ASSESSMENT OF COST ESCALATION AND OVERRUN IN CONSTRUCTION PROJECTS

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ABSTRACT

Cost is among the major considerations throughout the project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success. Despite its proven importance it is not uncommon to see a construction project failing to achieve its objectives within the specified cost. Cost overrun is a very frequent phenomenon and is almost associated with nearly all projects in the construction industry. This trend is more severe in developing countries where these overruns sometimes exceed 100% of the anticipated cost of the project. This paper is attempted to identify the major cost overrun and cost escalation factors in the construction industry. A thorough literature review is done through which a number of cost overrun and escalation causes are identified in construction industry scenario. From thorough study, total fifty three (53) factors were finalized to made part of the survey questionnaire. Out of these, cost escalation factors (14) and cost overrun factors (33) and (6) material factors were to be considered. Using SPSS (statistical package of social science) tool, average indices were identified and from that critical factors were to be ranked for cost overrun. Using relative importance index, cost escalation factors were to be ranked. And also, impact of material components on cost escalation were identified through various case studies. Finally some recommendations were suggested for further research.

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1. INTRODUCTION

The development and growth of the country mainly depends on successful implementation of infrastructure projects. However, the performance record in successful implementation of infrastructure projects in India has not been encouraging. Cost escalation is part and parcel of construction projects in India. Escalation in the construction market in recent years has been extremely volatile, and this trend is expected to continue in the near future due to competition for resources and skilled workers. This situation has created a great deal of uncertainty and nervousness among construction field. Central and State government's mega projects on an average annually face cost escalation of about Rs.400,000 to Rs.500,000 million (Source: Ministry of statistics and programme implementation, Government of India). The wealth of any nation is measured by its performance in infrastructure provision through its construction Industry. The financial success of construction project can be uncertain and at risk due to changes in escalation rates during construction. The success of a building construction project is mainly influenced by to what extent of cost escalation identified and allocated to the construction project

Historically large construction projects have been plagued by cost and schedule overruns. In too many cases, the final project cost has been higher than the cost estimates prepared and released during initial planning, preliminary engineering, final design, or even at the start of construction. Over the time span between project initiation concept development and the completion of construction many factors may influence the final project costs. This time span is normally several years in duration but for the highly complex and technologically challenging projects it can easily exceed 10 years. Organizations face a major challenge in controlling project budgets over the time span between project initiation and the completion of construction. The development of cost estimates that accurately reflect project scope, economic conditions, and are attuned to community interest and the macroeconomic conditions provide a baseline cost that management can use to impart discipline into the design process. Projects can be delivered on budget but that requires a good starting estimate, an awareness of factors that can cause cost escalation, and project management discipline. When discipline is lacking, significant cost growth on one project can raze the larger program of projects because funds will not be available for future projects that are programmed for construction.

Construction investments are sensitive to time and cost overrun. Delay and cost escalation are considered two threats to project success. The problem of cost overrun, especially 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 in terms of project cost variation subsequent to the owner's decision to build. Although, in theory, it might be expected that cost overruns have the same probability of occurring as cost under runs, cost overruns have a much higher frequency. The significance of the construction industry in the attainment of a nation's quest for development and self-reliance cannot be overemphasized. The industry serves valuable functions in the society that vary according to social needs. A cost overrun is defined as a cost that is above, or not in, the initial cost estimate for the project. Delays to the schedule are another indicator of a project's performance and can cause an overrun in a project's cost.

Cost overrun is a very frequent phenomenon and is almost associated with nearly all projects in the construction industry. The problem of cost overruns is critical and need to be study more to alleviate this issue in the future. Cost overruns are a major problem in both developing and developed countries. The trend is more severe in developing countries where these overruns sometimes exceeds 100% of the anticipated cost of the project. There are several factors that affect the construction cost and various studies have been conducted to address these factors. Low quality materials cause higher construction cost than expected because of the loss of materials during construction. This results from a lack of standards for materials and management systems.

1.2 AN OVERVIEW OF COST ESCALATION

Cost escalation is defined as changes in the cost or price of specific goods or services in a given economy over a period of time. This is a similar to the concepts of inflation and deflation except that escalation is specific to an item or class of items (not as general in nature), it is often not primarily driven by changes in the money supply, and it tends to be less sustained. While escalation includes general inflation related to the money supply, it is also driven by changes in

technology, practices, and particularly supply-demand imbalances that are specific to a good or service in a given economy.

For example, while general inflation (e.g., consumer price index) in the US was less than 5% in the 2003-2007 time period, steel prices increased (escalated) by over 50% because of supply-demand imbalance. Cost escalation may contribute to a project cost overrun but it is not synonymous with it. Over long periods of time, as market supply and demand imbalances are corrected, escalation will tend to more-or-less equal inflation unless there are sustained technology or efficiency changes in a market.

Escalation is usually calculated by examining the changes in price index measures for a good or service. Future escalation can be forecast using econometrics. Unfortunately, because escalation (unlike inflation) may occur in a micro-market, and it may be hard to measure with surveys, indices can be difficult to find. For example, the Bureau of Labor Statistics has a price index for construction wages and compensation (what the construction contractor's labor cost), but has none for the prices that owners must pay the construction contractor for their services. In cost engineering and project management usage, escalation and cost contingency are both considered risk funds that should be included in project estimates and budgets. When escalation is minimal, it is sometimes estimated together with contingency. However, this is not the best practice, particularly when escalation is significant.

1.3 AN OVERVIEW OF COST OVERRUN

A Cost overrun, also known as a cost increase or budget overrun, is an unexpected cost incurred in excess of a budgeted amount due to an under-estimation of the actual cost during budgeting. 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, raw material input, demand and supply, etc.

Cost overrun is common in infrastructure, building, and technology projects. Cost overruns in construction contracts include change orders and claims. A change order is a modification to a construction contract, and the resultant impact on cost and time must be mutually agreed upon by the owner and contractor. Claims represent proposed changes to the contract (potential change orders) that are being negotiated or litigated. The cost-overrun rate is influenced by several factors. Past researchers have investigated the change-order rate, which is

defined as the ratio between the dollar amount of change orders and the award amount. Although the change-order rate is not identical to the cost-overrun rate, it is likely that they are both influenced by the same factors because the change-order rate is a large part of most cost-overrun rates. It is expected that the same factors that influence the cost-overrun rate will influence the change-order rate. Three types of explanation for cost overrun exist: technical, psychological, and political economic. Technical explanations account for cost overrun in terms of imperfect forecasting techniques, inadequate data, etc. Psychological explanations account for overrun in terms of optimism bias with forecasters. Finally, political-economic explanations see overrun as the result of strategic misrepresentation of scope or budgets.

All three explanations can be considered forms of risk. A project's budgeted costs should always include cost contingency funds to cover risks (other than scope changes imposed on the project). As has been shown in cost engineering research, poor risk analysis and contingency estimating practices account for many project cost overruns. Numerous studies have found that the greatest cause of cost growth was poorly-defined scope at the time that the budget was established. The *cost growth*, or overrun of the budget before cost contingency is added, can be predicted by rating the extent of scope definition, even on complex projects with new technology.

1.4 NEED FOR THE PROJECT

- Escalation costs must be considered, to compare the costs of projects with differing durations, Escalation in cost estimating has two main uses: to convert historical costs to current costs and to escalate current costs into the future for planning and budgeting.
- Cost escalation affects the project total costs and causes cost overrun. Hence in the present study an attempt has been made to identify the critical factors that affect cost escalation and cost overrun in the construction industry.

1.5 OBJECTIVES

The objective of this thesis work is

- To determine the factors affecting cost escalation and cost overrun
- To formulate the questionnaire with factors which affect the cost escalation and overrun
- To identify the critical factors by ranking them
- To analyze material components through case studies

- To recommend the measures to avoid the cost overrun.

1.6 SCOPE OF STUDY

The scope of the study is focused for effect of cost escalation and overrun in construction projects

- The purpose of this study is to identify the issues involved in cost overruns and cost escalation in construction projects.
- Identifying certain factors through the literature review which impacts cost overrun and cost escalation.
- The factors will be identified through a survey from construction firms.
- To propose some recommendations and mitigation measures have been suggested to strategically cope up with these factors

2.REVIEW OF LITERATURE

2.1 GENERAL

Cost is the fundamental component for any construction project. However, cost overrun is observed as one of the most frequently occurring issues in construction projects worldwide. Many techniques were established to solve these problems and many researchers were made using different techniques to overcome these problems. Literature pertaining to the last thirteen years is reviewed in this chapter. It includes research work related to evaluation of cost escalation and overrun in construction firms.

2.2 LITERATURE REVIEW

Okpala and Aniekwu (1998) made an investigation into the causes of high costs of construction in Nigeria. A preliminary survey involving all the professionals in the construction industry identified delays and direct cost overruns of the project as the principal factors leading to the high cost of construction. A questionnaire was then designed incorporating factors causing delays and cost overruns. They found that a shortage of materials, financing, and payments for completed works and poor contract management are the three major causes of delay and cost overrun. On factors that could cause cost overruns without necessarily causing delay, price fluctuations, delay, and fraudulent practices were identified as the three most important factors.

The study has presented the subjective results of three important groups in the construction industry, and therefore should not be taken as an absolute statement of the true causes of delay and cost overrun.

Knight and Fayek (2000) surveyed of Alberta-based construction contractors to determine the factors that cause unanticipated project cost escalation during construction, from the contractor's perspective. The majority of factors identified impact labour productivity, which is a major source of cost overruns. They presented a method of modeling these factors using fuzzy membership functions, which capture the imprecision and subjectivity associated with the measurement of these factors. The results of the survey indicate that many factors affect costs, particularly when they occur in combination with other factors. Most factors impact labour productivity and cause rework, leading to increased costs. The impact of these factors and the resulting corrective actions can vary significantly, depending on the type, location, and size of the project. It was concluded from the survey that many of the factors affecting costs were measured subjectively or by a secondary indicator, providing the impetus for the use of fuzzy logic in their modeling.

Flyvbjerg et al (2003) presented results from the first statistically significant study of cost performance in transport infrastructure projects. The sample used is the largest of its kind, covering 258 projects in 20 nations worth approximately US$90 billion. The study showed that with overwhelming statistical significance that in terms of costs transport infrastructure projects do not perform as promised. Cost estimates used in decision-making for transport infrastructure development were highly, systematically and significantly misleading. Large cost escalations combined with large standard deviations translate into large financial risks. However, such risks were typically ignored or underplayed in decision-making, to the detriment of social and economic welfare. From the study it was concluded that with overwhelming statistical significance, No, transport infrastructure projects had not performed as promised, and, yes, costs were highly uncertain involving substantial elements of downside risk.

2.3 LITERATURE SUMMARY

1. Cost escalation factors were identified through a comprehensive literature review and verified through intense interviews.

2. Identification of these cost escalation factors supports efforts to understand the causes of project cost escalation.

3. This understanding permits the development of strategies, methods, and tools for better cost estimation and cost estimating management.

4. However, "the key to success is to realize and understand the challenges early in the planning process, to develop strategies to address them and to establish accurate and achievable expectations".

5. The resulting models for cost overrun and time delay estimation can be used as a tool at the contract planning stage to estimate the expected cost overrun and time delay associated with future highway construction projects.

6. Created model predict the amount of time and money that should be budgeted to the project.

3. RESEARCH METHODOLOGY

3.1 GENERAL

The establishment of cost overrun probability distributions for a number of reference classes requires access to credible data for a sufficient number of projects within the same reference classes for statistically meaningful conclusions to be drawn. Herein, cost overrun is defined as the difference between the actual and estimated costs as a percentage of the estimated cost, with all costs calculated in constant prices. Actual costs are defined as the accounted costs actually spent, as determined at the time of project completion. Estimated costs are defined as the budgeted or forecasted costs at the time of project approval.

The methodology of the study is follows:

1. A thorough literature review was done and also the expert opinions from industry experts were taken, through which a number of cost overrun and escalation causes were identified in the local construction industry scenario. In total fifty three (53) factors were finalized to made part of the survey questionnaire. Out of these cost escalation factors (14) and cost overrun factors (33) and also (6) material factors also considered.
2. Questionnaire consisting of two parts A and B was developed. In Part A personal Information of the respondent (for e.g. work experience, organization, annual volume of construction work) was asked. Part B was aimed to obtain information about causes of cost overrun and escalation in

construction industry, it was asked to rate those initially identified fifty three (53) factors according to their severity level on the given scale, information regarding low, very low, medium, high, very high cost overrun and escalation ranges experienced over projects were asked.

3. A survey was conducted through mail and personal interviews in which respondents were asked to rank and score these factors according to their experience.
4. Assessment of feedback from questionnaire survey.
5. Identifying material impact on cost escalation in building construction projects.
6. Recommending measures for this escalation and overrun.

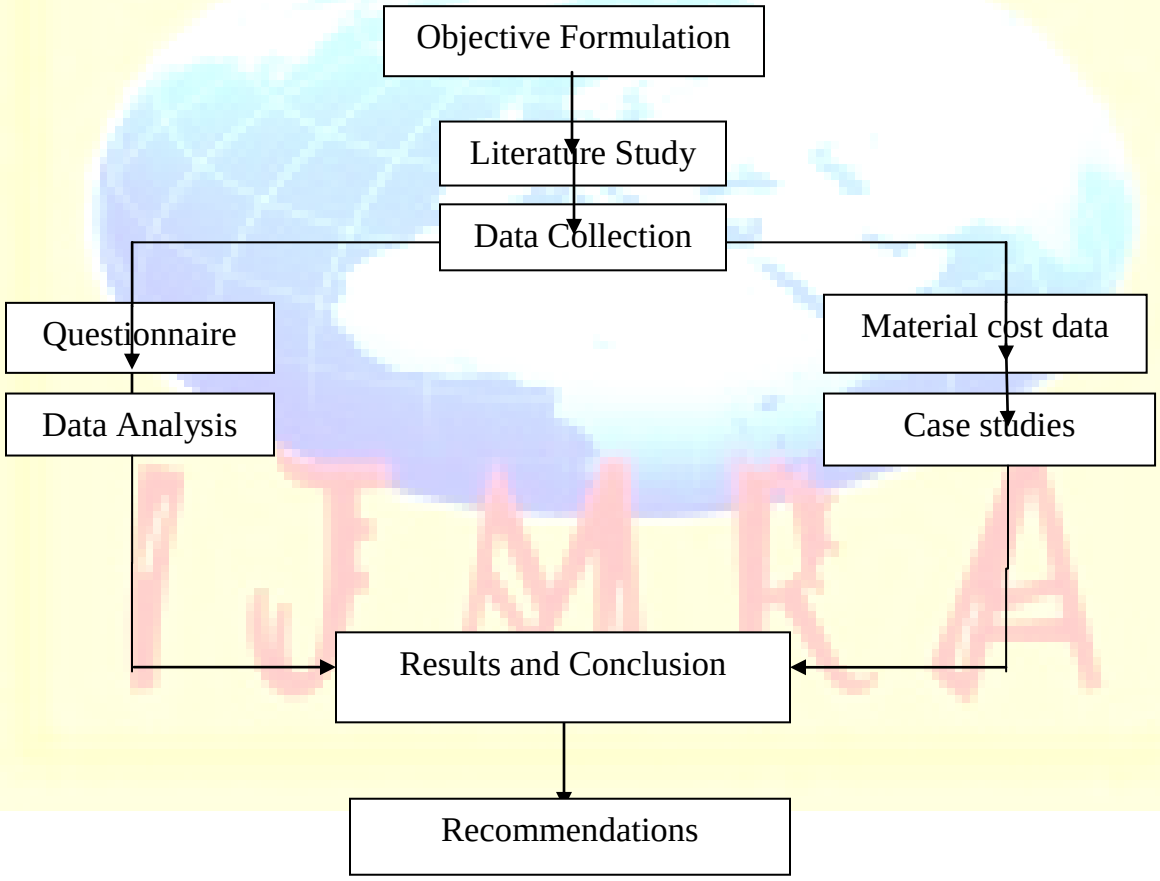

Fig 3.1 Project Framework Flow Chart

3.2 QUESTIONNAIRE SURVEY

The issues related to cost escalation and cost overrun vary with each of the participants namely clients, consultants and contractors. A questionnaire survey can be used as the primary

means of data collection from various project participants involved in projects. The respondents from three groups of project participants were asked to rank a common list of factors influencing cost escalation and overrun in construction projects

3.3 DATA ANALYSIS OF SPSS TOOL

The approaches used under SPSS are

a. Descriptive Analysis

b. Frequency Analysis

Although these techniques seem simple, the writer feels its adaptation is appropriate with the data and objective itself. These techniques signify the result of the analysis with much clarity and it is also easier for the reader to grasp the writer's message. In other words, these techniques are not all complicated and can be easily understood by all.

The main purpose in choosing the SPSS analysis techniques is to provide clear and non-technical formats for common statistical procedures. It is also, because it is widely available and covers a broad spectrum of statistical procedures.

3.3.1 FREQUENCY ANALYSIS

Frequency distribution is a mathematical distribution which the objective is to obtain a count of the number of responses associated with different values of one variable and to express these counts in percentage terms. It also helps to determine the extent of item non-response and indicates the shape of the empirical distribution of the variable such as a histogram or a vertical bar chart in which the values of the variable are portrayed along the x-axis and the absolute or relative the frequencies of the values are placed along y-axis. The frequencies procedure is used to find and graph the number of cases falling into different response categories for discontinuous variables.

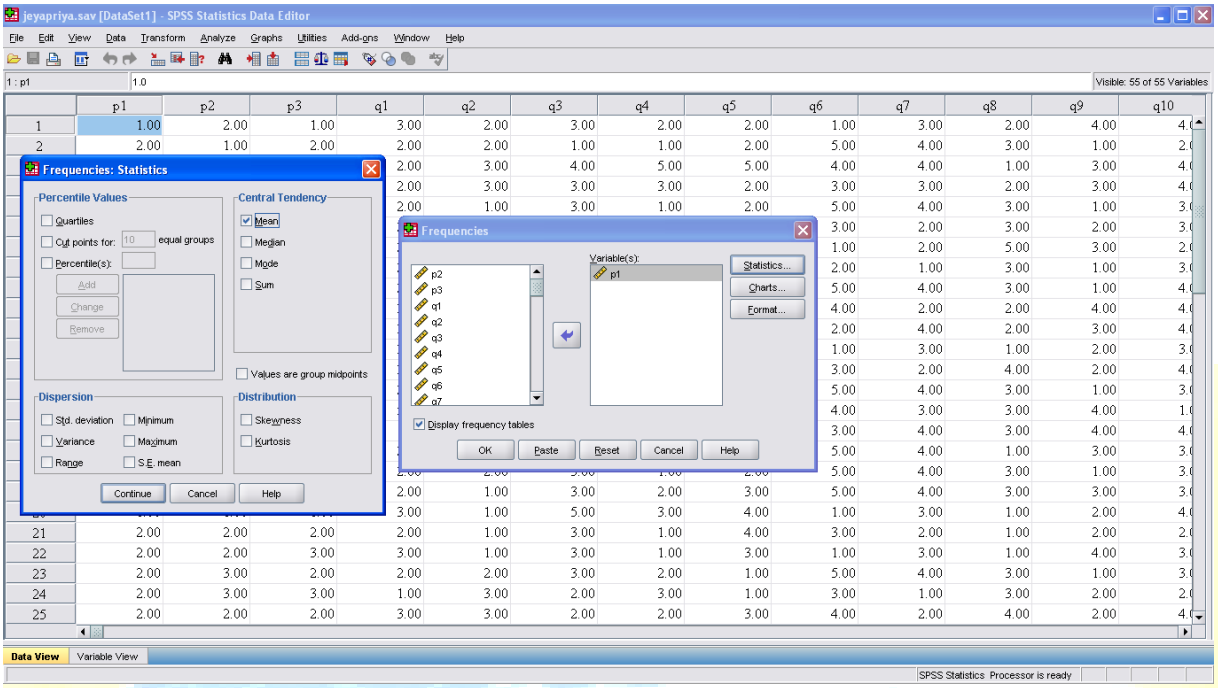

Fig 3.4 Frequency Analysis

3.3.2 DESCRIPTIVE ANALYSIS

This is the SPSS procedure that computes descriptive statistics. These statistics are used to summarize a set of scores in a convenient form and typically are the first calculations performed on a distribution of scores. With the descriptive procedure, any or all of the following statistics can be calculated such as mean, variance, standard deviation, and sum of scores, minimum and maximum scores, range, standard error, skewness and kurtosis.

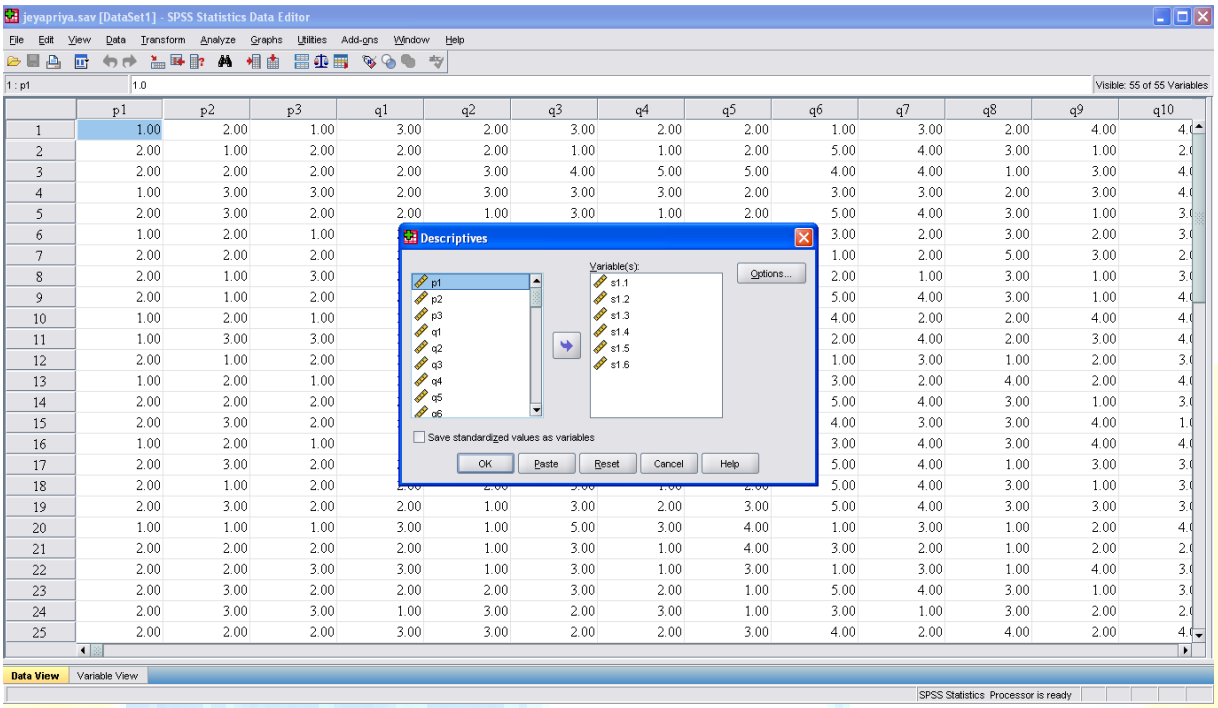

Fig 3.5 Descriptive Analysis

4. DATA ANALYSIS AND FINDINGS

4.1 GENERAL

The analysis of the data obtained from the questionnaires received and the conclusion drawn are presented.

4.2 COMPANY PROFILES

In order to interpret the results of the surveys, the title of the person interviewed, the type and size of the company, and the type, size, and location of the project that was referred to during the interview were identified using SPSS.

4.2.1 DESIGNATION

The designations of respondents in their organization are manager, government contractor, architect and engineer. The percentages of responses collected from engineer are 22.8% and 77.2% collected from others (manager, contractor, and architect).The designation are shown in table 4.1 and the designation chart are shown in the fig 4.1

Table 4.1 Designation

Designation	Frequency	Percent	Valid Percent	Cumulative Percent
Engineer	26	37.1	37.1	37.1
Others(manager, contractor, architect)	44	62.9	62.9	100.0
Total	70	100.0	100.0	

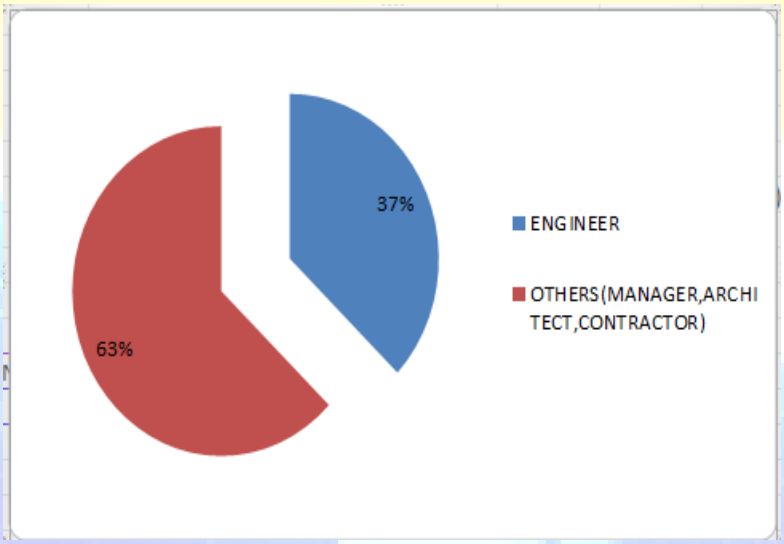

Fig 4.1 Designation

4.2.2 EXPERIENCE

The questionnaires were distributed to the respondents depending on their experience. It consists of three sections 28.1% response from up to 5years experience, 43.9% response from 5-10 years experience, 28.1% response greater than 10 years experience. The experiences of the respondents are shown in table 4.2 and the experiences of respondents are shown in fig 4.2.

Table 4.2 Experience

Experience	Frequency	Percent	Valid Percent	Cumulative Percent
up to 5 years	20	28.6	28.6	28.6
5-10 years	32	45.7	45.7	74.3
> 10 years	18	25.7	25.7	100.0

Total	70	100.0	100.0	

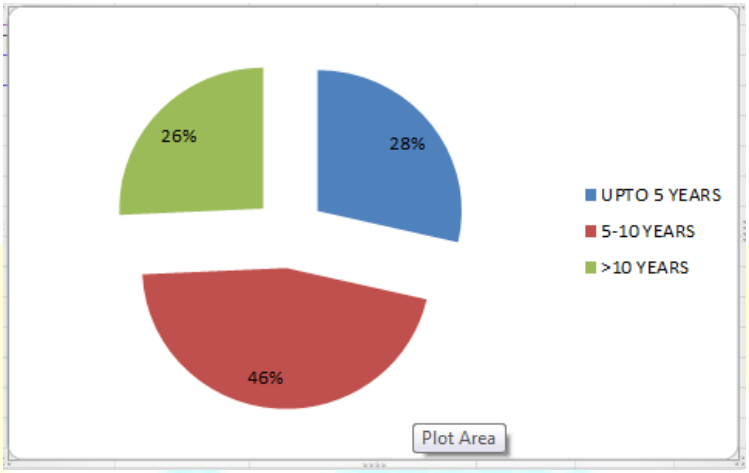

Fig 4.2 Experience

4.2.3 FACTORS INFLUENCING COST OVERRUN

A number of variables influencing the cost overrun in construction industry were identified following a thorough literature review. The literature review was done through books, internet, leading construction management and engineering journals. A careful study of previous literature suggests cost overrun factors that can be grouped under five categories

1. Client related factors
2. Architect related factors
3. Structural engineer related factors
4. Contractor related factors
5. External factors

4.2.3.1. CLIENT RELATED FACTORS

Responses in this section are given on five point scale. Most frequent factors respond to 'very high' condition whereas the least frequent factors correspond to 'very low condition'. The results of analysis are tabulated. The responses of client related factors are shown in Table 4.6.

Table 4.6 Client Related Factors

Factors	Very Low		Low		Medium		High		Very High	
	N	%	N	%	N	%	N	%	N	%

Number of changes/extra work order	27	47.4	8	14	14	24.6	8	14		
Slow decision making	7	12.3	10	17.5	14	24.6	9	15.8	17	29.8
Delay in contract award	5	8.8	12	21.1	27	47.4	8	14	5	8.8
Delay in handling over of site	8	14	6	10.5	29	50.9	14	24.6		
Unrealistic schedule	19	33.3	14	24.6	10	17.5	5	8.8	9	15.8
Cash flow during construction	4	7	28	49.1	14	24.6	10	17.5	1	1.8

4.2.3.2. ARCHITECT RELATED FACTORS

Responses in this section are given on five point scale. Most frequent factors respond to 'very high' condition whereas the least frequent factors correspond to 'very low condition'. The results of analysis are tabulated. The responses of Architect related factors are shown in Table 4.7.

Table 4.7 Architect Related Factors

Factors	Very Low		Low		Medium		High		Very High	
	N	%	N	%	N	%	N	%	N	%
Deficiencies in cost	5	8.8	23	40.4	11	19.3	15	26.3	3	5.3
Estimation & specification prepared	24	42.1	6	10.5	14	24.6	9	15.8	4	7
Incomplete architectural drawing	24	42.1	8	14	10	17.5	11	19.3	4	7
Delay in work approval	7	12.3	8	14	10	17.5	9	15.8	23	40.4
Variation orders	18	31.6	17	29.8	15	26.3	5	8.8	2	3.5
Poor information &	7	12.3	13	22.8	32	56.1	5	8.8		

dissemination										
Inadequate supervision	4	7	20	35.1	13	22.8	8	14	12	21.1

4.2.3.3. STRUCTURAL ENGINEER RELATED FACTORS

Responses in this section are given on five point scale. Most frequent factors respond to 'very high' condition whereas the least frequent factors correspond to 'very low condition'. The results of analysis are tabulated. The responses of Architect related factors are shown in Table 4.8.

Table 4.8 Structural Engineer Related Factors

Factors	Very Low		Low		Medium		High		Very High	
	N	%	N	%	N	%	N	%	N	%
Incomplete structural drawing	8	14	31	54.4	11	19.3	5	8.8	2	3.5
Structural design variations	5	8.8	20	35.1	23	40.4	6	10.5	3	5.34
Inadequate supervision	4	7	19	33.3	25	43.9	7	12.3	2	3.5
Late issuance of instruction	4	7	27	47.4	14	24.6	8	14	4	7
Poor services & design information	3	5.3	31	54.4	9	15.8	12	21.1	2	3.5

4.2.3.4. CONTRACTOR RELATED FACTORS

Responses in this section are given on five point scale. Most frequent factors respond to 'very high' condition whereas the least frequent factors correspond to 'very low condition'. The results of analysis are tabulated. The responses of Architect related factors are shown in Table 4.9.

Table 4.9 Contractor Related Factors

Factors	Very Low	Low	Medium	High	Very High

	N	%	N	%	N	%	N	%	N	%
Contract tender price higher than original estimate	4	7	11	19.3	12	21.1	27	47.4	3	5.3
Planning & scheduling deficiencies	9	15.8	17	29.8	20	35.1	9	15.8	2	3.5
Non availability of sufficient amount of skilled labour	18	31.6	14	24.6	12	21.1	11	19.3	2	3.5
Financial difficulties	2	3.5	9	15.8	34	59.6	8	14	4	7
Low bid	4	7	12	21.1	28	49.1	10	17.5	3	5.3
Lack of coordinates between project participants	21	36.8	10	17.5	15	26.3	8	14	3	5.3
Shortening of contract period	10	17.5	6	10.5	28	49.1	9	15.8	4	7

4.2.3.5. EXTERNAL FACTORS

Responses in this section are given on five point scale. Most frequent factors respond to 'very high' condition whereas the least frequent factors correspond to 'very low condition'. The results of analysis are tabulated. The responses of External factors are shown in Table 4.10.

Table 4.10 External Factors

Factors	Very Low		Low		Medium		High		Very High	
	N	%	N	%	N	%	N	%	N	%
Bad weather	22	38.6	12	21.1	15	26.3	6	10.5	2	3.5
Strike	24	42.1	23	40.4	6	10.5	3	5.3	1	1.8

Productivity	19	33.3	15	26.3	14	24.6	6	10.5	3	5.3
Environmental impact	25	43.9	12	21.1	8	14	9	15.8	3	5.3
Site conditions	16	28.1	10	17.5	23	40.4	6	10.5	2	3.5
Price changes	12	21.1	7	12.3	6	10.5	27	47.4	5	8.8
Fraudulent practices and kickbacks	2	3.5	13	22.8	12	21.1	27	47.4	3	5.3
Insurance	8	14	26	45.6	14	24.6	8	14	1	1.8

4.4 IDENTIFICATION OF MAJOR COST COMPONENTS OF BUILDING CONSTRUCTION PROJECT

The major material components contributing to overall cost of the projects were analysed through case studies of three building projects i.e. Construction of hotel building at Madurai, Construction of residential building at Chennai, Construction of jewellary park at Ramanathapuram.

The case study analysis of Construction of hotel building is presented in figure 4.16

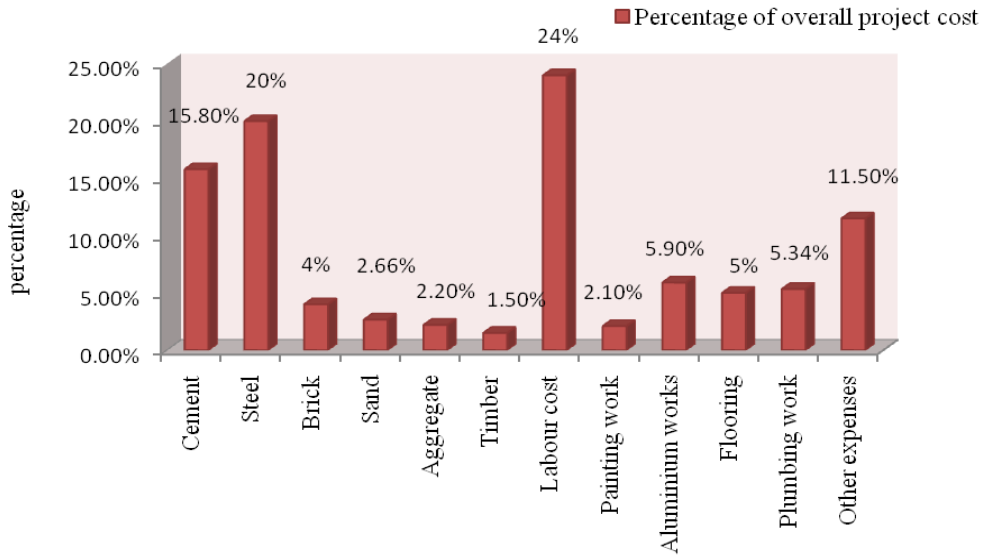

Figure 4.16 Construction of hotel building at Madurai

From the figure4.16, it can be inferred that cost components of cement and steel is about 35% of overall cost of the project.labour components was about 24% and component of brick, sand, aggregates and timber contributing about 11% of overall cost of the project.

The case study analysis of construction of residential building at Chennai, is presented in figure 4.17

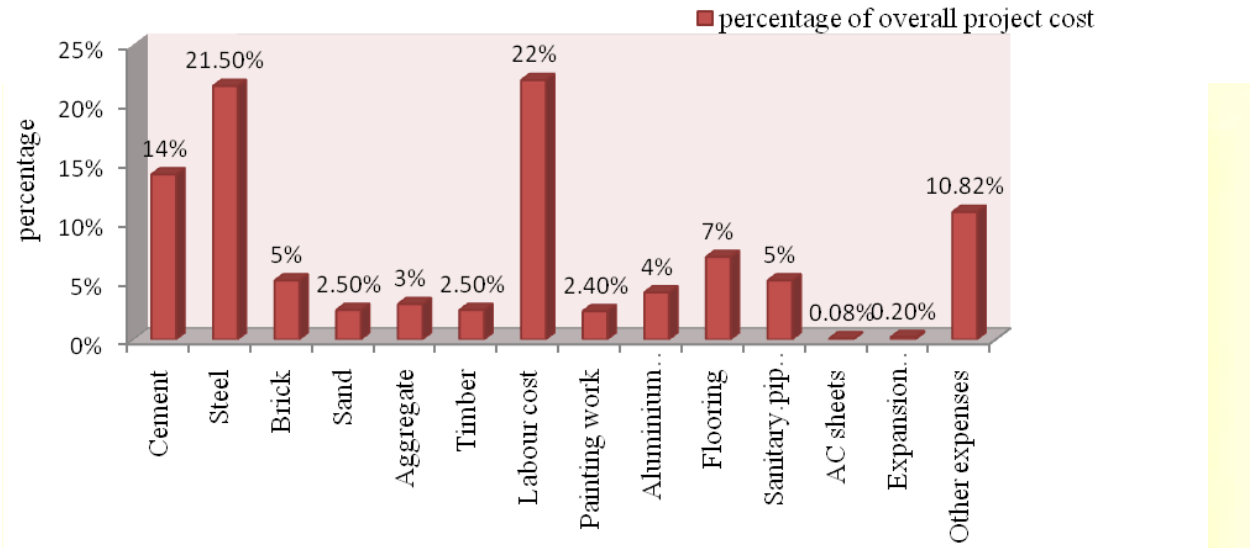

Figure 4.17 Construction of residential building at Chennai

From the figure 4.17, it can be inferred that cost components of cement and steel is about 36% of overall cost of the project.Labour components was about 22% and component of brick, sand, aggregates and timber contributing about 13% of overall cost of the project.

The case study analysis of construction of jwellery park building is presented in figure 4.18.

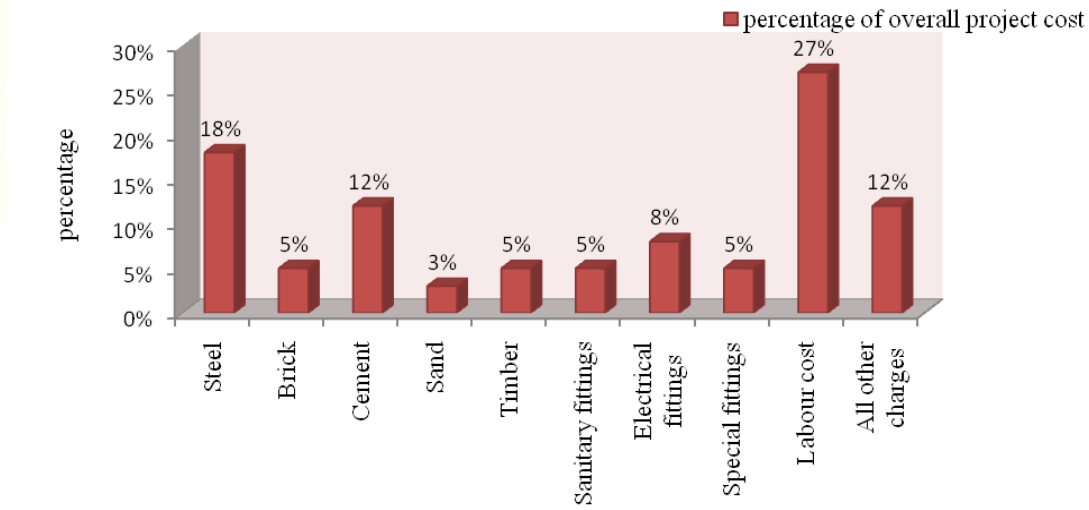

Figure 4.18 Construction of jewellary park at Ramanathapuram

From the figure4.18, it can be inferred that cost components of cement and steel is about 23% of overall cost of the project.Labour components was about 27% and component of brick, sand, and timber contributing about 13% of overall cost of the project. From the study, it is found that cost components of key materials i.e. cement, steel, brick, sand and coarse aggregates were contributing about fifty percent of overall cost of the projects.

5. CONCLUSION

- The perception analysis of three groups of respondents was done in both cost escalation and cost overrun. i.e. client, consultant and contractor.
- Based on five point scale, average index, relative importance index and relative weight age was calculated for each factor.
- From this model, most significant factors causing cost escalation and overrun were identified.
- The perception analysis of clients representatives, five most significant factors causing cost overrun are price changes, low bid, financial difficulties, deficiencies in cost, slow decision making. The five most significant factors causing cost overrun as perceived by consultant representatives are low bid, price changes, slow decision making, financial difficulties, and deficiencies in cost. Perception analyses of contractor representatives are slow decision making, low bid, and deficiencies in cost, price changes, and financial difficulties. The overall ranking indicates that the three groups felt that five most significant factors that can cause cost overrun in building construction projects are price changes, low bid, financial difficulties, deficiencies in cost, slow decision making and non availability of sufficient labor.
- The perception analysis of clients representatives, five most significant factors causing cost escalation are power tariff, raw material input, demand and supply, inflation and freight and transportation cost. The five most significant factors causing cost escalation as perceived by consultant representatives are raw material input, power tariff, demand and supply, labour cost and freight and transportation cost. Perception analyses of contractor representatives are demand and supply, raw material input, freight and transportation cost, power tariff. The overall ranking indicates that the three groups felt that five most significant factors that can cause cost escalation in building construction projects are power tariff, raw material input, freight and transportation cost, demand and supply and labour cost.

- From the study, it is found that impact of cost escalation in building construction projects are mainly due to the escalation in prices of steel and cement, followed by brick and sand categories.
- There was fair degree of agreement between survey based factors affecting cost escalation and the actual cost escalation impact in building projects examined through the case studies.

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