A

Dissertation Report on

Analysis of Cost Variation between Estimated Cost and Actual Cost of Residential Building Project

Submitted

in partial fulfilment of the requirements for the degree of

Master of Technology

in

Civil - Construction Management

by

Awati Vrushabh Devchandra

(Roll No. 1927008)

Under the Supervision of

Dr. N. T. Suryawanshi

Department of Civil Engineering

K.E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

(An Autonomous Institute, Affiliated to Shivaji University, Kolhapur)

2020-2021

K.E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

(An Autonomous Institute, Affiliated to Shivaji University, Kolhapur)

CERTIFICATE

This is to certify that, **Vrushabh Devchandra Awati (Roll No.-1927008)** has successfully completed the dissertation work and submitted dissertation report on **"Analysis of Cost Variation between Estimated Cost and Actual Cost of Residential Building Project"** for the partial fulfillment of the requirement for the degree of Master of Technology in Construction Management from the Department of Civil Engineering, as per the rules and regulations of Rajarambapu Institute of Technology, Rajaramnagar, Dist: Sangli.

Date:

Place: RIT, Rajaramnagar

Dr. N. T. Suryawanshi

Name and Sign of Supervisor

Name

Name and Sign of External Examiner

Prof. D. S. Patil

Name and Sign of Head of Program

Dr. P. D. Kumbhar

Name and Sign of Head of Department

Dr. S. S. Gawade

Name and Sign of PG Convener

DECLARATION

I declare that this report reflects my thoughts about the subject in my own words. I have sufficiently cited and referenced the original sources, referred or considered in this work. I have not misrepresented or fabricated or falsified any idea/data/fact/source in this my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute.

Place: RIT, Rajaramnagar Name of Student: Awati Vrushabh Devchandra

Date: Roll No: 1927008

ACKNOWLEDGEMENTS

I would like to thank my project guide, Dr. N. T. Suryawanshi, for the guidance, encouragement and advice he has provided throughout my time as his student. I have been extremely lucky to have a supervisor who cared so much about my work, and who responded to my questions and queries so promptly.

I am also very thankful to Dr. P. D. Kumbhar (Head of Department, Civil Engineering) and Prof. D. S. Patil (Head of Programme, Construction Management) for their valuable suggestions, critical examination of work during the progress, I am indebted to them.

I would also like to thank all the teaching and non-teaching staff of Civil Engineering Department at Rajarambapu Institute of Technology, Rajaramnagar, Sangli for their support and help. I acknowledge with thank to Central library staff and colleagues. I sincerely thank to Dr. Mrs. S. S. Kulkarni (Director, RIT), for supporting me to do this work and I am very much obliged to her.

The people with greatest indirect contribution to this work are parents and my friends, who constantly encouraged me during this period.

Place: RIT, Rajaramnagar Name of Student: Vrushabh D. Awati

Date: Roll No: 1927008

ABSTRACT

Civil Engineering projects experience cost variation and thereby exceed initial contract budgeted amount. Everywhere the number of building construction projects is increasing from time to time. However, it becomes difficult to complete projects in the allocated cost. Taking into account the scarce financial resources, cost variation is one of the major problems everywhere. From the studies it was found that almost all building construction projects suffered from cost variation. The rate of cost variation varies for different projects. Therefore, this dissertation is carried out to find out information on the factors that cause cost variation during construction and their effects on building construction projects. Questionnaire survey together with desk study is to be used to collect data on cost variation. The analysis of questionnaire survey was done by using Relative Importance Index (RII) method. The content validity and reliability test were conducted to validate questionnaire by using SPSS software. In this thesis various factors from literatures are collected and questionnaires regarding the factors affecting cost variation in building construction projects are to be investigated and analyzed using case study and give suggestions to the case study to reduce cost variation.

In this study for a selected case study of residential building project, an earned value analysis technique was adopted. The progress was monitored at the end of six months. From earned value analysis cost performance index (CPI) and schedule performance index (SPI) is found out. Major activities that would cause of cost overrun and delays the project are concreting and brick work activities. It was found that (CPI) of concreting activity is 0.91, it indicates project is 9 % over budget also SPI found is 0.83, which indicates project is 17 % behind the schedule. It was also found that (CPI) of brick work activity is 0.8, it indicates project is 20 % over budget and (SPI) found is 0.5, it indicates project is 50 % behind the schedule. According to the progress, corrective actions has been taken to maintain work progress. The most important factors of cost variation are found to be unexpected ground condition, liquidity of organization, number of workers and shortage of materials. It is hoped that these findings will guide efforts to improve the performance of the construction industry in the future.

Keywords: Cost overrun, Earned Value Analysis, Relative Importance Index, Content Validity, Reliability Test, Estimation, Causes of cost overrun.

Contents

List of Figures

List of Tables

ABBREVIATIONS

CV	Cost Variance
SV	Schedule Variance
CPI	Cost Performance Index
SPI	Schedule Performance Index
RII	Relative Importance Index
EV	Earned Value
AC	Actual cost

Chapter 1

INTRODUCTION

1.1 Introduction

Every country whether in the developing stage or already developed stage has the need for building construction development to further the economic, social, technical growth of the country. Construction is everlasting activity across the world. Construction profitability fluctuates according to the law of demand and supply. Construction process needs resources in the form of men, material, machinery and money. Construction activity requires wide variety of materials which form substantial part of entire construction cost & lastly money is at the core of business activities & construction being a capital intensive business generally operates under money constraints. India is the fastest growing economy in the world. The successful completion of project is so largely depend on time & cost and sometimes critical in both the planning and control phase.

The construction industry is very competitive business area. The rates at which contractors fail have been and remain extremely high. Project cost control aims at controlling changes to the project budget. It provides management with cost related information for making decisions with a view to complete the project with specified quality, on time, and within budgeted cost. This information extracted from performing data and other sources is use to minimize waste, update current budgeted performance data and other sources, forecast cost trends and make decisions about future[1].

Cost control involves processing of cost accounting reports, received from various responsibility centers or operating divisions relating the cost incurred with

standards analyzing the reasons for variances and presenting the result of monitoring to the project management for making decisions for the future and not of the past. The construction industry unlike many manufacturing situations is concerned mostly with one-off projects. This naturally creates difficulties for effective management control, because each new contract often has a fresh management team; labors is transient and recruited on an ad hoc basis; sites are dispersed throughout the country, which tends to cause problems in effective communication with other parts of the company; subcontractors labors are common and added to all this are the ever changing weather conditions. These are some of the problems which have prevented the typical contracting company from installing the standard costing system as known by the manufacturing industry. Poor planning and control of materials, lack of materials when needed, poor identification of materials, re-handling and inadequate storage cause losses in labor productivity and overall delays that can indirectly increase total project costs. Effective management of materials can reduce these costs and contribute significantly to the success of the project.

In construction almost all clients are interested in obtaining fully functional facilities completed in time, cost and quality. A builder who is able to construct within the estimated time and budget, to the right standards and scope is an excellent builder. To control cost variation is an obvious objective of most managers. It should be recognized that no amount of paperwork achieves this control. Ultimately the decision of the managers that something should be done differently, and the translation of that secession into practice, is the actions which achieve control. The paperwork can provide guidance on what control actions should take and, while we shall continue to call it the cost variation control system. Few studies comparing actual cost and estimated cost are to be taken. This study is related to calculation of cost variance for different activities involved in the building construction. The study of difference between estimated cost and actual cost is to be analyzed. Cost changes are occurred due to various factors, by studying these factors cost variation can be analyzed [2].

Cost-control procedures are only useful if they are based on an up-to-date and accurate accounting of the costs incurred by the company with greater insight into potential risk areas. Despite the availability of various control techniques and

project control software many construction projects still do not achieve their cost objectives. Most project managers and contractors find difficulty in controlling costs on their construction sites due to a number of problems which include poor project preparation, lapse in management and control, over budgeting, poor materials, labours , shortages, increased cost of materials, delays in deliveries, wastage of materials, unexpected weather changes, loss of materials, insecurity and poor communication. This results into cost variation of projects.

1.1.1 Definition

The term cost variation is defined as difference between actual cost and estimated or budgeted cost. Cost variation is defined as the excess in actual cost as compared to the original cost estimate initially made for a project [3]. Cost variation is defined as an increase of cost which is not expected (i.e. excess of a budgeted cost) during estimation of the initial budget. It is the phenomenon in which the client has to spend more money for the completion of project than the originally estimated i.e. the project goes over the budget [4]. Cost variation is the difference between the final and originally estimated cost which are made at the beginning of the project to build a project. Even if the project planning and scheduling process varies with project type, time and country, it is possible to locate for a particular project a specific point in the procedure that could be identified as the time where the formal decision is made to build the project. Actual cost is defined as real, accounted cost determined at the time of completing a project. Costs variation is an occurrence in which the provision of contracted projects, service or goods are claimed to require extra financial resources than initially agreed between a project owner and a contractor.

1.1.2 Cost Variations in Construction Projects

In other words, a cost variation indicates that the work actually performed is more cost or less cost than planned from earned value data. A positive value indicates a favorable condition and a negative value indicates an unfavorable condition. It may be expressed as a value for a specific period of time or cumulative to date. Cost variance is a way of showing the financial performance of a project. Cost Variance is a very important factor to measure project performance. Cost variation indicates how much over or under-budget the project is. Cost variances may

be either positive or negative figures. Negative figures happen if you spend more on a project than you allowed in your budget. Positive figures result if you spend less on a project than the budget predicted. Negative cost variance figures are almost always a bad thing for a business, as companies cannot always guarantee they can come up with the funds to cover the excess cost. However, positive cost variances aren't always good for a company, either. For instance, if you come out in the black on your project budget by sacrificing customer service or quality parts, you may not sell as many of the products or may lose clients. You must examine any cost variance figures you get in the context of your business to determine the true impact those numbers will have. Regardless of whether the variance is positive or negative, it means one of two things. The first is that, due to insufficient or inappropriate data or human error, you overestimated or underestimated expenses. The second possibility is that events or circumstances arose that altered the costs, such as a supplier being unable to come through on your order and necessitating the expedition of materials from another, more expensive supplier. Sometimes these events or circumstances are preventable, in which case, risk management strategies can help, but this is not always the case, particularly because it is difficult to foresee every possible problem or scenario that could play out. Cost variance allows you to monitor the financial progression of whatever it is you are doing in your business. When cost variances are low, you know you have controlled your risks well. You also know you have retrieved and analyzed data related to operations sufficiently. Ideally, your actual costs should match what you budgeted and your cost variance should be zero, but in practice this is fairly difficult to achieve.

Cost variations are very unique in nature varying from project to project due to the difference circumstances each project is subjected to. Reasons for variations are mainly of two main categories having sub categories. First being the project related factors while others related to the factors independent of the project. It is extremely important to give enough time to the planning phase of a project particularly Infrastructure projects are long term projects and it is very important that they are relevant for the different stakeholders. Since this planning phase is very important phase of an infrastructure project, it should be carried out in the most professional manner and by the most competent authority. During the

execution phase of a project there is always a struggle between three main factors such as cost, time and quality. Focusing on any one of these might have an impact on the other two. The ideal situation normally lies within the triangle made by these three factors. But since it is very difficult to achieve the ideal situation every time, mostly there are always variations.

Cost variation is very vast topic and gives a lot of dimension to work and studies. Due to the different nature of each and every project, it is even harder to identify some hard and fast reasons, which results in the cost overruns. Reasons for overruns are a variable phenomenon which changes with the nature and the location of the certain proposed project i.e. reasons for the cost overrun for a bridge construction will be very different as that of the tunnel construction. There can be similarities but saying that cost variation reasons are the same, would be not a reasonable thing. With increase in number of the large construction projects and because of the technological advancements it is very common to have variations. It's the amount with which a project go through which helps us in making decision related to abandonment or their profitability has been seriously impaired. So, as the result it's seemed very common to have a variance ranging between 10 to 15 % but as the projects go more complex, this ratio can go beyond even imagination. This research will be helpful to identify the importance of variations in terms of their affects on the project total cost or estimates. The main aim of that research was to identify the cost varying factors in mainly building projects.

1.2 Outline of Project Report

This dissertation report is divided into 7 chapters which describes the different investigations conducted in this study.

Chapter 1: This chapter includes introduction to concrete 3D printing.

Chapter 2: This chapter gives the research gap and objectives of the research.

Chapter 3: This chapter includes the methodology adopted and research progress of the project work carried out.

Chapter 4: This chapter contains data collection and questionnaire design. Selection of data collection technique and collection of causes also explained in this chapter.

Chapter 5: This chapter contains a case-study of building project referred for this project, which is suffered from the cost variation problem.

Chapter 6: This chapter includes results of the research.

Chapter 7: This chapter includes the conclusion of the research.

1.3 Closure

In the first chapter introduction and general information about cost variation in construction industry is given. This chapter describes about various causes of cost overrun in construction.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, various literatures of different authors of past studies are mentioned and the useful data is used in further study of project.

2.2 Review of Previous Studies

2.2.1 Shubham Sharma and Ashok Gupta, (2021) "Analysis of factors affecting cost and time overruns in construction"

This paper discussed into the factors that cause these construction projects to fail financially. Fail primarily in terms of construction costs, i.e. cost overruns. In this study, attempts had done to provide a thorough examination of the stages involved in the conception, construction, and execution of these projects. These phases all give an overlook on the causes or reasons, which gives the project less financial credibility. There have been very few studies conducted in the field of overruns in large infrastructure projects. Due to the scarcity of comparative studies, this task has become more time consuming and difficult to complete in order to cover all possible aspects. The initial stage starts with the identification of problem, after which the client or problem owner takes the initiative in tackling the problem. After which the list of requirements and wishes for the problem are transformed in provisional list of requirements. That provisional list covers the list of requirements and wishes put forward by the clients and stake holders, to solve a clearly described and well defined problem.

2.2.2 Marsha Enrica and Humiras Purba, (2021) "Risk leading to cost overrun in construction projects"

This paper reviewed the risk factors that influence the cost of a building construction project. Data for the survey are collected at random from building contractors. Each respondent is asked to rate each of the 79 cost factors identified in the literature review on a scale of one to five. According to the priority ranking of these factors, only 35 cost factors are regarded by respondents working for small, medium, and large construction companies. The most important factor influencing the costs of building construction projects was discovered to be the client's requirement for quality.

2.2.3 Chhavi Gupta and Chitranjan Kumar (2020), "Study of Factors Causing Cost and Time Overrun in Construction Projects"

This paper discussed about an investigation into the causes of high costs in construction industry. 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. It was distributed to engineers, architects, quantity surveyors, contractors and others involved in construction. A method of analysis was formulated and carried out based on the profession of the respondents and on the role of the individual in the industry which includes clients, consultant and contractors and on the nature of construction industry. In this study, initially an exploratory survey was conducted to identify the major factors that could cause delay and cost overruns. In all, 20 people, five architects, five civil engineers, five builders (contractors), and five quantity surveyors, were interviewed. 20 variables that could cause delays and cost overruns and seven other variables that could result in the escalation of construction costs without necessarily causing delay were selected. In the variable selection process, some variables that could influence others were given priority.

2.2.4 Devi Vaishnavi S.,(2017), "Cost Escalation in Construction Projects."

This study investigated the important levels of factors causes cost overrun in construction projects undertaken by construction companies. Eight factors named De-

sign and Documentation Related Factors (DDF), Financial Management Related Factors (FIN), Communication Related Factors (ICT), Material and Machinery Related Factors (MMF), Human Resource Related Factors (LAB), Project Management Related Factors (PMCA), Contractors Site Management Related Factors (CSM), External Factors (EF) and their respective sub- factors are found to be responsible for cost escalation. Based on these above factors questionnaire was prepared and distributed 38 respondents. The data received from questionnaire survey was analyzed using Statistical Package of Social Science (SPSS) to carry out reliability test, hypothesis, correlation and ranking. The survey results indicated that Contractors Site Management Related Factors (RII=0.928), which is being most significant among the others that leads to delay in completion of the project and causes overrun. Relative Important index (RII) have been employed and calculated for ranking of causes of cost overrun in the construction project. The RII is used to rank the different causes. These rankings make it possible to cross-compare the relative importance of the factors as perceived by the groups of respondents. Each individual causes RII perceived by all respondents should be used to assess the general and overall rankings in order to give an overall picture of the causes of construction cost overrun in construction industry.

2.2.5 Sindhu Vaardini and S. Karthiyayini (2016), "Study of Cost Overruns in Construction Projects"

This paper reviewed construction project operations, which stated project cost variance in terms of the material, equipments, manpower, subcontractor, overhead cost, and general condition. Material is the main component in construction projects. Therefore, if the material management is not properly managed it will create a project cost variance. Project cost can be controlled by taking corrective actions towards the cost variance. The objective of this research paper is to identify the main cause of the cost variance and to recommend the corrective actions. The approach to serve that objective is by conducting surveys to high rise building construction projects in order to identify the cause of project cost variance in material purchasing, and by interviewing experts in order to obtain recommendations in taking corrective actions. The causes of cost variances and their corrective actions in materials management can be grouped. Corrective action data acquired

from the expert are analyzed. A team of experts acts as information resources. The goal of this method is to combine expertise opinion toward an incident or a problem. Corrective action towards the cause of material cost variance acquired from the expert are summarized and evaluated subsequently. This few factors in this paper where used for factors contributing in cost variation of building projects.

2.2.6 Jansu Ann Jose and Xavier Belarmin C.S., (2015), "Analysis of Time and Cost Overrun in Building Construction."

This paper demonstrates, a construction project is successful only if the targets are achieved as per planned schedule and minimum cost i.e. without time delay and cost overrun. Delay of a construction project is defined as late completion of the project as compared to the planned schedule. Cost overrun is observed as the most frequently occurring issue in construction projects worldwide and this trend is more severe in developing countries. Cost overruns were identified as the most critical effects of time delay followed by dispute and arbitration. This scenario grabs more attention in the case of high rise buildings. Our study focuses on analyzing the time and cost overrun in a high rise building. Detailed study on time overrun which leads to cost overrun is conducted. The most critical factors are identified using questionnaire survey and analyzed. The study will helps to identify the critical factors for time and cost overrun and can find out the solutions and recommendations which can be considered to control those factors. The ranking and classification of factors done in this is used in this project.

2.2.7 Mhando Yusuph B., Mlinga Ramadhan S. and Alinaitwe Henry M., (2015), "Factors Influencing Variations in Public Building Project."

This study identified many public building projects have been subjected to excessive variations often leading to cost and time overrun. Cost and time overruns have led to non-fulfillment of the project objectives. This situation poses difficulties in attaining value for money in those building projects. This study is aimed at identifying the major factors that influence occurrence of variations in building projects and to suggest the means of mitigating those factors. Literature was reviewed on the major factors influencing variations in building projects and their causative agents. Using relative importance index (RII) and mean score analysis

methods from review, the major causes of variations are ranked according to their level of influence and occurrence. Based on the review results it was noted that the change of plans or scope by owner, errors and omissions in design by consultant, unavailability of materials and equipment by contractor, differing site conditions and weather conditions are among the most significant causes of the variations in the construction of building projects. The authors hope that the findings of the study will increase the awareness of the variation phenomenon on overall construction projects performance and be useful to professionals, academicians, researchers and policy makers involved in building projects. Efforts are needed to mitigate variations and improve the value of the construction project. Further research can focus mainly on measures to manage and reduce detrimental variations in building projects.

2.2.8 Tejale Dhanashree S., (2015), "Analysis of Construction Project Cost Overrun by Statistical Method."

This paper investigated that cost overrun has been a major issue in many Indian construction projects. The successful execution of construction projects and keeping them within prescribed schedule and cost is very important for effective cost performance. Most of the construction projects suffer from cost overruns due to a multiplicity of factors. The present work is carried out on studying significant factors causing cost overruns in construction projects. A questionnaire for the survey has been prepared by Authors based on 45 common factors for cost overruns identified from literature review and discussion with experts. These factors are related with Owner, Contractor, Consultant, and Management, Material, Equipment, Labor and External. The cost overrun methodology presented in this study gives statistical method which is used in construction sector for computing impact of project cost overruns. The finding of the paper will help the project manager to act on critical causes and further try to reduce cost overrun of project. Cost overrun is defined as excess of actual cost over budget. Cost overrun is also sometimes called cost escalation, cost increase, or budget overrun. In the study Relative Important index (RII) have been employed and calculated for ranking of causes of cost overrun in the construction project. The RII is used to rank the different causes. These rankings make it possible to cross-compare the rela-

tive importance of the factors as perceived by the two groups of respondents (i.e. owner and contractors). Each individual causes RII perceived by all respondents should be used to assess the general and overall rankings in order to give an overall picture of the causes of construction cost overrun in construction industry. All the numerical scores of each of the identified factors were transformed to relative importance indices to determine the relative ranking of the factors. Higher the value of RII, more important is the cause of cost overrun.

2.3 Research Gap

In this work, factors affecting cost variation between estimated and actual cost will be identified and studied by conducting the survey in the form of questionnaire in the construction industry. With the help of case study, feasibility study will be done for identified factors. Their impact will be assessed. From this study, recommendations will be suggested so that cost variation can be reduced.

2.4 Objectives

Following are the objectives of the work,

1. To estimate cost overrun and schedule overrun of of selected case study of ongoing building project.
2. To study and analyze factor affecting on cost overrun and schedule overrun of selected residential building.
3. To give recommendations in order to reduce cost overrun and schedule overrun of selected residential building.
4. To implement the recommendations during execution of ongoing residential building project.

2.5 Closure

From the literature study, causes of cost variation were found.. Hence, this literature study will form base for further project work.

Chapter 3

METHODOLOGY

3.1 General

The chapter frames the problem statement for the project work. The objective is derived from the perspective of finding major causes of cost variation. The methodology chart has been prepared which depict the steps that were followed in this research.

3.2 Problem Statement

In this work, factors affecting cost variation between estimated and actual cost will be identified and studied by conducting the survey in the form of questionnaire in the construction industry. With the help of case study, feasibility study will be done for identified factors. Their impact will be assessed. From this study, recommendations will be suggested so that cost variation can be reduced.

3.3 Proposed Methodology

The strategy followed in this project was first started with problem identification which has been done through unstructured literature review and informal discussion with colleagues and professionals in the sector; and then the dissertation design was formulated. Then data and information sources were determined based on the formulated dissertation design. The review includes books, journals, internet sources and other documents. After an in-depth literature review and desk study a questionnaire listing the various causes of cost variations were distributed to reputed construction contractors clients and consultants to get their professional

opinion based on experience. Upon obtaining the desired data, checking and sorting of data has been done. The data were then analyzed for cross-checking the validity and conformity of the information obtained through the overall project work. This was followed by thorough discussions in order to draw a conclusion and to forward recommendations based on the findings of the study. An objective type survey design was used for this project. It was attempted to collect data from relevant peoples to rank the causes of cost variation on the basis of importance. To achieve the objectives of the study the following methodology were followed:

- An absolute review of the literature related to the topic of this project is performed.
- To achieve the dissertation objectives, the questionnaire technique has been selected due to applicability to this project.
- The questionnaire has been developed based on the literature findings & preliminary discussions with consultants, contractors & architects under guidance of our guide.
- To ensure maximum participation the questionnaire has been distributed to consultants, contractors/builders and architects.
- The questionnaire response from consultants, contractors/builders and architects was collected first and then after studying their responses ranking has been done to causes of cost variation.
- The data collected has been presented, tabulated & analyzed using suitable statistical technique.
- Also a case study has been taken for study of causes of cost variation in construction industry.
- A discussion of the results is linked with findings of the literature and case-study, then cost variation were identified and ranked based on their severity.
- A conclusion of the major findings is stated & some recommendations are given to mitigate the salient problem.

3.4 Closure

Studying the questionnaire major causes of cost variation can be concluded. Research methodology decided will help to achieve the objective.

Chapter 4

DATA COLLECTION AND ANALYSIS

4.1 General

Cost variation in construction projects are as a result of many causes. Each cost variation causes have different rate of occurrences and impact on the project cost at completion. Some causes may happen frequently but their impacts on cost may be less severe, whereas some causes happen rarely but their impact may be severe. Therefore, it is necessary to identify cost variation causes based on both occurrences and their impact, in order to rank their overall effects on cost variation.

4.2 Selection of Data Collection Technique

For collecting the data for this dissertation, the personal interviews and desk study discussions were carried out and a questionnaire is formed; and a survey through questionnaire was done. The questionnaire technique is adopted for the following reasons.

The questionnaire is believed to give more honest and frank opinions as the respondents are not required to state their names. If interviews are conducted by the author then respondents and particularly contractors and consultants might not express their opinions frankly on the issues related to their clients.

The causes of construction cost variation are too many to be covered in 30 minutes interview and the respondents might not have longer time to spend on longer

interviews.

The questionnaire is designed carefully to obtain the required data from the respondent that serves to achieve the dissertation objectives. The English language is chosen for the questionnaire as it suits all the respondents. The subject knowledge and experience together with the findings of the literature were used to form the questionnaire. The main data required for this dissertation is divided into two main categories. The first category is the information about the respondent's characteristics and their involvement in the building projects. The second one concerns respondent's opinions on the cost variation faced. The first and second category of the questions is designed based on the respondent's knowledge and the familiarity of the construction industry and the involvement. The questionnaire is kept as short as possible, but comprehensive enough, so that it could be completed within 20 to 30 minutes.

4.3 Collection of Causes

Causes are collected from two sources-

Literature survey (National & international journals and papers)

First, an international literature survey was performed to create an initial pool of possible causes for cost variations in construction projects. This literature survey encompassed dozens of journal articles. Any potential cause for cost variations in construction mentioned in these references had been added to the list. The literature survey yielded ample number of potential causes.

Discussion with guide and experts practicing in this construction industry

In a parallel route local expert survey was carried out. The experts were not exposed to the previous findings of the international literature survey. Their answers pertained to the local, city-specific circumstances. This discussion yielded 36 potential causes. The first focus phase of the dissertation consisted of categorizing, filtering duplications, and merging similar or closely related causes Figure 4.1 shows the representation of procedure carried out while collecting causes.

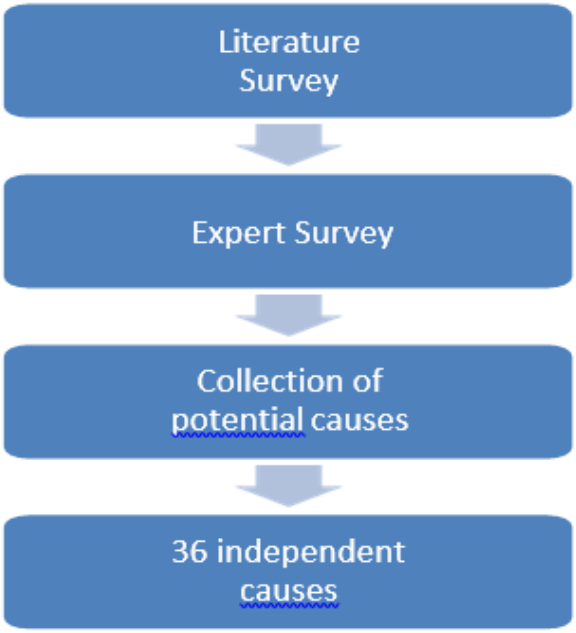


Figure 4.1: Flow chart of questionnaire

4.4 Questionnaire Design

The questionnaire is designed carefully to obtain the required data from the respondent that serves to achieve the dissertation objectives. The present status of construction industry with the help of literature review was used to form the questionnaire. Some questionnaires that are related to topic are reviewed and some questions that are found to be applicable to the construction industry were extracted from them. The main data required for this dissertation is divided into two main categories. The first category is related to the information about the respondent's characteristics and their involvement in the construction industry. It identifies the questions concerning the performance of the projects that respondents have been involved in, number of the projects that respondent has participated in and in how much amount is the cost variation. The second section includes cost variation causes that were collected earlier to which respondents give their opinions on the severity of certain causes of construction cost variation in building projects. This section contains 6 categories in which 36 cost variation causes are classified. For each factor, the respondents were requested to answer the severity impact of it cost. A six-point scale of 0 to 5 was considered for evaluating the 36 impact of each factor). These numerical impact values are assigned to the respondents rating:

0: Never;

1: Less;

2: Sometimes;

3: Average;

4: Often;

5: Always (See Annexure A for Questionnaire).

Part I is related to general information for the company. The participants were requested to answer questions pertaining to their experience in building construction and their opinions about the percentage average cost variation in building construction projects they have experienced. Part II includes the list of the identified factors affecting cost variation in building projects [5]. For each factor a question was asked: what is the degree of severity of this factor on cost variation in building projects? This severity was categorized on a six-point scale as follows: never, less, sometimes, average, often, always. In part II the respondent is required to comment on the severity of several causes that lead to construction cost variation. Therefore, it is important to identify the degree to how much the respondents agree or disagree on the severity of these causes based on their own experience and knowledge. The questionnaire was surveyed by an introduction about the dissertation topic and its aims. It also encourages the respondent to honestly participate and to respond as soon as possible considering him/her as a partner in the dissertation and the main beneficiary from the dissertation outcomes. The introduction also informed the respondent confidentiality for obtained data to gain the respondent's trust and to ensure honest response. The data from the questionnaire was analyzed statistically. The perspective of owner and contractor has been analyzed to rank the causes of cost variations based on their Relative important index. Relative important index method was used for hierarchal assessment of factors and found out the top most significant factors of cost variations. The questionnaire was designed so that it is easy to read and responses are easy to fill in. An ordinal scale of measurement will be applied for data measurement in questionnaire survey. These sections were designed to obtain the responses on a ordinal scale that indicates the relative importance of various cost variation.

4.5 Questionnaire Content

The questionnaire included 36 cost varying factors which are divided into six categories that are related to the factors of cost.
Parts of the questionnaire are:

- Factors related to finance
- Management factors
- Factors related to labour
- Factors related to material
- Factors related to project
- Other factors(external factors)

Scoring System and Method of Analysis
In the questionnaire, an Ordinal scale of measurements is applied for data measurements in questionnaire survey. Ordinal scale used for this study includes Never; Less; Sometimes, Average, Often and Always. However, abbreviation replaced with numbers i.e. 0 for never (0 %); 1 for less (1-20 %); 2 for sometimes (21-40 %); 3 for average (41-60 %); 4 for often (61-80 %); 5 for always (81-100 %) [7] is adopted to understand the perception of personnel involved in handling construction projects as shown in Table 4.1.

Table 4.1: Ordinal Scale

Sr No.	Category	Explanation	Weightage
1	Never	0% cost variation contributing factors. Total cost is not affected by these factors at all.	0
2	Less	1-20% cost variation contributing factors. Total cost is less affected by these factors.	1
3	Sometimes	21-40% cost variation contributing factors. Total cost is slightly affected by these factors.	2
4	Average	41-60% cost variation contributing factors. Total cost is moderately affected by these factors.	3
5	Often	61-80% cost variation contributing factors. Total cost is significantly affected by these factors.	4
6	Always	81-100% cost variation contributing factors. Total cost is extremely affected by these factors.	5

In the study Relative Important index (RII) have been employed and calculated for ranking of causes of cost variation in the construction project. The RII is used

to rank the different causes. These rankings make it possible to cross-compare the relative importance of the factors as perceived by the two groups of respondents (i.e. owner and contractors). Each individual causes RII perceived by all respondents should be used to assess the general and overall rankings in order to give an overall picture of the causes of construction cost variation in construction industry (Tejale, 2015). All the numerical scores of each of the identified factors were transformed to relative importance indices to determine the relative ranking of the factors. Higher the value of RII, more important is the cause of cost variation.

Following formula is used for the calculating the Relative Importance Index (RII) for different causes

$$\mathrm{i} = \frac{\sum W}{A \times N}$$

Where, $0 \leq \mathrm{RII} \leq 1$

W= Score given to each cause by respondent ranges from 0 to 5 where 0 is not affected and 5 is extremely affected.

A= Highest Score i.e. 5 in this case

N= Total No. of respondents[8]

Identified causes are classified into four groups depending upon their Relative Importance Index (RII). Table 4.2 shows the RII and their respective groups. For study of the construction cost variation causes in building projects, causes coming under Group I are taken into consideration and study has been carried out according to these causes. According to this classification, causes of cost variation having RII greater than or equal to 0.600 are come under Group I. For further study these causes of Group I are considered and these causes are treated as major causes of construction cost variation in building projects. The responses from contractors, builders and architects are analyzed according to this classification of groups.

Table 4.2: Classification of Groups

Sr. No	Relative Importance Index (RII)	Group
1	≥0.600	I
2	0.400 to 0.599	II
3	0.200 to 0.399	III
4	≤0.199	IV

4.6 Content validity

Content validity is different from face validity, which refers not to what the test actually measures, but to what it superficially appears to measure. Face validity assesses whether the test "looks valid" to the examinees who take it, the administrative personnel who decide on its use, and other technically untrained observers. Content validity requires the use of recognized subject matter experts to evaluate whether test items assess defined content and more rigorous statistical tests than does the assessment of face validity. Content validity is most often addressed in academic and vocational testing, where test items need to reflect the knowledge actually required for a given topic area (e.g., history) or job skill (e.g., accounting). In clinical settings, content validity refers to the correspondence between test items and the symptom content of a syndrome.

According to Lawshe, if more than half the panelists indicate that an item is essential, that item has at least some content validity. Greater levels of content validity exist as larger numbers of panelists agree that a particular item is essential. Using these assumptions, Lawshe developed a formula termed the content validity ratio:

CVR=(Ne - N/2)/(N/2)

CVR=content validity ratio,

Ne = number of SME panelists indicating essentials.

N total number of SME panelists.

This formula yields values which range from +1 to -1; positive values indicate that at least half the SMEs rated the item as essential. The mean CVR across items may be used as an indicator of overall test content validity.

Table 4.3: Content Validity value

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	CVR
Liquidity and organization	1	1	1	1	1	1	1	1	1	1	1
Taxes and intrest rates	1	1	1	1	1	1	1	1	1	1	1
Inflation	1	1	1	1	1	1	1	1	1	1	1
Deflation	1	1	1	1	1	1	1	1	1	1	1
Cost management	1	1	1	1	1	1	1	1	1	1	1
Inspection and testing	1	1	1	1	1	1	1	1	1	1	1
Design changes	1	1	1	1	1	1	1	1	1	1	1
Predetermined underestimation	1	1	1	1	1	1	1	1	1	1	1
Unavaliablity of competent staff	1	1	1	1	1	1	1	1	1	1	1
Absenteesim rate	1	1	1	1	1	1	1	1	1	1	1
labour strike	1	1	1	1	1	1	1	1	1	1	1
Inappropriate contractors	1	1	1	1	1	1	1	1	1	1	1
Mistakes during construction	1	1	1	1	1	1	1	1	1	1	1
Time needed to rectify defects	1	0	1	1	1	0	1	1	1	1	0.6
Disputes	1	1	1	1	1	1	1	1	1	1	1
Quality of finishing	1	1	1	1	0	1	1	1	1	1	0.8
Number of workers	0	1	1	1	1	0	1	1	1	1	1
Forms of procurement	1	0	1	1	1	0	1	1	1	0	0.28

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	CVR
Shortage of material	1	1	1	1	1	1	1	1	1	1	1
Transportation of material	1	1	1	1	1	0	1	1	1	1	0.8
Items manufactured offsite	1	1	1	1	1	1	1	1	1	1	1
Storage of materials	1	1	0	1	1	1	1	1	1	1	0.8
Damage of material	1	1	1	1	1	1	1	1	1	1	1
Construction equipment	0	1	1	1	1	1	1	1	1	1	0.8
Project size	1	0	1	1	1	1	1	1	1	1	0.8
Project type	1	0	1	1	0	1	1	1	1	1	0.6
Project location	1	1	1	1	1	1	1	1	1	1	1
Site characterstics	1	1	1	1	1	1	1	1	1	1	1
Number of stories	1	1	1	1	1	1	1	1	1	1	1
Cost of rework	1	1	1	1	1	1	1	1	1	1	1
Unexpected ground conditions	1	1	1	1	1	1	1	1	1	1	1
Demand and supply	1	1	1	1	1	1	1	1	1	1	1
Force majeure	1	1	1	1	1	1	1	1	1	1	1
Land cost	1	1	1	1	1	1	1	1	1	1	1
Incentives	1	1	1	1	1	1	1	1	1	1	1
											CVR= 0.91

4.7 Reliability test

Reliability test using Cronbach's Alpha reliablity test .This test is also known as Internal Consistency Reliability Test in SPSS.

Before performing analysis of questionnarie first of all checkout the validity of questionnaries responces.

There are many ways to perform Reliablity Test, such as Cronbach's alpha, K test ,T test , one way anova, two way anova.

Cronbach's alpha is commonly used technique to measure the reliablity effect

Cronbach's basic equation for alpha

$$\alpha = \frac{n}{n-1} \left(1-\frac{\sum Vi}{Vtest}\right)$$

N = number of question

Vi = variance of score on each question

Vtest = total variance of overall scores

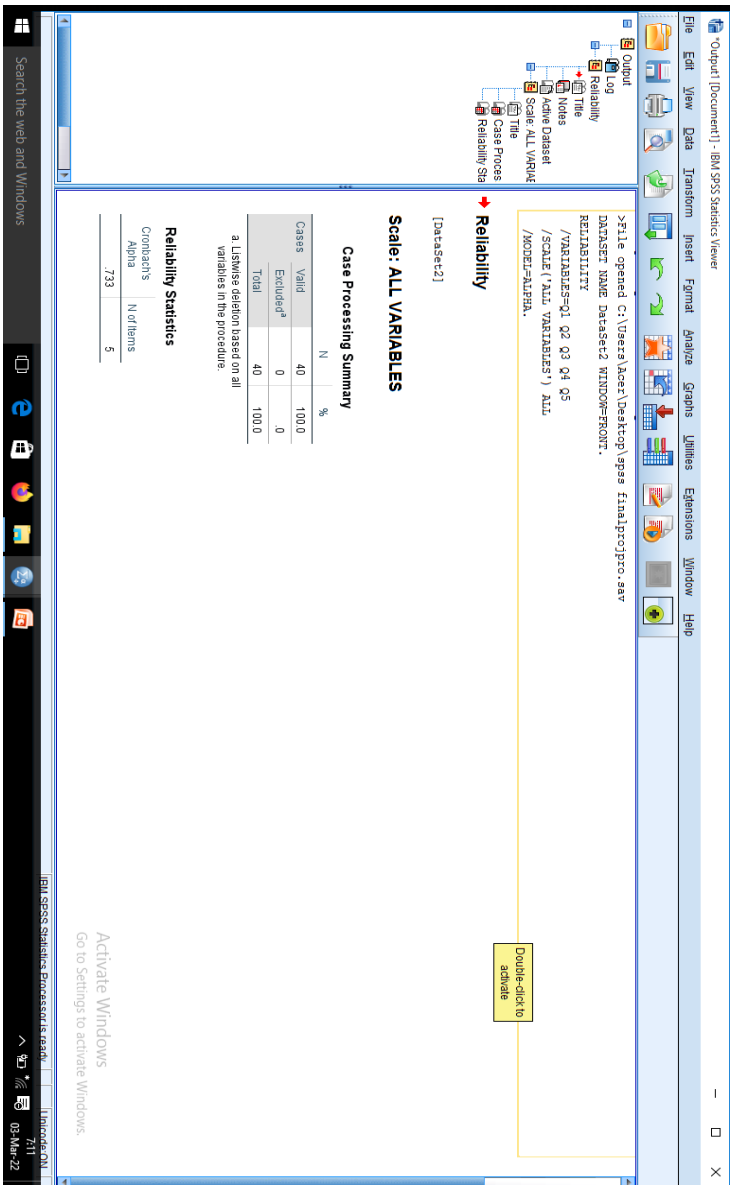


Figure 4.2: Result of Reliability Test

4.8 Closure

Questionnaire was prepared and content validity and reliability test of questionnaire was done.

Chapter 5

CASE STUDY ANALYSIS

5.1 General

A residential building is selected for the case study. From the case study we can get the different causes of cost variation.

5.2 Details of case study

Surya builders are a well-known construction developer firm working in Sangli. The firm is working on various building projects since last two decades. It is one of the oldest real estate developers firm with great name and have completed more than 50 projects across Sangli. Surya builders initially started it services in small contracts & projects and now working in developing real estate industry by constructing apartments, high rise buildings and bungalow projects. The brand has been associated with mega complexes, townships, etc. since the past 2 decades. It is one of the largest players in real estate market in Sangli.

Salient Features of the Project:

1. Name of Project: Anu Tara Apartment
2. Name of Developer: Surya Constructions
3. Experience: 20 years
4. Facilities: Security guard, CCTV surveillance, lift, solar system for water heating, fire fighting system
5. Total number of floors: 4
6. Total number of parking floors: 1
7. Total plot area: 7494 Sq. ft (696.5 Sq. m)

8. Total built up area: 10491 Sq. ft (974.6 Sq. m)

9. Total number of flats: 08

"Anu Tara" is a residential and commercial building project taken for this study. This building is a situated at Vikas Chowk, Sangli. This building project is constructed by Surya Construction, Sangli and was started in August 2019 and completed in April 2021(Figure 5.1 shows the actual picture of project after completion). This residential and commercial project is having total plot area 7494 Sq. ft (696.2 Sq. m)and total built up area 10491 Sq. ft (974.6 Sq. m). This building consists of 4 floors excluding basement, the ground floor and basement area is used for commercial and parking purpose while the remaining floors are used as residential purpose. The total estimated cost of the project was Rs 1crore 65 lakhs, but actual total cost of the project has gone up to around Rs 1 crore 81 lakhs. The cost variation in this project is about 16 lakhs.

Figure 5.1: Site picture ongoing construction

Figure 5.2: Site Picture after the completion of building

5.3 Earned Value Analysis of Selected Case Study

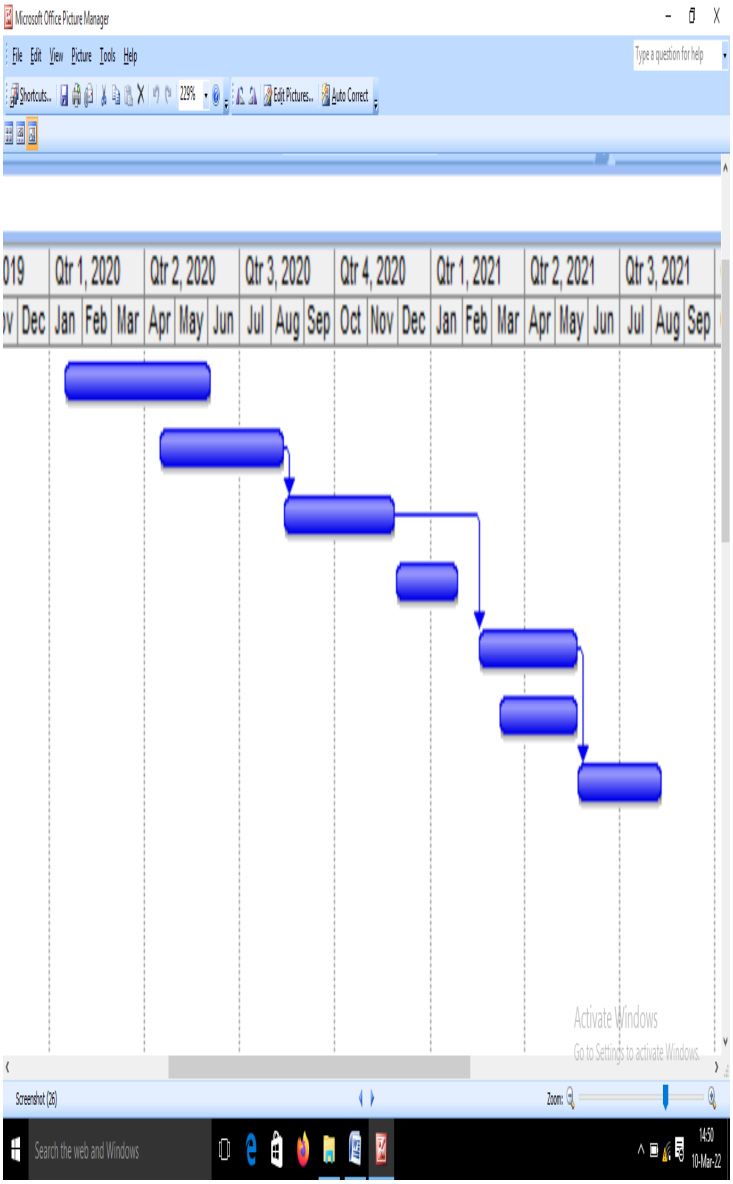


Figure 5.3: Schedule of Activities using MSP software

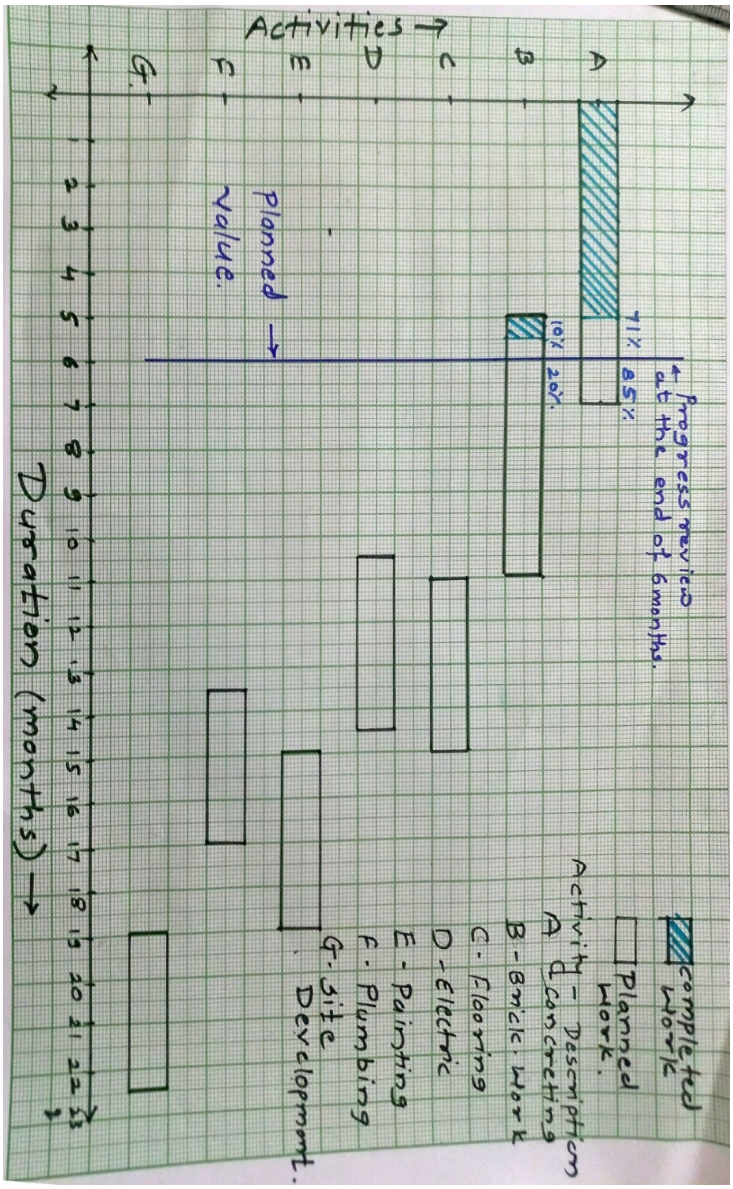


Figure 5.4: Details of planned value and earned value

Table 5.1: Earned value and planned value for concreting work

Actual Work Performed	Earned Value(EV)/ Budgeted Cost Work Performed (BCWP)	Actual Cost Work Performed (ACWP)	Planned Value(PV)/ Budgeted Cost Work Scheduled (BCWS)
Concreting – 71%	48.28 lakhs	53 lakhs	57.8 lakhs

Progress of work monitored at the end of 6 months. Two activities concreting and brickwork masonry is in progress but not as per the work scheduled.

For Concreting:

Planned Value (PV) = (Planned % Complete) x (Budget at completion)

= 85 % x 68 lakhs

= 57.8 lakhs

Earned Value (EV) = (% of completed work) x (Budget at completion)
= 71 % x 68 lakhs
= 48.28 lakhs

For Brick Work:

Table 5.2: Earned value and planned value for brick work

Actual Work Performed	Earned Value(EV)/ Budgeted Cost Work Performed (BCWP)	Actual cost(AC)/ Actual Cost Work Performed (ACWP)	Planned Value(PV)/ Budgeted Cost Work Scheduled (BCWS)
Brick work –10 %	2.4 lakhs	3 lakhs	4.8 lakhs

Planned Value (PV) = (Planned % Complete) x (Budget at completion)
= 20 % x 24 lakhs
= 4.8 lakhs
Earned Value (EV) = (% of completed work) x (Budget at completion)
= 10 % x 24 lakhs
= 2.4 lakhs

It was found that concreting completed was only 71 % (earned value) and actual planned value is 85 % (planned value).For another activity Brick work as per planned it should get 20 % complete at the end of 6 months but actually it was completed 10 % only .The various indices was found taken Schedule Variance (SV), Cost Variance (CV), Schedule Performance Index (SPI) and Cost Performance Index (CPI)

For Concreting:

Schedule Variance (SV) = Earned Value (EV) – Planned Value (PV)
= 48.28 - 57.8
= -9.52 lakhs
Cost Variance (CV) = Earned Value (EV) – Actual Cost (AC)
= 48.28 - 53
= -4.72 lakhs

Schedule Performance Index (SPI) = [Earned Value (EV) / Planned Value (PV)]
= (48.28 / 57.8)

= 0.83

Cost Performance Index (CPI) = [Earned Value (EV) / Actual Cost (AC)]
= (48.28 / 53)
= 0.91
Project may be 17 % behind the schedule and resulting 9 % over budget in case of concreting activity.

For Brickwork:

Schedule Variance (SV) = Earned Value (EV) – Planned Value (PV)
= 2.4 - 4.8
= -2.4
Cost Variance (CV) = Earned Value (EV) – Actual Cost (AC)
= 2.4 - 3
= -0.6

Schedule Performance Index (SPI) = [Earned Value (EV) / Planned Value (PV)]
= (2.4 / 4.8)
= 0.5
Cost Performance Index (CPI) = [Earned Value (EV) / Actual Cost (AC)]
= (2.4 - 3)
= 0.8
Project may be 50 % behind the schedule and resulting 20 % overbudget in case of brickwork activity.

From the calculation it was found that the values of cost performance index and schedule performance index are less than 1. It indicates that the project is behind the schedule and is over budget. It was also observed that in the initial phase due to Covid19 situation most of the time work was stopped due to unavailability of workers. Lockdown happened and because of that availability of materials was insufficient.

After analysis of the project progress the corrective measures has been taken to speed up the work and is progressed as per the schedule and monitored all the times. The cost of the project was found increased at the completion time. The

causes of cost overrun were identified that are explained in the next chapter.

5.4 Analysis of Factors of cost variation

According to the definition of cost variation discussed in the introductory part, cost variations were also found in this project under study. The final cost of construction was higher than expected. The cost of construction increased after because of the problems that arose after the construction began and tended to become more critical when it was ready to get sold. As mentioned in the case study, most top level construction personnel were concerned about project cost variations; however, there were several factors that made them unable to prevent variations and certain factors were beyond their ability and responsibility. The following factors are drawn out from the case study and described as below: liquidity of organization, interest rate, design change/change orders, unexpected ground conditions, underestimation, construction management cost, and shortage of material, mistakes during construction and other expenses.

Liquidity of Organization

This is the factor to cause most of the cost variation of this building project. The cost due to this factor in this project has increased by a variation order of 4.16 % of the total cost varied. This cost is increased because of increase in two sub-factors i.e. labour cost and material cost, both the sub-factors has affected the estimated cost by 2.08 % each. According to the developer, the labour cost was increased due to increase in the work while the material cost was increased because of increase in the rate of material.

Interest Rate

Before starting of the project the complete schedule, final planning, required time and cost of the project were finalized. But due to some circumstances the company has to face cash problem i.e. there was problem in cash flow, so avoid this company has to go through other finance measures which increased the interest rate. This increased interest rate lead to variation in cost of total project by 2.19 %.

Design Change / Change Order

Before starting of actual construction of project developer was satisfied with design and drawings prepared by architects. No any alterations were done during

initial phase of project. But after starting of actual work when the project was at its finishing stage alterations in design where done. They came forward with the requirement of solar system for their clients which earlier was not included in the design. Also the elevation of the showrooms in the project was designed in a simple way but later the management came out with the decision to use ACP sheets for its elevation. When the project was in its completion phase the clients demanded for provision of paving blocks along the margins (periphery) of the building, which was initially decided to do koba. These total additional changes increased the estimated cost of project by 1.40 %.

Unexpected Ground Condition

At the time when the project started the site was facing water-logging issues, so to overcome this problem pitching and waterproofing was carried out which increased the extra cost of project with a variation order of 1.10 % in total estimated cost of this project.

Underestimation

This factor had affected by 0.97 % of increase in estimated cost of project. This variation was occurred because while estimation the cost of lift was considered form the past data of their other project which was completed recently. But for this project another company was chosen for providing lift facility because this company had its good reputation and results in market. Construction Management Cost.

This change in cost variation was due various miscellaneous expenses. The cost was increased by a variation order of 0.82 % due to increase in wages of departmental labours, security guards, preliminary site expenses, advertisement, common bills, etc.

Shortage of Material

When the project was in its completion phase it faced through shortage of material. As the firm is large and it has its various ongoing projects, it requires material in mass amount. The firm has direct contacts with various flooring and ceramics manufacturing companies through which company places direct orders. But during this project the country was facing demonetization problem due to which the companies where refusing to take order and were waiting for firm government policies, which lead to increase in the estimated cost of project by 0.55 %

Mistakes during Construction and Other Expenses

This building project has also faced the problem of material wastage during its construction. The material was wasted because of negligence of workers because during plastering work the material which is fallen on floor surface was not collected at the same time and as time passes it gets harden and cannot be removed manually, which lead to use of machinery like breaker to remove extra hardened material increasing the cost of project. Also there were some other expenses too. Other expenses are regarded as un-controllable expenses which are usually accounted for various miscellaneous works, and are difficult to control and sometimes it is beyond the control.

In this case-study, actual cost variation causes are discussed and ranked as per there percentage variation. From these, liquidity of organization causes most of cost variation. The other factors such as interest rate, design change/change order, unexpected ground conditions, underestimation, construction management cost, shortage of material and mistakes during construction and other expenses are other major factors that affect total cost of project causing cost variations. Table 5.1 and figure 5.2 below shows the ranking of causes as per there variation order.

Table 5.3: Total Cost Variation in Construction Project

Sr. No.	Cost Varying Factors	% Cost Variation
1	Liquidity of organization	4.16
2	Interest rate	2.19
3	Design change	1.40
4	Unexpected ground conditions	1.10
5	Underestimation	0.97
6	Construction management cost	0.82
7	Shortage of material	0.55
8	Mistakes during construction and other expenses	0.55
	Total cost variation	11.16

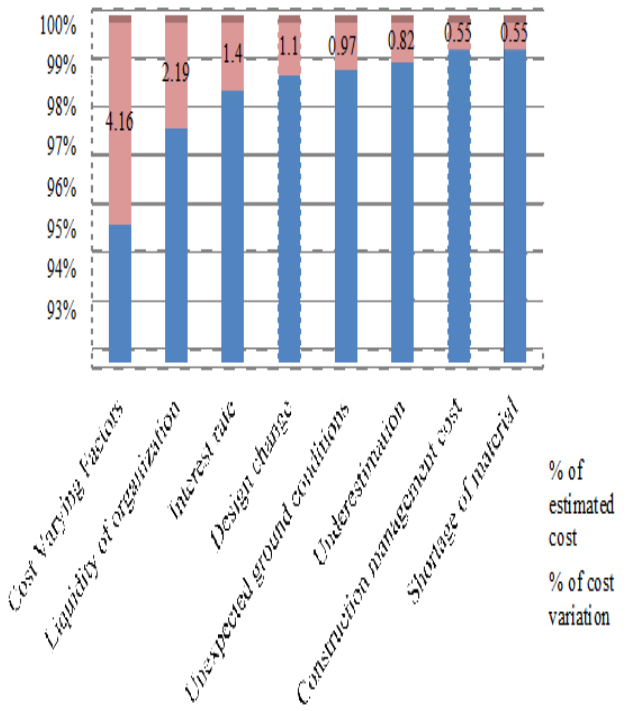


Figure 5.5: Total Cost Variation in Construction Project

5.5 Closure

This chapter includes the details of case study. Chapter presented major causes of cost overrun on construction site. This will help to make the final conclusion of the project.

Chapter 6

RESULTS AND DISCUSSION

6.1 General

This chapter explains the results and discussion of questionnaire survey considering cost variations of building projects from contractors, consultants and architects point of view, as well as the discussion of impact of these factors from case- study. Microsoft Excel was used for statistical evaluation of questionnaires. This chapter presents the way the questionnaires are distributed, responses are retrieved and subsequent analysis of the data collected through the questionnaire survey from professionals working for builders, consultants, contractors and architects who are involved in the building construction sector. The principal purpose of the survey is to rank the identified cost varying variables of building projects and then to find out the critical factors that are required to be given due attention in order to substantially minimize cost variation problems building construction projects.

6.2 Results and Discussion

6.2.1 Inferences from the Case Study

- After doing the case studies it is clear that the problem of cost variation is not bound to any particular type or size of project, neither it have any limitations for the location or region. The project referred for case-study faced more or less similar problems of cost variations those are collected from survey. The difference was only in the quantum of these variations. The reasons of these variations were mostly known and controllable. Still they are facing these

problems because of the following reasons:

- Liquidity of organization,
- Interest rate,
- Design change/change orders,
- Unexpected ground conditions,
- Underestimation,
- Construction management cost,
- Shortage of material,
- Mistakes during construction and other expenses.

  In all, liquidity of organization, shortage and unexpected ground conditions were the main reasons for time and cost variations in this project. Since most of the reasons are well known and can be controlled if a proper arrangement is made in consideration with proper project monitoring and tracking system.

6.2.2 Participation in the questionnaire survey

The questionnaire was distributed to contractors and consultants, builders and developers and to architects those are participated in various construction projects. Hand-to-hand delivery is preferred to improve the response rate and to encourage respondents. Moreover, phone calls are frequently made to remind respondents to complete the questionnaire. A total number of 55 questionnaire sets were aimed to be distributed to individuals; i.e., 20 builders and developers working for the client, 25 for consultants and contractors and 10 for architects. But however a total of 40 numbers of questionnaires were collected from the professionals working in this industry . Table 6.1 shows the number of distributed questionnaire and the number of received ones. The subject got a great interest from the concerned contractors, consultants and clients because it attempts to investigate a problem they are facing in their projects and they are the main beneficiaries from the research results and as a result an overall participation of 72.7 % is achieved.

Table 6.1: Questionnaire Distribution and Response

Description	Number Distributed	Number of Respondents	% Responses Received	% Responses from Total
Architects	**10**	**8**	**80**	**20**
Contractors & Consultants	**25**	**16**	**64**	**40**
Builders & Developers	**20**	**16**	**80**	**40**
Total	**55**	**40**	**80**	**100**

From the total of 55 questionnaires distributed, 40 responses are received (Table 6.1). These are 8 (20 %) from the architects, 16 (40 %) from contractors and consultants and 16 (40 %) from builders and developers. The overall response rate is 72 % (Table 6.1). However, the response rate for this survey is considered to be adequate for data analysis.In order for data to be acceptable for analysis, the response rate should be as much as possible above 50 % and if the response rate is lower than 30 %, the data fails to be representative and the result of the analysis are of little value for further interpretation [10]. The above data has been represented in the form of pie-chart in figure 6.1.

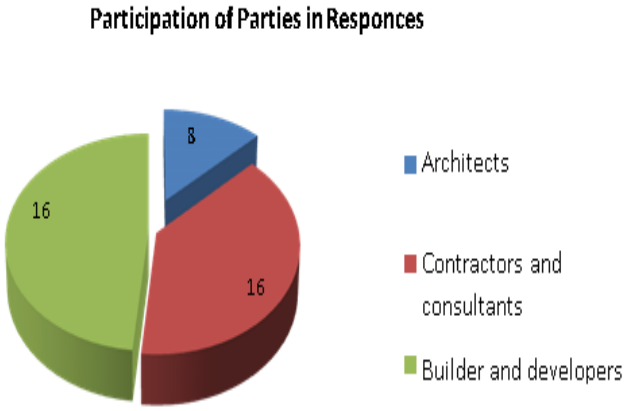


Figure 6.1: Participation in the Questionnaire Survey

General Profile of Respondents

Contractors and consultants, builders and developers and architects are professional respondents of the building projects .The demographic characteristics of the respondents surveyed in this research, that is their organization's experience in building construction projects, and the position of the respondents within their organization are presented in Figure 6.2.

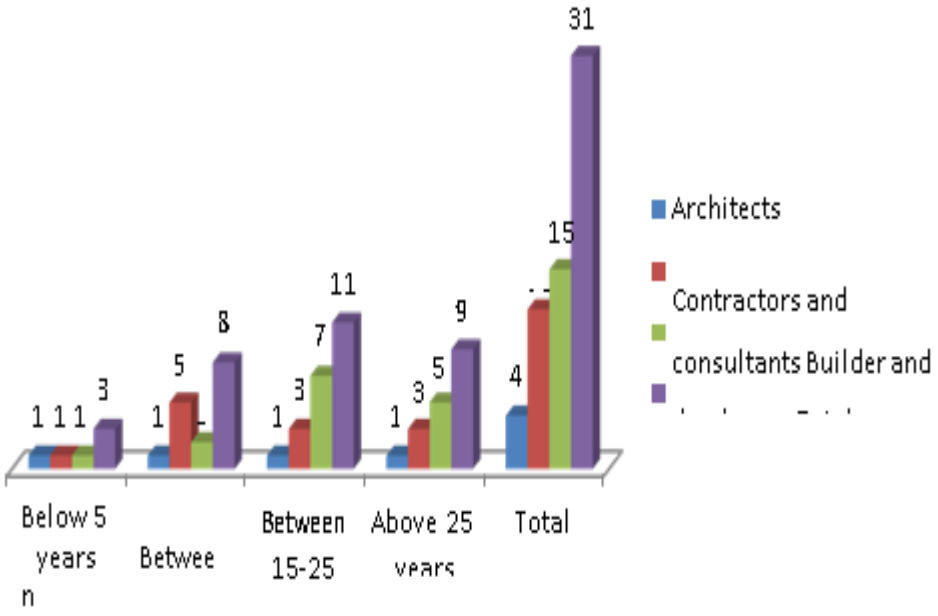


Figure 6.2: Graph Showing the Range of Experiences of the Respondent's Organization Involved in this Research Survey

As shown in Figure 6.3, the number of respondents having the following experience: 3 of them have less than 5 years experience, 8 of them have experience between 5 to 15 years, 11 of them have more than 10 years experience and 9 of them have more than 25 years of experience.

Figure 6.4 and table 6.2 shows that majority of respondents (i.e. 32.25 %) worked in projects of cost in the range of 50 lakh to 1 crore and about 25.80 % respondents are worked in projects having cost in the range of 1 to 2 crore. Again, about 19.36 % of respondents has been worked in projects of the cost range above 2 crore, 16.14 % of respondents are worked in the projects that ranges between 25 to 50 lakhs and about 6.45 % were participated in the projects of cost below 25 lakhs. The above data has been represented in the form of graph below.

Table 6.2: Cost of Projects Participated by Respondents in Percentage

Respondent (in %) / Cost	**< 25lakhs**	**25 – 50 lakhs**	**50lakh-1 crore**	**1 -2crore**	**>2crore**
Architects	0	3.23	3.23	3.23	3.23
Consultants and Contractors	6.45	9.68	12.90	6.45	3.23
Builders and Developers	0	3.23	16.12	16.12	12.90
Total (in %)	6.45	16.1	32.25	25.80	19.36

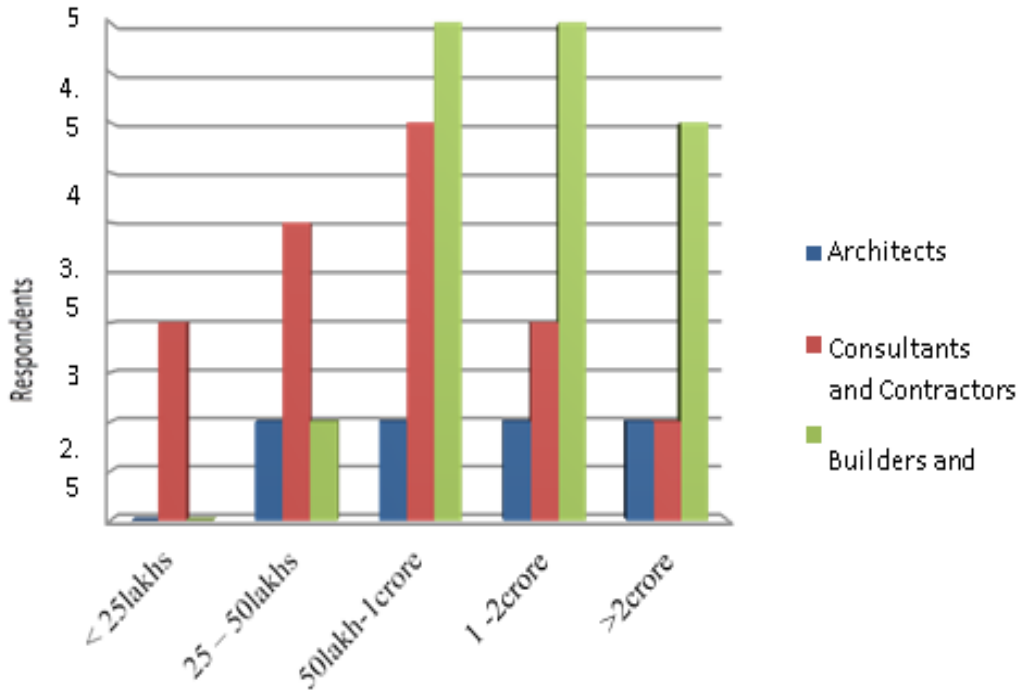


Figure 6.3: Graph Showing the Range of Experiences of the Respondent's Organization Involved in this Research Survey

Identification of causes

The ranking of causes of cost variation for construction projects has been done based on relative important index (RII) value calculated for each category. These categories are essential in identifying and enumerating the significant causes of variations and their causative agents in building projects as discussed further. Also the causes are identified according to the architects, contractors and consultants, builders and developers response.

Cost Variation Causes in Finance Category

Financial management is also important criteria in achieving successful construction project but if not well management it could lead to serious problem of cost overrun. Ashraf (2014) states that most of the contractors are lacking in financial

management which do not plan well in distributing the cost of the projects that might lead to poor cost performance. Hence, it is advisable to monitor financial spending thoroughly. Financial difficulties could also occur from the owner side where there is a delay payment of monthly valuations to the contractors which affect the cash flow of contractors. This leads to slower the project progress. Hence, appropriate funding level should be determined at the very inception of a construction project so that regular periodic payments may be made to the contractor for work done.

Finance category consists of four causes of cost variation as shown in Table 6.3. This category seems to have more impact on cost variation of building project as compared to other categories from the perception of the respondents. After ranking it can be seen that, cost variation in construction projects at this stage occurs mainly due to liquidity of organization like availability of cash, payment of contractors, payment of labour, etc. as it has highest RII 0.849. This cause also stands at 1st rank in overall list of causes. The inflation and taxes and interest rate also stand in second and third rank respectively in this category according to their impact on cost variation.

Table 6.3: Ranking of Causes in Finance Category

CauseNo.	**Description**	**RII**	**Rank in Category**	**Overall Rank**
1	Liquidity of organization	0.849	1	2
2	Taxes and interest rate	0.457	3	20
3	Inflation	0.489	2	19
4	Deflation	0.296	4	36

This ranking shows that, in building projects cost variation in finance category occurs due to delay in cash or delay in payments which may be produced due to unavailability of required amount of cash to the concerned party. Also this ranking shows that second factor of cost variation is due to change government tax policies or change rate of interest on money and third factor is inflation which usually occurs because of change value of money. The above data has been represented in the form of graph in figure 6.4.

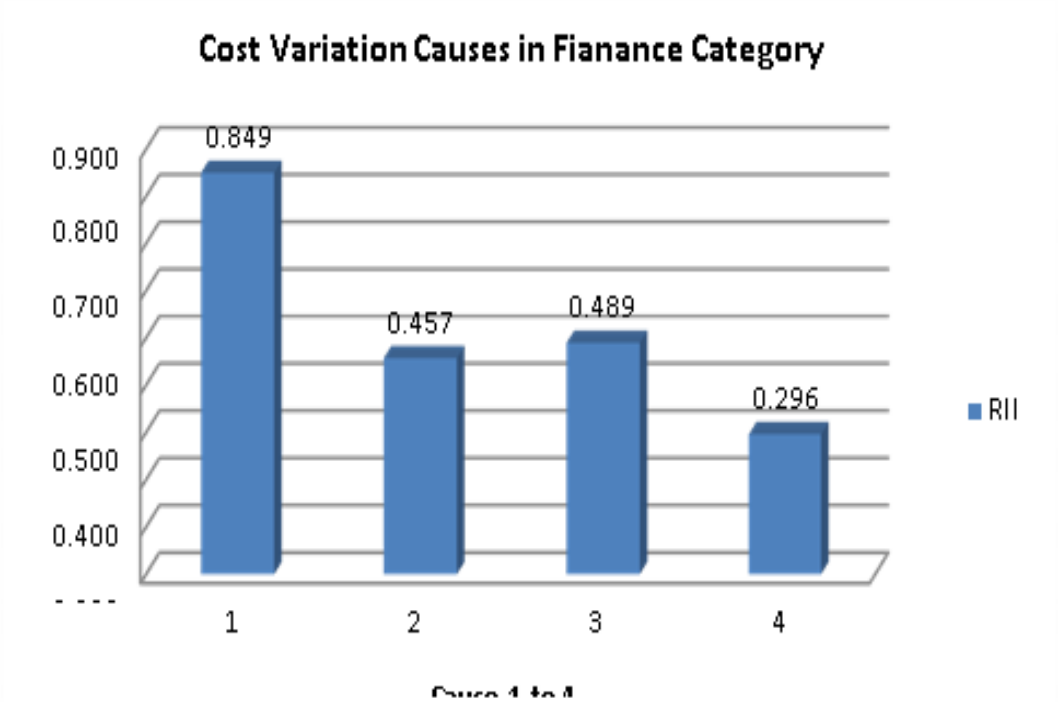


Figure 6.4: Graphical Representation of Causes in Finance Category and their RII

Cost Variation Causes in Management Category

Management category is the most significant contributor. According to few respondents, site management is highly depending on construction resources hence construction resources are more significant contributors to cost variation compared to site management. This finding is in line with previous research studies which highlight that improving site management is very critical for reducing cost variation as it affects on productivity significantly. Site management of contractor affects overall progress of project. Project management emphasizes on application of knowledge, skills, tools and techniques to project activities to meet project requirements and its role starts from the feasibility study of the project which continues till the commissioning of the project. Project management issues are also commonly accounted in many areas. These issues are avoidable and can be prevented but unfortunately construction industry experiences poor project management which affects significantly to the overall performance Management category consists of six causes of cost variation as shown in Table 6.4. After ranking it can be seen that, cost variation in construction projects in this category occurs mainly due to design changes or change orders like change in design from management, change in design by architect or design change as per customer re-

quirement as it has highest RII 0.839. This cause also stands at 2nd rank in overall list of causes. Unavailability of competent staff and construction management or management cost also stand in second and third rank respectively in this category according to their impact on cost variation.

Table 6.4: Ranking of Causes in Management Category

Cause No.	Description	RII	Rank in Category	Overall Rank
5	Construction management or management cost	0.403	3	28
6	Inspecting and testing	0.349	5	30
7	Design change or change order	0.839	1	5
8	Predetermined underestimation	0.339	6	32
9	Unavailability of competent staff	0.446	2	22
10	Absenteeism rate	0.382	4	29

This ranking shows that, in building projects cost variation in this management category occurs mainly due to design change or change order which may be produced due to demand or requirement of architect, contractor or customer of respective concerned party. Also this ranking shows that second factor of cost variation is due to unavailability of competent staff and third factor is construction management or management cost which is usually spent on managing the complete building projects. The above data has been represented in the form of graph in figure 6.6.

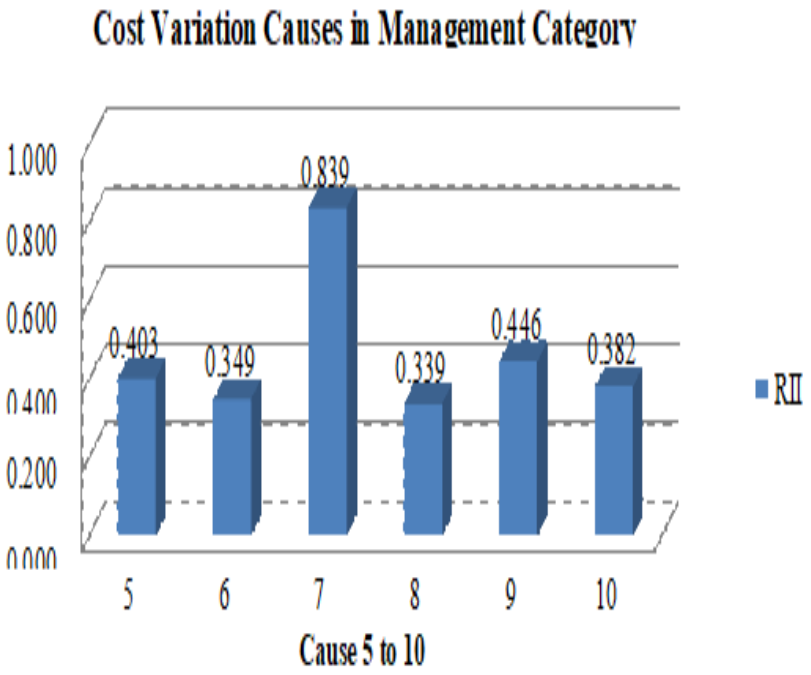


Figure 6.5: Graphical Representation of Causes in Management Category and their RII

Cost Variation Causes in Labour Category

This category is ranked as fourth major contributor of cost variation as agreed by respondents. Since, construction industry is regarded as labor intensive sector which is highly dependent on labour for execution of the study. Success of any construction project not only depends on the number of labour but also subjected to efficiency of the labour force. Hence, effective labour management is important area which needs serious attention in avoiding cost variation. Labour related issues are major problems of cost variation in every area . The labour category consists of eight causes of cost variation as shown in Table 6.5. After ranking it can be seen that, cost variation in construction projects in this category occurs mainly due to number of workers like availability of number of workers working in project, whether they are in excess or less number as it has highest RII 0.715. This cause also stands at 4th rank in overall list of causes. Quality of finishing or completing work and inappropriate contractors also stand in second and third rank respectively in this category according to their impact on cost variation.

This ranking shows that, in building projects cost variation in this labour category occurs mainly due to presence or availability of number of workers. Also this ranking shows that the sequence of ranks of other factors of cost variations are mis-

Table 6.5: Ranking of Causes in Labour Category

Cause No.	Description	RII	Rank in Category	Overall Rank
11	Labour strikes	0.317	8	34
12	Inappropriate contractors	0.511	3	14
13	Mistakes during construction	0.505	4	16
14	Time needed to rectify defects	0.349	7	31
15	Disputes	0.446	5	23
16	Quality of finishing/completing work	0.581	2	7
17	Health and safety cost	0.435	6	25
18	Number of workers	0.715	1	4

takes during construction, disputes amongst labour-labour or labour-contractor, health and safety cost, cost increased due to time needed to rectify defects and lastly labour strikes. The above data has been represented in figure 6.7.

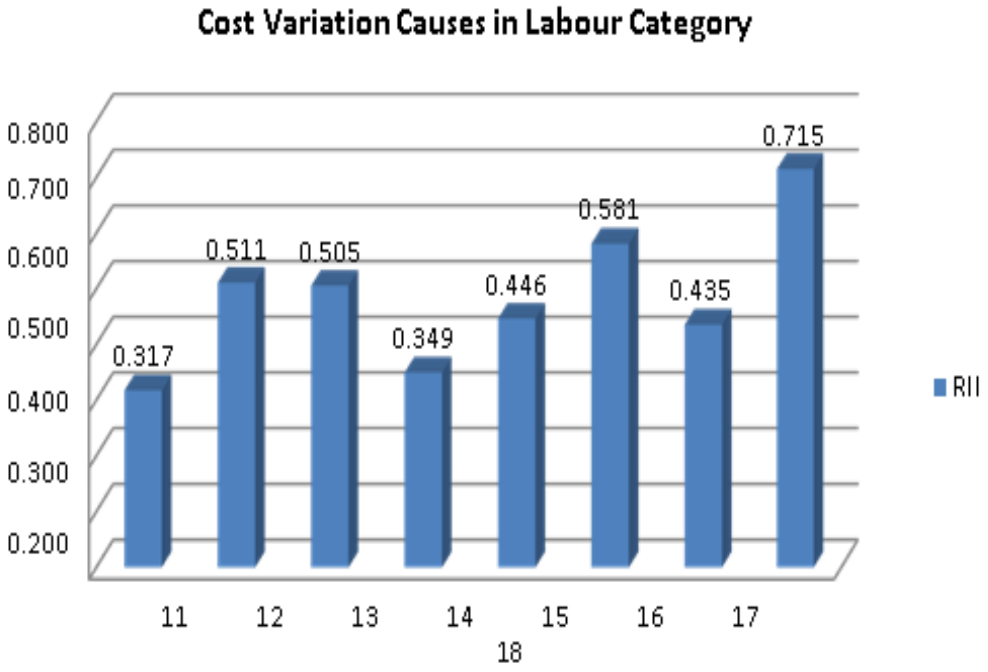


Figure 6.6: Graphical Representation of Causes in Labour Category and their RII

Cost Variation Causes in Material Category

Material and machineries are very important resources of any projects. The factors used in this survey where used from past studies . This category is ranked at third place with agreement respondents. Materials are considered as the backbone of construction projects, which accounted for nearly 70 % of the total value of project. Efficient material management is very critical in achieving successful

completion of project as any issue related to material will significantly contribute to cost variation [9]. Similarly, machinery resources are also important in assisting manpower resources in stepping up the efficiency of the study by saving huge amount of time and cost. Hence, adequate and efficient equipment use is more advantageous for project as compared to the application of obsolete and inadequate equipments. The material category consists of seven causes of cost variation as shown in table After ranking it can be seen that, cost variation in construction projects in this category occurs mainly due to shortage of material on project as it has highest RII 0.774. This cause also stands at 3rd rank in overall list of causes. Transportation of material stands second in this category while damage or wastage of material stands in third rank respectively in this category according to their impact on cost variation.

Table 6.6: Ranking of Causes in Material Category

Cause No.	**Description**	**RII**	**Rank in Category**	**Overall Rank**
19	Forms of procurement	0.446	6	24
20	Shortage of material	0.774	1	3
21	Transportation of material	0.548	2	10
22	Items manufactured offsite	0.306	7	35
23	Storage of material	0.511	4	15
24	Damage or wastage of material	0.538	3	11
25	Construction equipment	0.505	5	17

Also this ranking shows that the ranks of other factors of cost variations storage of material, construction equipment, forms of procurement and items manufactured offsite are fourth to seventh respectively. The above data has been represented in the form of graph in figure 6.8.

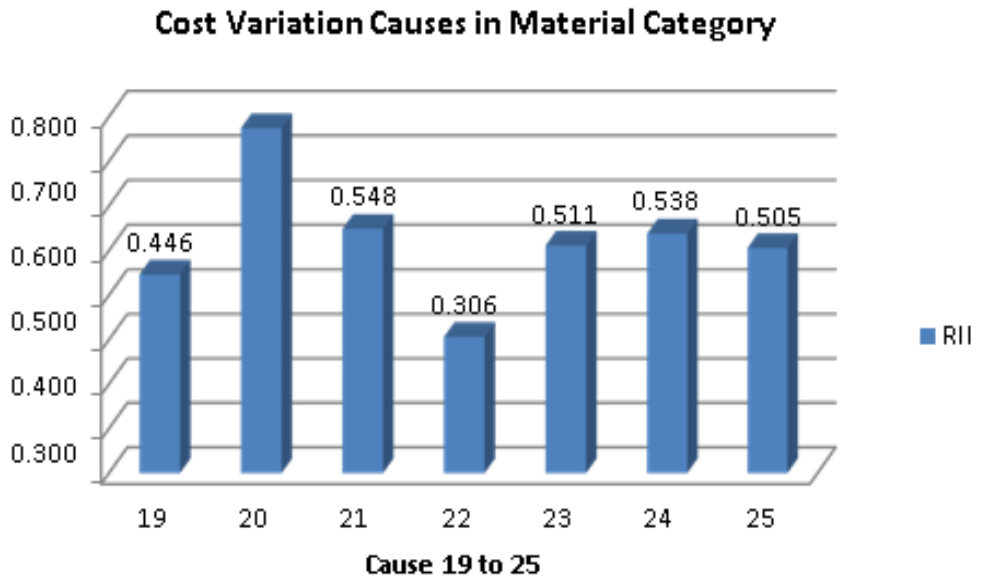


Figure 6.7: Graphical Representation of Causes in Material Category and their RII

Cost Variation Causes in Project Category

The project group of delay factors was ranked relatively high by consultants, contractors and architects. This agreement reflect the common point of view of the three parties, also the agreement reflect the effects of these factors on projects delay. All variables of this group have high importance index with respect to other factors in this survey.

Respondents consider that the causes of cost variation related to project are mostly occurs, due to that the rank of this group was high.

The project category consists of seven causes of cost variation as shown in table After ranking it can be seen that, cost variation in construction projects in this category occurs mainly due to cost of rework like availability of number of workers working in project, whether they are in excess or less number as it has highest RII 0.672. This cause also stands at 5th rank in overall list of causes. Project size and project location stands in second and third rank respectively in this category according to their impact on cost variation and also this two factors stand in sixth and eighth position in overall ranking.

Table 6.7: Ranking of Causes in Project Category

Cause No.	Description	RII	Rank in Category	Overall Rank
26	Project size	0.602	2	6
27	Project type or nature	0.532	5	12
28	Project location	0.581	3	8
29	Site characteristics	0.565	4	9
30	Number of stories or floor	0.457	7	21
31	Unexpected ground conditions	0.672	1	18
32	Cost of rework	0.887	6	1

Also this ranking shows that the ranks of other factors of cost variations site characteristics, project type or nature, unexpected ground conditions and number of stories or floors are fourth to seventh respectively. The above data has been represented in the form of graph in figure 6.9 below.

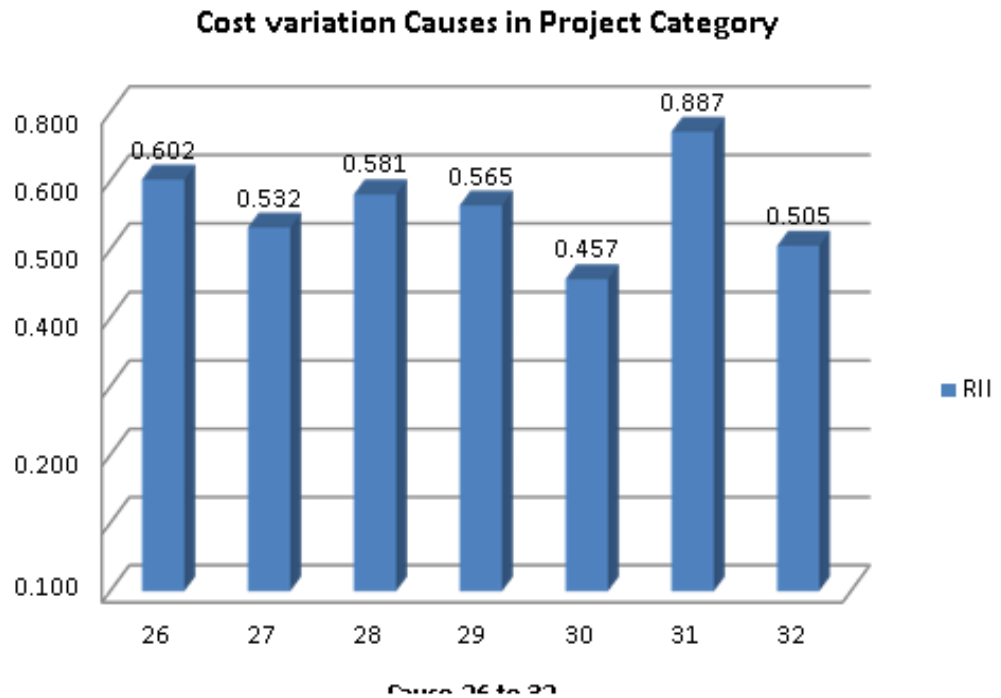


Figure 6.8: Graphical Representation of Causes in Project Category and their RII

Cost Variation Causes in Other Category

Other (external) factors are regarded as un-controllable factors which are usually difficult to control and sometimes it is beyond the control. In this survey, the external factor's category was ranked at sixth place as agreed by the respondents. The other category consists of four causes of cost variation as shown in table 6.8 and is represented by graph in figure 6.10. After ranking it can be seen that, cost variation in construction projects in this category occurs mainly due to demand

and supply which depends totally on market behavior as it has highest RII 0.715. This cause stands at 14th rank in overall list of causes. Land cost and incentive stands in second and third rank respectively in this category according to their impact on cost variation, and force majeure stand at fourth rank in this category as it occurs very rarely.

Table 6.8: Ranking of Causes in Other Category

Cause No.	Description	RII	Rank in Category	Overall Rank
33	Demand and supply	0.522	1	14
34	Force majeure	0.339	4	33
35	Land cost	0.430	2	26
36	Incentives	0.409	3	27

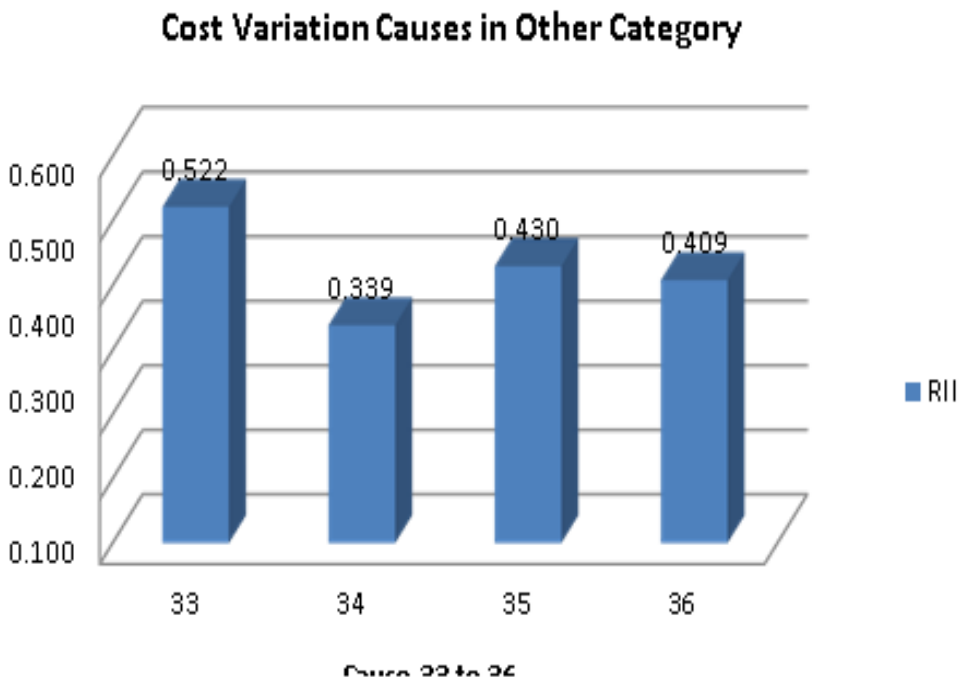


Figure 6.9: Graphical Representation of Causes in Other Category and their RII Cost Variation Causes as per Architects, Contractors & Consultants and Builder & Developers

In this stage, cost variation causes are discussed and ranked as per the responses of architects, contractors & consultants and builders & developers, in which total causes are included. From these, design change or change orders (drawing details, requirements, etc.) cause most of cost variation according to the architects and contractors & consultants review. But as per the response of builder & developers, the liquidity of organization is most affecting factor in cost variation of building project. The other factors such as shortage of material, number of workers, cost

of rework, quality of finishing, etc. are few major factors that affect total cost of project causing cost variations. Table 6.9 below shows the ranking of causes as per the responses of the architects, contractor and consultants and builders and developers. The above data has been represented in the form of graph in figure 6.11, figure 6.12 and figure 6.13 below.

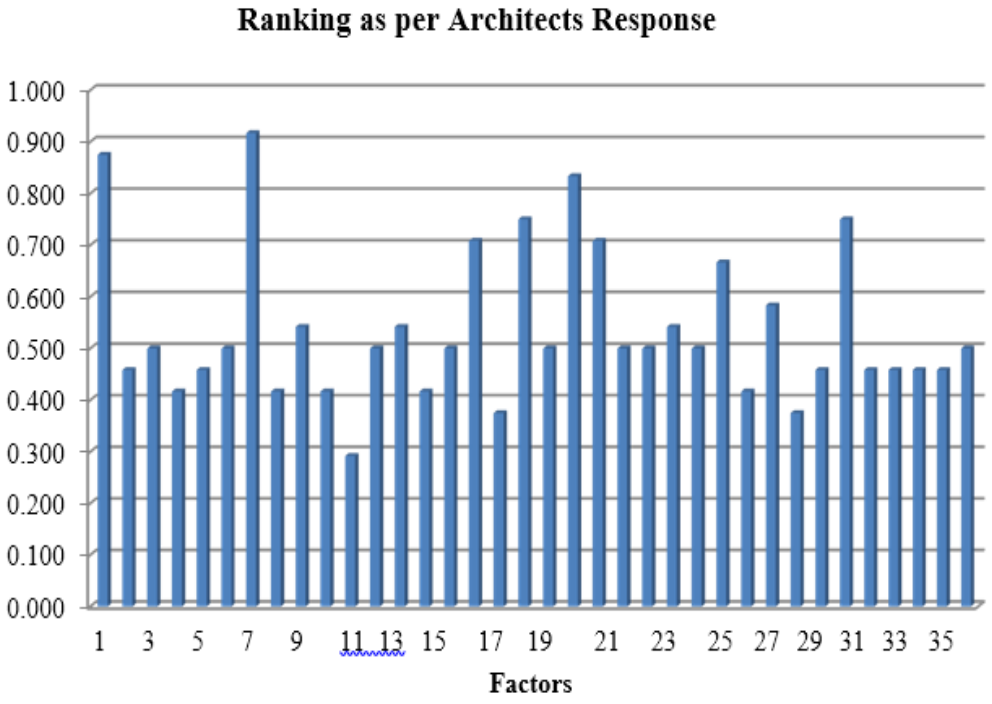


Figure 6.10: Graphical Representation of RII as per Archietects Response

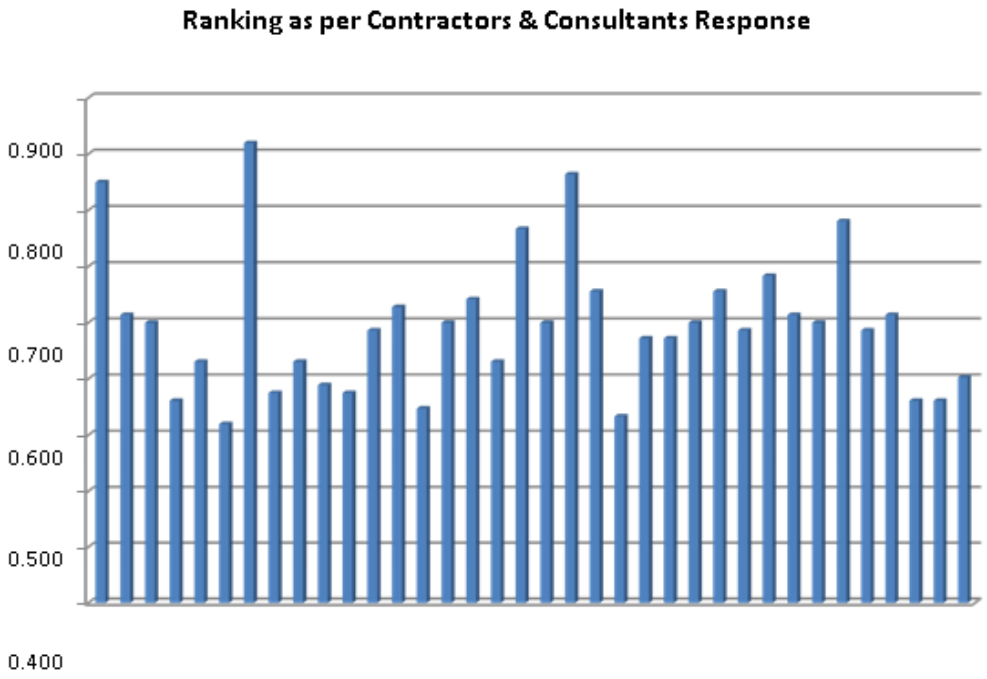


Figure 6.11: Graphical Representation of RII as per Contractors & Consultants Response

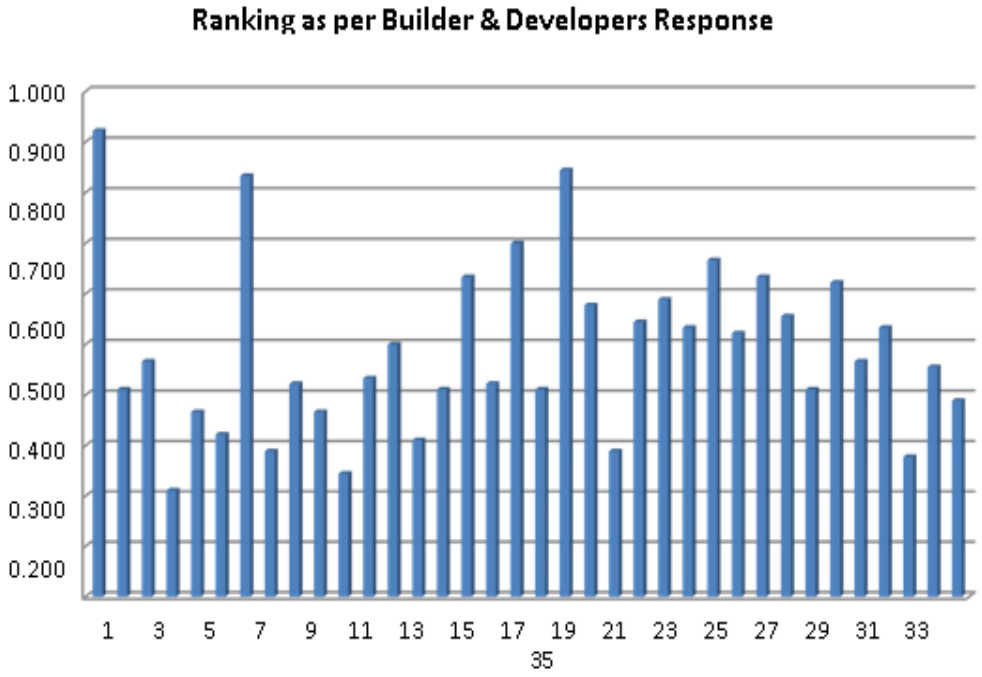


Figure 6.12: Ranking and their RII as per Builder & Developers responce

Table 6.9: Ranking and their RII as per Architect, Contractor & Consultant and Builder & Developers

Sr. No	Description	Architect		Contractor		Builder	
		RII	Rank	RII	Rank	RII	Rank
1	Liquidity of organization	0.875	2	0.750	1	0.839	2
2	Taxes interest rate	0.458	22	0.514	11	0.411	23
3	Inflation	0.500	13	0.500	14	0.467	17
4	Deflation	0.417	29	0.361	31	0.211	36
5	Construction management or management cost	0.458	23	0.431	24	0.367	28
6	Inspection testing	0.500	14	0.319	36	0.322	30
7	Design changes/change Orders	0.917	25	0.819	25	0.833	18
8	Predetermined underestimation	0.417	30	0.375	29	0.289	32
9	Unavailability of competent staff	0.542	10	0.431	25	0.422	21
10	Absenteeism rate	0.417	31	0.389	28	0.367	29
11	Labour strikes	0.292	36	0.375	30	0.244	35
12	Inappropriate contractors	0.500	15	0.486	19	0.433	20
13	Mistakes during construction	0.542	11	0.528	10	0.500	16
14	Time needed to rectify Defects	0.417	32	0.347	34	0.311	31
15	Disputes	0.500	16	0.500	15	0.411	24
16	Quality of finishing/ completing work	0.708	6	0.542	9	0.633	6
17	Health safety cost	0.375	34	0.431	26	0.422	22
18	Number of workers	0.750	3	0.771	3	0.774	3
19	Forms of procurement	0.500	17	0.500	16	0.411	25
20	Shortage of material	0.833	4	0.764	4	0.715	4
21	Transportation of material	0.708	7	0.556	7	0.578	10
22	Items manufactured offsite	0.500	18	0.333	35	0.289	33
23	Storage of material	0.500	19	0.472	22	0.544	12
24	Damage/wastage of material	0.542	12	0.472	23	0.589	8
25	Construction equipment	0.500	20	0.500	17	0.533	13
26	Project size	0.667	8	0.556	8	0.667	5
27	Project type/nature	0.417	33	0.486	20	0.522	15
28	Project location	0.583	9	0.583	6	0.633	7
29	Site characteristics	0.375	35	0.514	12	0.556	11
30	Number of stories	0.458	24	0.500	18	0.411	26
31	Cost of rework	0.750	5	0.681	5	0.622	8
32	Unexpected ground Conditions	0.885	1	0.856	2	0.849	1
33	Demand supply	0.458	26	0.514	13	0.533	14
34	Force majeure	0.458	27	0.361	32	0.278	34
35	Land cost	0.458	28	0.361	33	0.456	19
36	Incentives	0.500	21	0.403	27	0.389	27

Ranking of Categories

All the six categories involved in the total survey are combined together in following figure. The figure 6.14 shows average of RII of each group in this stage to compare them together. From figure 6.14, it is seen that causes of cost variation from project category show maximum RII 0.559. According to participant's response, causes related to project category are affecting the cost of any project in construction in large percentage, which is then followed by finance category as it shows second highest RII in this stage i.e. 0.523. The material category related causes of cost overrun are nearly at same level to finance category with RII 0.518. Labour category (manpower) and management category are at fourth and fifth position in this ranking with RII 0.483 and 0.460. The other(external factors) category stands at bottom position in this ranking as it shows lowest RII 0.425, which shows this is not affecting the project cost too much as compared to other factors in this stage according to participant's response.

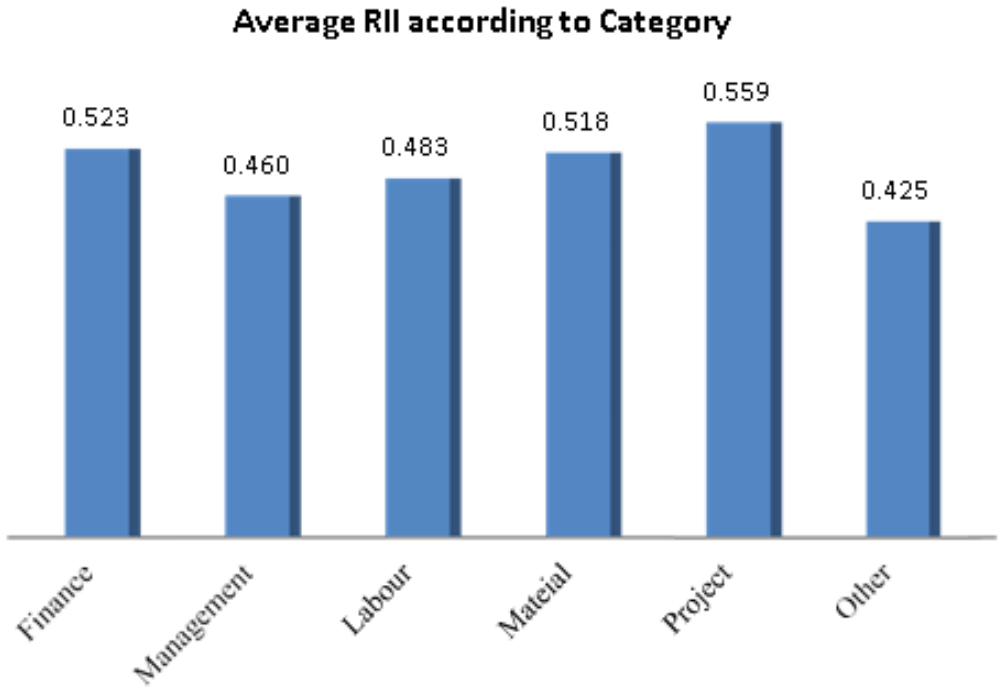


Figure 6.13: Graphical Representation of all Categories and their RII

[**Overall Ranking of Construction Cost Variation Causes**

In table 6.10, all the causes of cost variation are ranked as per the RII calculated earlier. In this table all the causes of six stages are arranged in a sequence according to their ranking. So, we get top six causes that are having RII more than

0.6 which are more effective in cost variation of construction projects that are – Liquidity of organization, design change or change order, shortage of material, number of workers, cost of rework and project size.

Table 6.10: Overall Ranking and their RII

Sr.No	Cost Variation Factor	Total Score	RII	Overall Rank
1	Unexpected ground condition	158	0.887	1
2	Liquidity of organization	156	0.839	2
3	Number of workers	144	0.774	3
4	Shortage of material	133	0.715	4
5	Cost of rework	125	0.672	5
6	Project size	112	0.602	6
7	Quality of finishing	108	0.581	7
8	Project location	108	0.581	8
9	Site characteristics	105	0.565	9
10	Transportation of material	102	0.548	10
11	Damage or wastage of material	100	0.538	11
12	Project type or nature	99	0.532	12
13	Demand and supply	97	0.522	13
14	Inappropriate contractors	95	0.511	14
15	Storage of material	95	0.511	15
16	Mistakes during construction	94	0.505	16
17	Construction equipment	94	0.505	17
18	Design changes	94	0.505	18
19	Inflation	91	0.489	19
20	Taxes and interest rates	85	0.457	20
21	Number of stories or floors	85	0.457	21
22	Unavailability of competent staff	83	0.446	22
23	Disputes	83	0.446	23
24	Forms of procurement	83	0.446	24
25	Health and safety cost	81	0.435	25
26	Land cost	80	0.430	26
27	Incentives	76	0.409	27
28	Construction management	75	0.403	28
29	Absenteeism rate	71	0.382	29
30	Inspection and testing	65	0.349	30
31	Time needed to rectify defects	65	0.349	31
32	Predetermined underestimations	63	0.339	32
33	Force majeure	63	0.339	33
34	Labour strikes	59	0.317	34
35	Items manufactured offsite	57	0.306	35
36	Deflation	55	0.296	36

6.3 Closure:

From the results and discussion it was found that unexpected ground condition, liquidity of organization, number of workers and shortage of materials are the causes of cost variation.

Chapter 7

CONCLUSION AND FUTURE SCOPE

7.1 Conclusions

Based on the research following conclusions are drawn-

- It was found that unexpected ground condition, liquidity of organization, number of workers, shortage of materials, construction management cost, mistakes during construction, inflation, design changes and other expenses are all cost varying factors. From the analysis done the major factors on cost overrun are found four in number, they are unexpected ground condition, liquidity of organization, number of workers, shortage of materials. Study also suggest the recommendation to overcome the causes of cost overrun.

Recommendation to Overcome Causes of Cost Overrun

- Recommendation on Unexpected ground condition :
  Pre bid investigation should be carried out - Land should be inspected before biding the contract. Various tests should be carried out to check the condition of the soil .
  Talk to people in nearby areas to get the information of lands condition in different seasons - Information about the land in different seasons should be collected by surveying people living in near by areas. Information about the floods and others can be collected by this.

- Recommendation on Unexpected ground condition :

Use earn value analysis technique. Earn value analysis is a critical technique for measuring and controlling the performance and progress of a project that is used in a variety of industries. It calculates cost and timing variances, as well as performance indices, and predicts project cost and duration.

- Recommendation on number of workers :

  For any project it is very essential to adopt manpower planning technique. Resource smoothing and leveling are important methods of manpower planning that need to adopt.

  If money is sufficient and the time remaining for the project's completion is short, out sourcing or contracting out some of the the projects task to a third party.

  Planning and applying Management Information system: A management information system (MIS) is an integrated system that provides information to support an organization's operations, management, and decision-making functions, which will help in managing cash flow.

- Recommendation on Shortage of materials :

  The shortage of material would result in cost variation, it is recommended to conduct EOQ analysis and material procured on the site as per EOQ analysis. Various EOQ models can be developed.

  Prepare a detailed materials schedule planning in accordance with the scope of work, and conduct data acquisition to create accurate and complete data and information.

  Develop an excellent payment schedule to prevent delay in material delivery. Conduct comprehensive and careful selection of suppliers, which considers supplier daily capacity and material quality.

7.2 Future Scope

This study was limited to a residential building project. Further research can be conducted on the analysis of cost variation in larger projects with a longer construction period.

REFERENCES

[1] Abdersiak Adam and Goran Lindahl, (2017) "Aggregation of factors causing cost overruns and time delays in large public construction" International Journal of Civil Engineering & Technology, Volume 3 , Issue 4, pp. 137 - 146

[2] Aishwarya Patil, (2017), " Analysis of cost overrun in construction projects", International Research Journal of Engineering and Technology, , Volume 2 , Issue 3, pp. 58-71

[3] Ashraf M. Adnan, (2014), "Overrun in Large Urban Infrastructure Projects", Division of Building and Real Estate Economics, Department of Real Estate and Construction Management, Royal Institute of Technology, Thesis No. 391

[4] Chhavi Gupta and Chitranjan Kumar, (2020) "Study of factors causing cost overrun and time overrun in construction projects", International Journal of Engineering Research and Technology, Vol. 2, No. 3, pp. 171-197

[5] Devi Vaishnavi S., (2017), "Cost Escalation in Construction Projects", International Journal for Research in Applied Science & Engineering, Vol. 5, No. 1, pp. 271-277

[6] Jansu Ann Jose and Xavier Belarmin C.S., (2015), "Analysis of Time and Cost Overrun in Building Construction", Proceedings of International conference on recent advances in engineering science and management, New Delhi, pp. 305-311

[7] Jennifer Shane and Keith Molenaar,(2018) " Construction project cost escalation factors", Journal of Management in Engineering, Vol.27. No. 3, pp. 112-147

[8] Marsha Enrica and Humiras Purba, (2021) "Risk leading to cost overrun in construction projects" , Advance researches in Civil Engineering, Vol.1, No3, pp 43-79

[9] Mhando Yusuph B., Mlinga Ramadhan S. and Alinaitwe Henry M., (2015), "Factors Influencing Variations in Public Building Projects", Proceedings of 4th Construction Management Conference Department of Construction Management, South Africa, , Vol.1, No7 pp. 102-139

[10] Mostafa Mohammd and Sherif Sabry El-Attar,(2019) "Factors leading to cost overrun occurance in construction projects" , Journal of Construction Engineering and Management Vol.7, No4 pp. 122-149

[11] Murat Gunduz,(2017) "Causes of cost overrun in construction industry" , Second International Conference on Civil Engineering and Material Science, Vol.4, No2 pp. 68-114

[12] Patel Harjinder and Patel Saurabh,(2017) "Analysis of cost and time overrun in construction project using smart-pls", International Journal of Advance Research and Innovative Ideas in Education, Vol.5, No3 pp. 210-239

[13] Prajapati Santosh kumar, Gupta Rakesh and Pandey Mukesh, (2016), "Causes and Effects of Cost Overrun on Construction Projects in Madhya Pradesh", International Journal of Engineering Development and Research, Vol. 4, No. 2, pp. 1346-135

[14] Shete Anant Narayan and Kothawade Vaibhav Durwas, (2016), "An Analysis of Cost Overruns and Time Overruns of Construction Projects in India", International Journal of Engineering Trends and Technology, Vol. 41, No. 1, pp. 33-36

[15] Shubham Sharma and Ashok Gupta , (2021) " Analysis of factors affecting cost and time overruns in construction projects" , International research Journal of Engineering and Technology, Vol.11, No2 pp. 132-169

[16] Sindhu Vaardini and S. Karthiyayini,(2016) "Study on cost overruns in construction projects" , International Journal of Applied Engineering Research, Vol.11 , No 3, pp. 31-52

[17] Tejale Dhanashree S., (2015), "Analysis of Construction Project Cost Overrun by Statistical Method", International Journal of Advance Research in Computer Science and Management Studies, Vol. 3, No. 5, pp. 349-355

[18] Tien-Choon Toha, Connie Tingb, Kherun-Nita Alic, Godwin-Uche Aliaghad and Omar Munira, (2012), "Critical Cost Factors Of Building Construction Projects In Malaysia", Proceedings of International Conference on Asia Pacific Business Innovation and Technology Management, , Vol.11, No2. pp. 221-249

[19] Seabee planners and estimators handbook (NAVFAC p-405)

APPENDIX 1

Questionnaire

1. Name of the Respondent: .....

2. Name of Company/ Organization : .....

3. Location: .....

4. Working Experience: .....

5. Projects Completed: .....

6. Project details: Estimated cost= .....

Actual cost= .....

7. In what amount the factors divided into following categories affect the cost variation between estimated and actual cost of project?

Finance

1	Liquidity of organization	Never (0)	Less(1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
2	Taxes interest rate	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
3	Inflation	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
4	Deflation	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)

Management

5	Construction management	Never (0)	Less(1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
6	Inspection testing	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
7	Design changes	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
8	Predetermined underestimation	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
9	Unavailability of competent Staff	Never (0)	Less(1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
10	Absenteeism rate	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)

Labour

11	Labour strikes	Never (0)	Less(1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
12	Inappropriate contractors	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
13	Mistakes during construction	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
14	Time needed to rectify defects	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
15	Disputes	Never (0)	Less(1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
16	Quality of finishing	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
17	Health safety cost	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
18	Number of workers	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)

Material

19	Forms of procurement	Never (0)	Less(1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
20	Shortage of material	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
21	Transportation of material	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
22	Items manufactured offsite	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
23	Storage of material	Never (0)	Less(1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
24	Damage	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
25	Construction equipment	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)

Project

26	Project size	Never (0)	Less(1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
27	Project type/nature	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
28	Project location	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
29	Site characteristics	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
30	Number of stories/floors	Never (0)	Less(1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
31	Cost of rework	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
32	Unexpected ground conditions	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)

Other

33	Demand supply	Never (0)	Less(1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
34	Force majeure	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
35	Land cost	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)
36	Incentives	Never (0)	Less (1)	Sometimes (2)	Average (3)	Often (4)	Always (5)

LIST OF PUBLICATIONS ON PRESENT WORK

[1] Vrushabh Awati. (2021). Analysis of cost variation between estimated cost and actual cost of residential building project. International Research Journal of Engineering and Technology.

[2] Vrushabh Awati. (2021). Analysis of cost variation between estimated cost and actual cost of residential building project. International Journal of advanced science engineering and information technology.(Under review)

CONFERENCE PAPER

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 02 | Feb 2022 www.irjet.net p-ISSN: 2395-0072

Analysis of Cost Variation between Estimated Cost and Actual Cost of Residential Building Project

Vrushabh Awati[1], Nagesh Suryawanshi[2]

[1,2]Department of Civil Engineering, Rajarambapu Institute of Technology, Rajaramnagar Sakharale, Maharashtra, 415414, INDIA

Abstract—*The main aim of this study is to prioritize the main causes of cost overrun in construction projects. Sangli area is selected to collect the data. The collected data is then analyzed and compared to the actual budget the estimated cost to see the various causes of cost overrun. With the help of various workers such as Consultants contractors site engineers and others questionnaire is prepared to the various factors which causes Cost overrun. The study will show the main factors which results in cost overrun. In further projects this type of study he's going to help the project manager to work on various causes of cost overrun.*

Keywords—**Cost overrun; Relative importance index; Factors of cost overrun; Relative important index**

1. INTRODUCTION

Cost is the major factor which is to be considered as one of the most important parameter of the project and he's also proven most construction projects fail to achieve its objectives the specific cost. Almost all the projects have been in construction industry have been affected by cost variation in frequent cases. Cost overrun differs from region to region and is also dependent on economic and geographic factors. Human resources are also related to Cost overrun in few cases. To identify and prioritize the major cause of cost overrun is the focus of this case study. This will help to reduce cost over similar projects. With the help of various workers such as architects and engineers a questionnaire is formed. These factors are ranked by Relative importance index.

2. METHODOLOGY:

To achieve the objectives of the study the following activities have been conducted:

2.1 Questionnaire Design

The questionnaire has been developed based on the literature findings & preliminary discussions with consultants, contractors & architects. To ensure maximum participation the questionnaire has been distributed to consultants, contractors/builders and Architects. The questionnaire response from consultants, contractor's, builders and architects was collected first and then after studying their responses ranking has been done to causes of cost variation. The data collected has been presented, tabulated & analyzed using suitable statistical technique. Also a case study has been taken for study of causes of cost variation in construction industry. A discussion of the results is linked with findings of the literature and case- study, then cost variation were identified and ranked based on theirs severity. A conclusion of the major findings is stated & some recommendations are given to mitigate the salient problem.Selection of data collection technique. Personal interviews and desk study discussions were carried out and a questionnaire is formed. The questionnaire is prepared by honest and frank opinions as the respondents are not required to state their names. If interviews are conducted by the author then respondents and particularly contractors and consultants might not express their opinions frankly on the issues related to their clients. The causes of construction cost variation are too many to be covered in 30 minutes interview and the respondents might not have longer time to spend on longer interviews. The questionnaire is

CONFERENCE PAPER CERTIFICATE

UNDER REVIEW PAPER

Analysis of Cost Variation Between Estimated Cost and Actual Cost of Residential Building Project

Vrushabh Awati[a*], Nagesh Suryawanshi[a],

[a] Department of Civil Engineering, Rajarambapu Institute of Technology, Sakharale, Maharashtra, 415414, INDIA

*Corresponding author: vrushabh1902@gmail.com

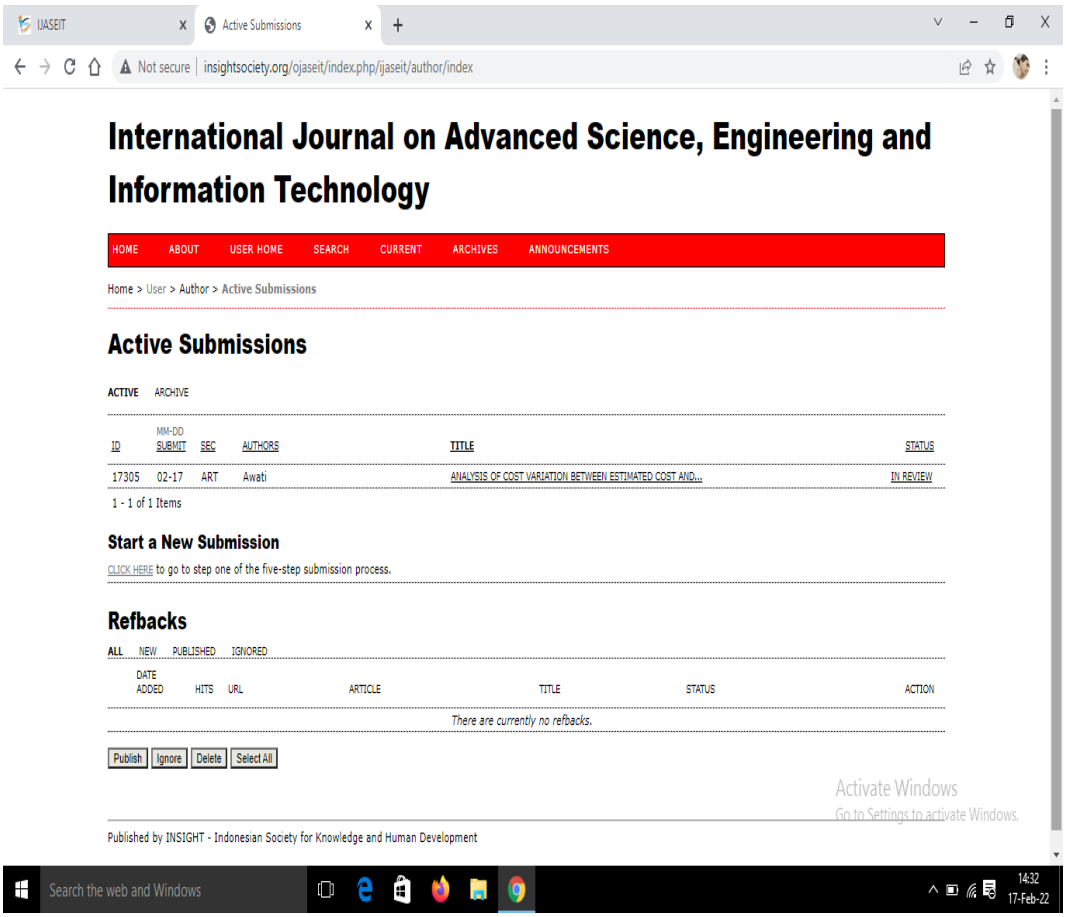
***Abstract*— Achievement of any construction venture depends on the timely completion of project within the specified budget. Method of execution management of workers, equipment, scheduling and cost are some of the factors that affect the project management and these factors are the reason in for the cost and time overruns around the world. This study objective is to identify and prioritise the major cause of time and cost overrun in construction industry using a completed project. Data is collected from Sangli and Kolhapur area. This data is analysed and compared with the estimated and actual budget schedules to understand the cause of cost and time overruns. Factors are identified from the project using questionnaire with the help of people who work for the project through various parties like consultants, contractors site engineer etc. The results of the study shows that main factors of the time and cost overruns are poor Material Management site conditions ,unskilled labour, contractor financial difficulties, machines and equipment difficulties. By opting the result and analysis of factors recommendations are suggested as possible remedial solutions for the forthcoming project. These types of study will help the project manager to act on critical causes and further try to reduce the cost overrun of project.**

***Keywords*— Cost overrun; Construction project; Factors of cost overrun;Relative important index.**

INTRODUCTION

Cost is one of the major considerations throughout the project management lifecycle 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 common to see a construction project feeling to achieve its objectives within the specific cost. Cost variation is a very frequent phenomenon and is almost associated with all construction projects. Maintaining study cost projection on any projects had been recently and issue of serious concern both to the Nation and also depend on the economic political and geological factors mainly there is no proper method to check the ability level of the work force before deploying to work and lead to poor output of cost overruns. The factors are sometime mainly associate with human resources which highly influenced the cost overrun. In many countries grant for construction activities is used and route to regulate the economy as the construction industry continues to grow up in size due to planning and budgeting problems were occurring. In developing countries the growth of construction industry will help to anchorage the rise of nations GDP and give the many employment

UNDER REVIEW PAPER STATUS



IJASEIT | Active Submissions

Not secure | insightsociety.org/ojaseit/index.php/ijaseit/author/index

International Journal on Advanced Science, Engineering and Information Technology

HOME ABOUT USER HOME SEARCH CURRENT ARCHIVES ANNOUNCEMENTS

Home > User > Author > Active Submissions

Active Submissions

ACTIVE ARCHIVE

ID	MM-DD SUBMIT	SEC	AUTHORS	TITLE	STATUS
17305	02-17	ART	Awati	ANALYSIS OF COST VARIATION BETWEEN ESTIMATED COST AND...	IN REVIEW

1 - 1 of 1 Items

Start a New Submission

CLICK HERE to go to step one of the five-step submission process.

Refbacks

ALL NEW PUBLISHED IGNORED

DATE ADDED	HITS	URL	ARTICLE	TITLE	STATUS	ACTION

There are currently no refbacks.

Publish Ignore Delete Select All

Activate Windows
Go to Settings to activate Windows.

Published by INSIGHT - Indonesian Society for Knowledge and Human Development

Search the web and Windows 14:32 17-Feb-22

APPROVED COPY OF SYNOPSIS

A

Synopsis Report On

"**Analysis of cost variation between estimated cost and actual cost of residential building project.**"

Submitted

In partial fulfillment of the requirements for the degree of

Master of Technology In
Civil-Construction Management
By

Mr.Vrushabh Devchandra Awati
(Roll No. 1927008)

Under the Supervision of

Dr. N.T.Suryawanshi
(Department of Civil Engineering, RIT Islampur)

Department of Civil Engineering

K. E. Society
Rajarambapu Institute of Technology, Rajaramnagar
(An Autonomous Institute, Affiliated to Shivaji University, Kolhapur)

2020 – 2021

Page **1** of **12**

Approved Copy of Synopsis
Page.....1.....

K. E. Society's

RAJARAMBAPU INSTITUTE OF TECHNOLOGY, RAJARAMNAGAR

(An Autonomous Institute, Affiliated to Shivaji University, Kolhapur.)

SYNOPSIS OF M. TECH. DISSERTATION

1.Name of Course	: M. Tech. Civil-ConstructionManagement
2.Name of the Student	: Mr. Vrushabh Devchandra Awati
3.PRN of Student	:1927008
4.Name of Guide	: Dr.N.T.Suryawanshi
5.Proposed Title	:Analysis of cost variation between estimated cost and actual cost of residential building project .

6.Synopsis of Proposed Work

Introduction:

Every country whether in the developing stage or already developed stage has the need for building construction development to further the economic, social, technical growth of the country. Construction is everlasting activity across the world. Construction profitability fluctuates according to the law of demand and supply. Construction process needs resources in the form of men, material, machinery and money. Construction activity requires wide variety of materials which form substantial part of entire construction cost & lastly money is at the core of business activities & construction being a capital intensive business generally operates under money constraints. India is the fastest growing economy in the world. The successful completion of project is so largely depend on time & cost and sometimes critical in both the planning and control phase.

The construction industry is very competitive business area. The rates at which contractors fail have been and remain extremely high. Project cost control aims at controlling changes to the project budget. It provides management with cost related information for making decisions with a view to complete the project with specified quality, on time, and within budgeted cost. This information extracted from performing data and other sources is use to minimize waste, update current budgeted performance data and other sources, forecast cost trends and make decisions about future. Cost control involves processing of cost accounting reports, received from various responsibility centers or operating divisions relating the cost incurred with standards analyzing the reasons for variances and presenting the result of monitoring to the project management for making decisions for the future and not of the past. The construction industry unlike many manufacturing situations is concerned mostly with one-off projects. This naturally creates difficulties for effective management control, because each new contract often has a fresh management team; labors is transient and recruited on an ad hoc basis; sites are dispersed throughout the country, which tends to cause problems in effective communication with

other parts of the company; subcontractors and 'lump' labors are common; added to all this are the ever changing weather conditions. These are some of the problems which have prevented the typical contracting company from installing the standard costing system as known by the manufacturing industry. Poor planning and control of materials, lack of materials when needed, poor identification of materials, re-handling and inadequate storage cause losses in labor productivity and overall delays that can indirectly increase total project costs. Effective management of materials can reduce these costs and contribute significantly to the success of the project.

In construction almost all clients are interested in obtaining fully functional facilities completed in time, cost and quality. A builder who is able to construct within the estimated time and budget, to the right standards and scope is an excellent builder. To control cost variation is an obvious objective of most managers. It should be recognized that no amount of paperwork achieves this control. Ultimately the decision of the managers that something should be done differently, and the translation of that secession into practice, is the actions which achieve control. The paperwork can provide guidance on what control actions should take and, while we shall continue to call it the cost variation control system. Few studies comparing actual cost and estimated cost are to be taken. This study is related to calculation of cost variance for different activities involved in the building construction. The study of difference between estimated cost and actual cost is to be analyzed. Cost changes are occurred due to various factors, by studying these factors cost variation can be analyzed.

Cost-control procedures are only useful if they are based on an up-to-date and accurate accounting of the costs incurred by the company with greater insight into potential risk areas. Despite the availability of various control techniques and project control software many construction projects still do not achieve their cost objectives. Most project managers and contractors find difficulty in controlling costs on their construction sites due to a number of problems which include poor project preparation, lapse in management and control, over budgeting, poor materials, labour shortages, increased cost of materials, delays in deliveries, wastage of materials, unexpected weather changes, loss of materials, insecurity and poor communication. This results into cost variation of projects.

About Study Area-

Residential Building projects cost and schedule overrun analysis and recommendations.

Literature Review:

a. **Daniel OkpalaC.and AniekwuAnny N., (1988),"Causes of High Costs of Construction in Nigeria",**discussed 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, it was distributed to engineers, architects, quantity surveyors, contractors and others involved in construction. a method of analysis was formulated and carried out

based on the profession of the respondents and on the role of the individual in the industry (i.e. client, consultant, and contractors) and on the nature3 of construction (civil works and building works). Results indicate that 1) high costs can be minimized by minimizing lapses in the management of human and material resources; 2) despite some slight differences, the professionals generally agreed that shortage of materials, methods of financing and payments for completed works, and poor contract management are the three major reasons for high construction costs; and (3) price fluctuation was identified as the most important factor responsible for the escalation of project costs.

b. **Alin Veronika, Leni S Riantiniand and Bambang Trigunarsyah, (2006)**,"Corrective Action Recommendation for Project Cost Variance in Construction Material Management",explained that there is a project cost variance in terms of the Material, equipments, manpower, subcontractor, overhead cost, and general condition. Material is the main component in construction projects. Therefore, if the material management is not properly managed it will create a project cost variance. Project cost can be controlled by taking corrective actions towards the cost variance. The objective of this research paper is to identify the main cause of the cost variance and to recommend the corrective actions. The approach to serve that objective is by conducting surveys to high rise building construction projects in order to identify the cause of project cost variance in material purchasing, and by interviewing experts in order to obtain recommendations in taking corrective actions. Method Analysis used in this research is Delphi method. The result of the research shows that the corrective action towards the variance of the material purchasing cost is actually a preventive action (before process).

c. **Devi Vaishnavi S.,(2017), "Cost Escalation in Construction Projects"**,discussed the Construction industry is an integral part of a country's economy, its growth and plays a pivotal role in developing the country's infrastructure. The current status report published by the Indian Ministry of Statistics and Programme Implementation (MOSPI) highlighted that out of the 951 projects being monitored 309 projects have cost overruns and 474 projects are behind schedule. The scope of this study is to investigate the importance levels of factors causes cost overrun in construction projects undertaken by construction companies. Eight factors named Design and Documentation Related Factors (DDF), Financial Management Related Factors (FIN), Communication Related Factors (ICT), Material and Machinery Related Factors (MMF), Human Resource Related Factors (LAB), Project Management Related Factors (PMCA), Contractors Site Management Related Factors (CSM), External Factors (EF) and their respective sub- factors are found to be responsible for cost escalation. Based on these above factors questionnaire was prepared and distributed 38 respondents. The data received from questionnaire survey was analyzed using Statistical Package of Social Science (SPSS) to carry out reliability test, hypothesis, correlation and ranking. The survey results indicated that Contractors Site Management Related Factors (RII=0.928), which is being most significant among the others that leads to delay in completion of the project and causes overrun.

d. **Prajapati Santoshkumar,Gupta Rakesh and Pandey Mukesh, (2016),** "Causes and Effects of Cost Overrun on Construction Projects in Madhya Pradesh". explained that many projects experience cost overrun and there for exceed initial contract amount. In Madhya Pradesh, the number of construction projects is increasing from time to time. However, it becomes difficult to complete projects in the allocated cost and time. Taking into account the scarce financial resources of the country, cost overrun is one of the major problems in Madhya Pradesh. Therefore, this research was carried out to dig-out information on the factors that cause cost overrun during construction and their effects on construction projects in Madhya Pradesh. Questionnaire survey together with desk study was used to collect data on cost overrun. A total of 27 questionnaires from clients, consultants and contractors were collected and a desk study of 34 completed public building construction projects in Madhya Pradesh were investigated and analyzed using both descriptive and inferential statistics. From these results it was found that 44 out of 15 public building construction projects suffered cost overrun. The rate of cost overrun ranges from a minimum of 0% to the maximum of 120% of the contract amount for individual projects. In this research it was found that the rate of cost overrun decreases with the increase in contract amount. The case of time and cost overruns in any sort of projects is a long standing one. However, reviewing the existing literature reveals that most of the projects in developing countries often encounter problems with delays and cost overruns. While a significant number of transportation projects in Madhya Pradesh experience several puzzles with delays in completion and cost overruns, there hardly exist any of investigations on these major concerns. The purpose of this study is to identify this is important causes of cost and schedule overruns in transportation sector projects of Madhya Pradesh and to suggest possible solutions for reducing such overruns. The most common effects of cost overrun identified by this research were delay, and supplementary agreement or adversarial relations among stakeholders, and budget shortfall of project owners. It is so hoped that these findings will guide efforts to improve the performance of the construction industry in the future.

e. **Tejale Dhanashree S., (2015), "Analysis of Construction Project Cost Overrun by Statistical Method",** elaborated that cost overruns have been a major issue in many Indian construction projects. The successful execution of construction projects and keeping them within prescribed schedule and cost is very important for effective cost performance. Most of the construction projects suffer from cost overruns due to a multiplicity of factors. The present work is carried out on studying significant factors causing cost overruns in construction projects. A questionnaire for the survey has been prepared by Authors based on 45 common factors for cost overruns identified from literature review and discussion with experts. These factors are related with Owner, Contractor, Consultant, and Management, Material, Equipment, Labor and External. The cost overrun methodology presented in this study gives statistical method which is used in construction sector for computing impact of project cost overruns. The finding of the paper will help the project manager to act on critical causes and further try to reduce cost overrun of project.

f. **Tien-ChoonToha, and Omar Munira, (2012),"Critical Cost Factors Of Building Construction Projects In Malaysia"** ,explained the objective of this study is to determine the critical cost factors of building construction projects. Survey data are randomly collected from building contractors in the Klang Valley, Malaysia. Each respondent is asked to assign a one-to-five rating for each of the 79 cost factors identified from the literature review. Priority ranking of these factors shows that only 35 cost factors are regarded by the respondents working for the small, medium and large construction companies in the Klang Valley, Malaysia as highly relevant for building construction projects. Client requirements on quality' is found to be the most critical factor that influences the costs of building construction projects.

g. **Vishweswar and S. Janani, "Study and Analysis of Time and Cost Overrun in Construction Sector",** discussed that construction activity in developing countries requires considerable investment outlays. In addition, the majority of construction companies in these countries are marked by overruns in cost and time. Successful execution of construction projects and maintaining them within defined schedule and expense is very important for effective time performance and cost efficiency. This research work is done on studying important factors that cause overruns in time and overruns in costs. A questionnaire was developed based on factors of time and cost overruns learned from literature review. These factors are grouped into 4 categories for time overruns and 4 categories for cost overruns and distributed to the various companies ' Contractor, site engineer, mason, supervisor, quantity surveyor. Some of those factors are frequent design change by owner, poor maintenance of safety stock level, un use of advanced engineering design software, poor site management and supervision by contractor, equipment unavailability and failure, escalation of material prices, ineffective planning and scheduling, decrease in rate of labour productivity mostly affect the time and cost overrun.

h. **Swapnil and Rav dobariya al "Identifying factors causing cost overrun of the construction projects in India",** explained the delay and cost overrun are common phenomena in projects worldwide. However, these are especially severe in developing countries. In India as per MOSPI report, 235 projects out of 410 were severely affected cost overrun due to certain factors. A short questionnaire was conducted with 15 prominent factors responsible for cost overrun and forwarded to 190 constructional professionals across India. Total 85 responses were received and it was analyzed using various statistical tools such as analysis of variance (ANOVA) and factor analysis tool using SPSS. In this study, top three factors affecting cost overruns were identified such as price escalation of raw material, delay in planned activity and lack of co-ordination between construction parties which could be significantly responsible for cost overrun of construction project in India. Factor analysis method was also carried out to group the factors into three components of overall questionnaire. These components, such as client control component, project management component, and contractor control component, would be useful to the various parties involved in the construction activities. This paper also provides

suggestive frameworks which have been framed after discussing with large number of construction professionals or expert

i. **Pankaj P. Bhangale, "Analysis of time and cost overrun to key Success of high-rise commercial building Project - a case study",** discussed time overruns and Cost overruns have been a major issue in many Indian construction projects especially in high-rise building projects. The successful execution of construction projects and keeping them within prescribed schedule and cost is very important for effective time performance and cost performance. Successful management of construction projects is based on three major factors i.e. time, cost and quality. The successful completion of construction projects within the specified time has become the most valuable and challenging task for the Managers, Architects, Engineers and Contractors. The aim of the study is to study the management of time and cost overruns to key success of high rise commercial building project which shall not be increased by more than ten percent of estimated cost. Time and cost overrun is analyzed by identifying the factors influencing time and cost overruns in high rise commercial building project. A valid questionnaire for the survey was developed based on factors for cost overruns identified from literature review. These factors are grouped into 8 categories for cost overruns and distributed to Contractors, Consultants, and Owners of high-rise construction projects.

j. **Shete Anant and Vaibhav Kothawade al "An Analysis of Cost Overruns and Time Overruns of Construction Projects in India",**explained the purpose of this research is to assess causes and effects of cost and time overruns in construction projects. This study is descriptive, designed to obtain views from, consulting firms, regulatory boards and construction firms in regard to causes and effects of cost and time overruns in construction projects in India. The main aim of this paper is to identify the major reasons for cost overruns in construction projects in India as well as the critical success factors that are helping to avoid the cost overruns. For this, the existing literature is reviewed and critical success factors are identified. Based on them, survey questions and interview questions are prepared. The findings supported the proposed hypothesis, i.e., lack of certain critical success factors leads to cost overruns in construction projects in India. They also confirmed the proposed proactive and reactive strategies of some researchers. The effective critical success factors include appropriate planning in the initial stages, skills of contractors and architects, good relationship and regular coordination among client and contractor, and early contribution of contractor with the project. The ideal methods that help to reduce cost overruns include efficient planning, proper management of site and supervision of the project, suitable planning and arrangement of project, proper methods for construction, regular meetings on development of the project, and hiring proficient subcontractors and suppliers.

Research Gap:

Building project is space-time product that it generates income over time in

exchange for the use of space. At present, the building construction sectors are playing a crucial role in the overall development of India's core infrastructure. No market is continually in equilibrium hence the cost varies from time to time. Building construction is the one that is characterized by cycles of booms and busts. Construction market remains consistently under- or overpriced for long periods. The length of time involved may be related to the period it takes for buyers and sellers to move in and out of the market. In the stock market this period is generally short whereas in the property market it is relatively long. Hence there is a need of the study of cost variation as it is one of the high speed developing aspects in all the terms. General trends may, therefore, emerge and if they can be forecasted for the construction industry they may prove to be helpful in reducing the cost variations in building projects within the area. This cost variation factors needs to be studied in depth & this can be helpful to stakeholders in industry as well as me.

Problem Statement:

In India, construction is the second largest economic activity after agriculture. Construction accounts for nearly 65 per cent of the total investment in infrastructure and is expected to be the biggest beneficiary of the surge in infrastructure investment over the upcoming years. The basic goal in any industry is to achieve the completion of project with stipulated budget. It is the same with construction industry. The construction of building project being one of the most complex, fragmented, schedule and resource driven industry, is always facing serious problems like cost variation. Cost variation in construction is a worldwide phenomenon, and its effects are normally a source of friction between owners, project managers, and contractors. Cost variation is a very frequent phenomenon and is almost associated with nearly all projects in the construction industry. Despite its proven importance it is not uncommon to see a construction project failing to achieve its objectives within the specified cost. Hence, it is important to identify the factors that contribute to cost variation to avoid and reduce the problems.

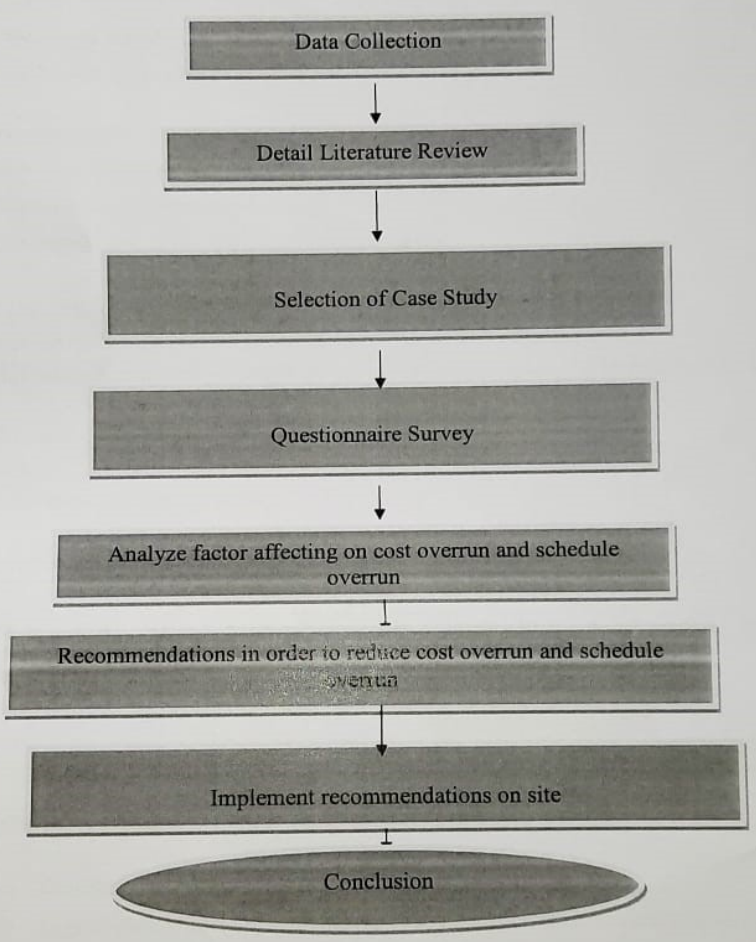
Proposed Objectives:

Following are the objectives of the proposed work.

1. To estimate cost overrun and schedule overrun of selected case study of ongoing building project
2. To study and analyze factor affecting on cost overrun and schedule overrun of selected residential building.
3. To give recommendations in order to reduce cost overrun and schedule overrun of selected residential building.
4. To implement the recommendations during execution of ongoing residential building projec

Methodology-

To meet the objectives of dissertation work following methodology has been proposed,



Plan of Proposed Work:

Phase-I (July-Sept 2020)

a) Study of literature related to cost overrun and schedule overrun of Residential Projects.
b) Collecting literatures.
c) Deciding study area for research work.

Phase-II (Oct-Dec 2020)

a) Selection of case study
b) Preparation of questionnaire
c) Conduction and analysis of questionnaire survey

Phase-III (Jan-March 2021)

a) Recommendations in order to reduce cost overrun and schedule overrun
b) Implement the recommendations during execution of ongoing residential building project.

Phase-IV (April-May 2021)

a) Results
b) Conclusion and Report writing.

Following table shows the expected time required to complete phase work,

Activity	MONTH (JULY 2020 TO MAY 2021)										
	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
Phase I											
Phase II											
Phase III											
Phase IV											

1. **Facilities Available:**

   a. College central library for refer journals and books.
   b. Digital library for refer literature from national and international journals.
   c. Departmental computer lab for structural software.

2. **Expected Date for Completion of Work: -May 2021**

References:

a. Alin Veronika, Leni S Riantiniand and Bambang Trigunarsyah, (2006),"Corrective Action Recommendation for Project Cost Variance in Construction Material Management",*Proceedings of the Tenth East Asia-Pacific Conference on Structural Engineering and Construction*, Thailand, Vol. 5, pp. 23-28

b. Daniel OkpalaC.and AniekwuAnny N., (1988),"Causes of High Costs of Construction in Nigeria",*Journal of Construction Engineering and Management*, Vol. 114, No. 2, pp. 233-244

c. Devi Vaishnavi S.,(2017), "Cost Escalation in Construction Projects",*International Journal for Research in Applied Science & Engineering*,Vol. 5, No. 1,pp. 271-277

d. Prajapati Santoshkumar,Gupta Rakesh and Pandey Mukesh, (2016), "Causes and Effects of Cost Overrun on Construction Projects in Madhya Pradesh",*International Journal of Engineering Development and Research*, Vol. 4, No. 2, pp. 1346-1350

e. Tejale Dhanashree S., (2015), "Analysis of Construction Project Cost Overrun by Statistical Method", *International Journal of Advance Research in Computer Science and Management Studies*,Vol. 3, No. 5, pp. 349-355

f. Tien-ChoonToha, and Omar Munira, (2012),"Critical Cost Factors Of Building Construction Projects In Malaysia",*Proceedings of International Conference on Asia Pacific Business Innovation and Technology Management,* Malaysia, Vol. 57,pp. 360 – 367

g. A.R.Vishweswar and S.Janani ,Study and Analysis of Time and Cost Overrun in Construction Sector, *International Journal of Advanced Science and Technology* ,Vol. 29, No. 03, pp. 6682 – 6689.

h. Swapnil and Rav dobariya al "Identifying factors causing cost overrun of the construction projects in India" *Indian Academy of Sciences,* Vol. 41, No. 6, pp. 679–693

i. Pankaj P. Bhangale, "Analysis of time and cost overrun to key Success of high-rise commercial building Project - a case study",*International Journal of Civil Engineering and Technology,* Volume 7, Issue 4, pp. 400–405

j. Shete Anant and Vaibhav Kothawade al "An Analysis of Cost Overruns and Time Overruns of Construction Projects in India", *International Journal of Engineering Trends and Technology (IJETT)* – Volume-41 , pp 33-3

Approved Copy of Synopsis
Page 12 / 12

Date:

Place: RIT, Rajaramnagar

Mr. Vrushabh Devchandra Awati
PRN– 1927008,
S. Y. M. Tech.

Prof. D. S. Patil
Head of Program
Civil- Construction Management,
RIT, Rajaramnagar

Dr.N.T. Suryawanshi
(Project Guide) Civil
Engg. Dept RIT,
Rajaramnagar

DPGC Member, RIT, Rajaramnagar.

DPGC Member, RIT, Rajaramnagar.

Dr. P. D. Kumbhar Head Department
Civil Engg. Dept.
RIT, Rajaramnagar

Dept. of Civil Engg. RIT APPROVED COPY of Synopsis M. Tech Civil Const. Mgmt.

PLAGIARISM REPORT

turnitin

Similarity Report ID: oid:28699:14941945

9% Overall Similarity

Top sources found in the following databases:

- 6% Internet database
- Crossref database
- 7% Submitted Works database
- 4% Publications database
- Crossref Posted Content database

TOP SOURCES

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Asian Institute of Technology on 2021-10-04 Submitted works	2%
2	coursehero.com Internet	1%
3	stateitpmo.mt.gov Internet	<1%
4	Z. Klimaszová, T. Fazekaš, M. Kuželová. "Development and validation o... Crossref	<1%
5	Özden Altındağ, Volkan Öngel. "Information Management, Organization... Crossref	<1%
6	Walden University on 2007-06-28 Submitted works	<1%
7	ir.dut.ac.za Internet	<1%
8	en.wikipedia.org Internet	<1%

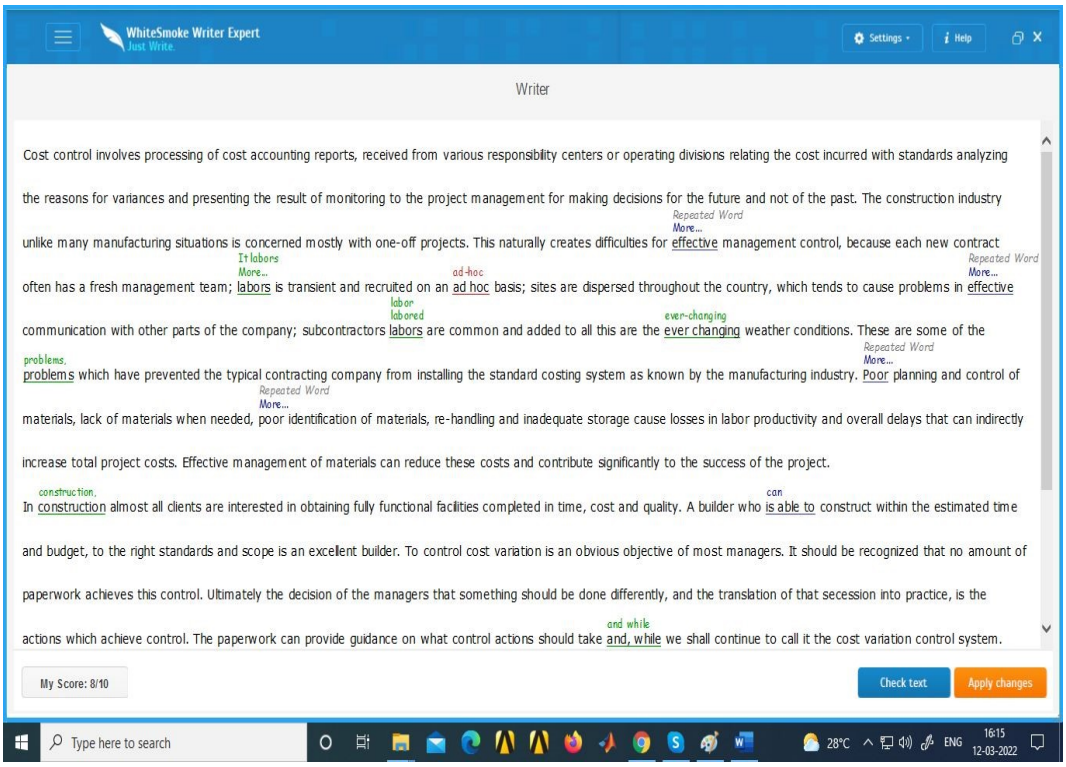
Sources overview

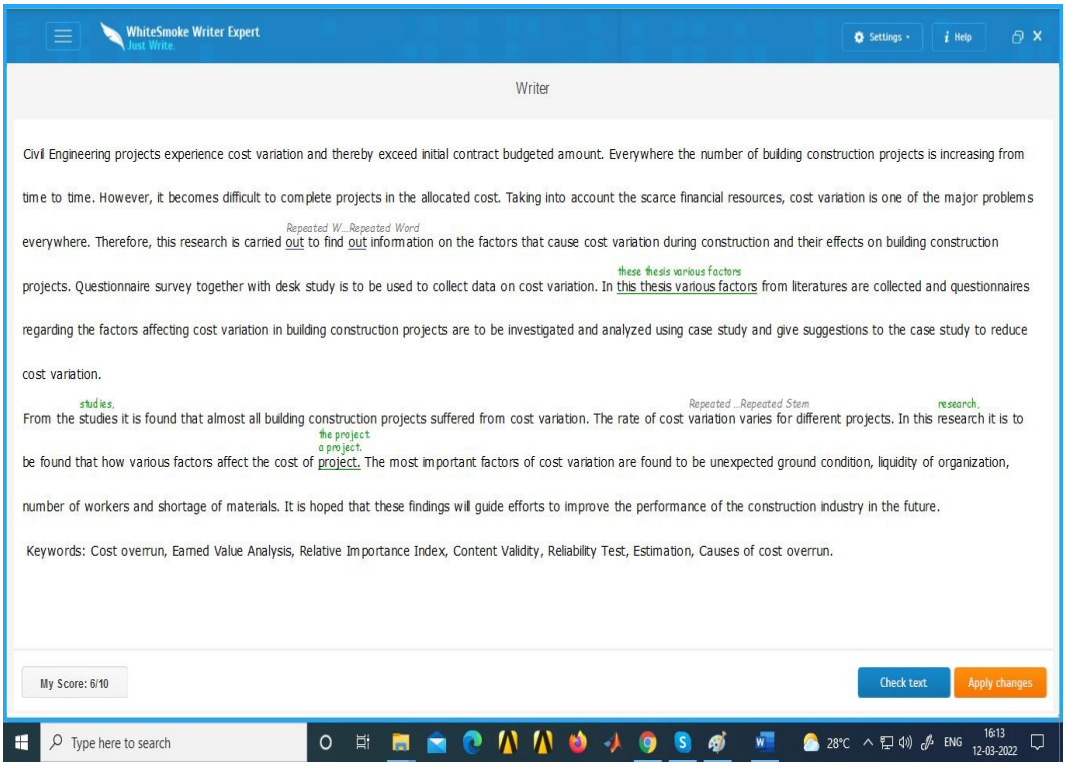
turnitin

Similarity Report ID: oid:28699:14941945

9	eprints.qut.edu.au Internet	<1%
10	Asian Institute of Technology on 2014-05-06 Submitted works	<1%
11	Western Governors University on 2015-11-29 Submitted works	<1%
12	Ghana Technology University College on 2021-10-23 Submitted works	%
13	Mohammad Azim Eirgash. "Earned Value Analysis for Constructio Crossref	<1%

WHITE SMOKE REPORT





VITAE (CV)

Name of the student:	Mr. Vrushabh Devchandra Awati
Roll No.	1927008
Permanent Address:	Shri Residency Near Kalpadrum Ground, 3rd Sangli. Tal-Miraj Dist- Sangli, Pin- 416416
Email:	vrushabh1902@gmail.com
Contact no:	8484803903
Date of Birth:	February 19, 1996

Mr. Vrushabh Devchandra Awati, obtained B.E. in Civil Engineering from Dr. J. J. Magdum college of Engineering, Jaysingpur under Shivaji University in 2019. He is studying M. Tech. in Civil-Construction Management in Rajarambapu Institute of Technology, Islampur. His Master's thesis is related to Analysis of cost variation between estimated cost and actual cost of residential building project. His research interests are in the field of Construction Management. He has one national conference paper publication to his credit till date.