74. Sometime frequent design change is result of lack of proper planning at the formulation stage but some time reason of design change could be otherwise. Reasons of unavoidable design change are due to unresolved hindrances; new information emerged during sub soil investigation, addition of new concept/dimension due to political circumstances, development/know-how of new, appropriate technology, recent occurrence of natural calamity in project area etc. Frequent design change lead to wasteful expenditure and could be categorised as national wastage.

#### 4.7 High cost of machineries

“High cost of machineries” has been ranked at seventh position with RII = 0.723.

During the phase of preparation of contract document almost all machinery to be used is assessed properly but during the phase of construction certain urgent requirements enforces to deploy machineries having advance technology. Deployment of such machinery in emergent situation may be cause of cost overrun.

#### 4.8 Lowest bid procurement

The important variable “Lowest bid procurement” has been ranked eighth with RII 0.714. Prime factor of cost overrun is the existing practice of the government to implement its lowest bid price method, which has a variety of inherent problems and cannot produce the excellent result. When the lowest bid procurement model for inviting the tender is adopted, contractor some time tries to grab the project grossly ignoring the realistic workable bidding cost. Occurrence of such circumstances results in lower quality, unwarranted disputes and cost over run on account of delayed project.

#### 4.9 Inaccurate time and cost estimate

“Inaccurate time and cost estimate” is ranked at ninth position having RII=0.693. During the formulation phase of the project different methodologies have seen to be adopted by different parties. Some times the cost estimates are derived from the average present cost of any commodity, taken from the leading manufactures/suppliers of the commodity. Deviation in cost estimates could be on account of various reasons like not taking average of adequate suppliers/manufacturers of commodity covering almost complete geographically area of country. Costs of the commodity furnished by the manufactures/suppliers are seen at higher side as actual costs of supplies are subjected to negotiation on account of tough competition. Precise estimation of project could better be attained when all the items required for completion of a project have been identified correctly. Omission of items which are required or inclusion of redundant items in the project will subsequently leads in to erroneous cost estimate. Precise estimation of labour intensive project requires proper consideration of area specific dimension along with agriculture requirement of labour in different seasons of year.

In vast number of project stipulated completion period is arbitrarily determined where as in some project stipulated completion period is vaguely linked with the cost of the project. In today’s modern era it is important and essential to determine completion period of a project viz-a-viz the nature of project, perceptible hindrances involved, geographical location of the project and urgency of completing the project.

#### 4.10 Additional work

The survey results reveal that “Additional work” is the tenth most important factor with RII=0.676. It is well accepted facts among all the concerned parties that scope of work ought to be described comprehensively and mentioned carefully so that necessity of additional work could be eliminated altogether. Nevertheless on account of some confusion at the planning stage or due occurrence of human error, addition works has seen to pop up as unavoidable evil. Approvals of such works are very time consuming and could affect contractual obligation adversely. In some worst circumstances additional work may leads to legal complications between concerned parties.

## V. ALLOCATION OF COST OVERRUN IN DIFFERENT STAGES OF LIFE CYCLE OF THE PROJECT

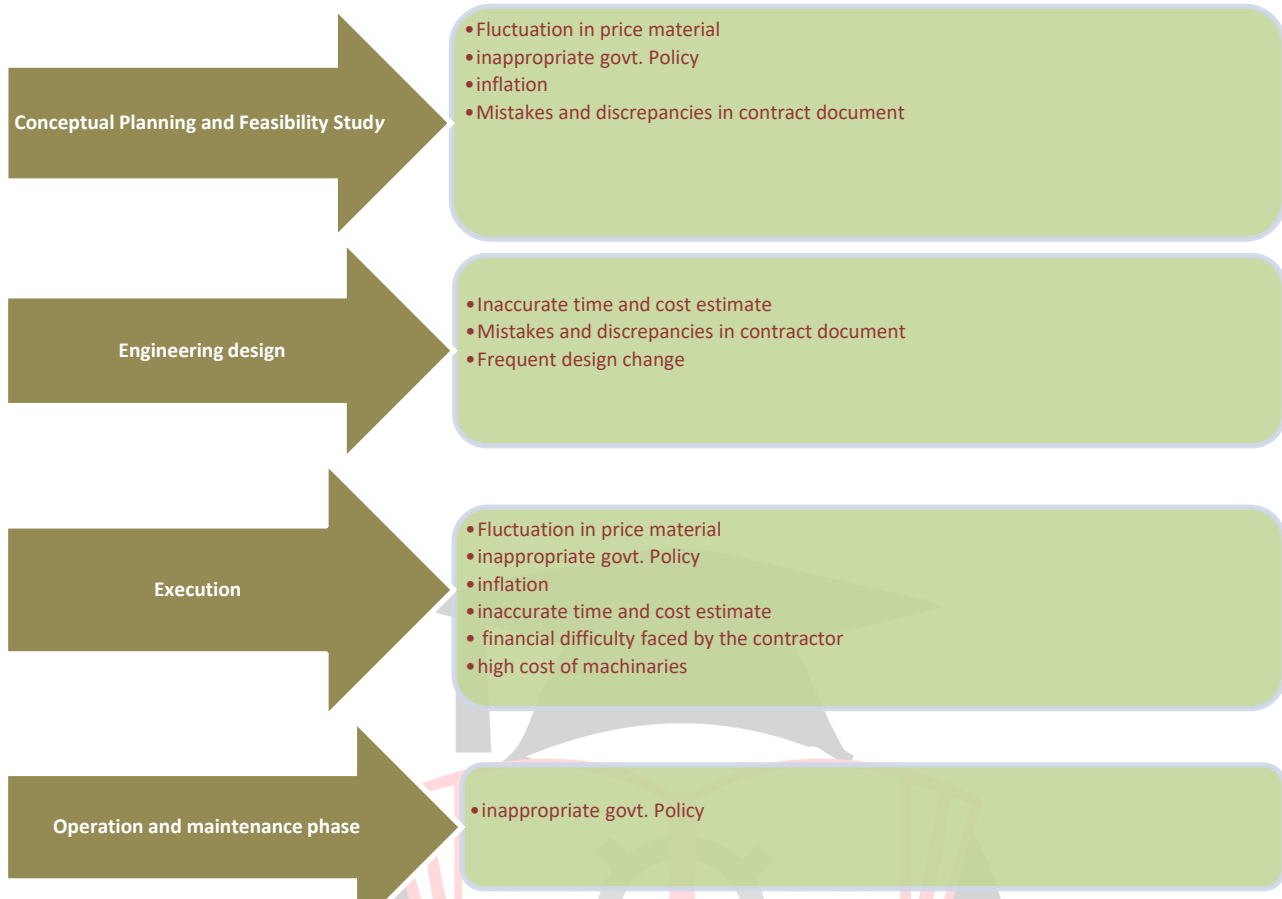


Fig. 3- Allocation of cost overrun in different stages of life cycle of the project

It is found that these cost overrun causes spread through the whole project life cycle and many causes occur at more than one phase. From cost overrun point of view conceptual planning and feasibility study, engineering design and execution phase are very critical.

## VI. CONCLUSION

Cost is one of the fundamental criteria for measuring the success of the project. Worldwide the construction projects are not successful due the problem of cost overrun and it is observed that the problem of cost overrun has not been addressed and handled with required attention in Indian construction industry also. A questionnaire-based survey is used to obtain the attitude of contractors towards factors affecting the cost overrun in construction projects in India. The top ten most important causes of cost overruns in construction projects of India as perceived by the respondents included fluctuation in price material, inappropriate govt. Policy, inflation, mistakes and discrepancies in contract document, financial difficulty faced by the contractor, frequent design change, high cost of machineries, lowest bid procurement policy, inaccurate time and cost estimate and additional work. To reduce the harmful consequences brought by the cost overrun factors

they are allocated in different phases of project life cycle for making proper action for preventing and minimising the cost overrun in Indian construction, the responses from the experts were also collected for allocating the factors in different phases of life cycle of the project. This research found that these causes of cost overrun spread through the whole project life cycle and many causes occur at more than one phase. From cost overrun point of view conceptual planning and feasibility study, engineering design and execution phase are very critical.

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