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Study on causes and effects of change orders on all aspects of construction in Tamilnadu

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ABSTRACT

Change orders are one of the major problems in construction projects. Change orders in construction projects are any occurrence in the project after the grant of the contractor or bow of work on sites. Such changes may happen due to the needs to satisfy the new or modified demands specified by the owner, to reduce project cost, or to correct existing design mistake. To make things bad most of the changes were made during construction stage. These will cause change orders, contractual disputes, cost overrun, time delay and frustration. In addition to that parties which are involved in the procedure of making the changes into reality will need to submit fresh claims on the extra work done. Hence, proper analysis and actions are required to measure the causes and effects of change orders. The objectives of this study is the identification and evaluation of causes and effects of change orders in construction site which includes data collection by running questionnaires among the parties contributing to these changes, which is analyzed using Relative Important Index (RII).

INTRODUCTION

Change order is the most critical part in any construction project, as it is created by the parties who involved in it. Therefore, causes of change order and its effects on construction project are very much critical for any construction firms. Impacts of change order on construction projects are high therefore effective management of change order are required to be done. This may change from project to project, place to place, time to time and also with respect to work. An important function of construction contracts is control of the process of change in the project. Construction contracts are changed for three broad general reasons; because of error in the documents, because of a change in the requirements of the project after bid, or because of the conditions under which the work is to be done are materially different from those specified by the parties. All of

these reasons can affect the contractor's performance in fulfilling the requirements, cost and time considerations [1-5].

AIM AND OBJECTIVES

Change order is a written order to the contractor, signed by the owner, and issued after execution of the contract, authorizing a change in the work or an adjustment in the contract sum or the contract time. Changes in drawings and contract documents usually lead to change in contract price or contract schedule. Changes also increase the possibility of contractual disputes. In general, change creates problems to all parties involved in the construction process [6-10].

The main objectives of this research study are to:

- Identify the main causes of change orders in construction sites.

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- Identify the effect of causes.
- To formulate results and recommendations [11-15].

METHODOLOGY

The research methodology, which is a combination of both case study and data obtained through questionnaire survey. Owners, contractors and design consultants were to be requested to answer questions pertaining to their experience in construction industry and their opinion about change orders. The questionnaire is divided into four sections. The first section contains general information about their respondents such as email address, contact address, company name, company

contact address, and type of work undertaken. Questions in the last two sections are posed in a multiple choice question format. The second section addresses causes leading to change orders. A list of major causes and changes as read from the literature is presented and the respondent is asked to put tick on the frequency of occurrence of these causes in his/her projects. Most frequent causes correspond to “very often” whereas the least frequent correspond to “Never” which denies existence of the condition as a cause. The third section addresses the possible effects of change orders. The list was developed from the literature review. Most frequent effect corresponds to “major impact” whereas the least frequent correspond to “no impact”.

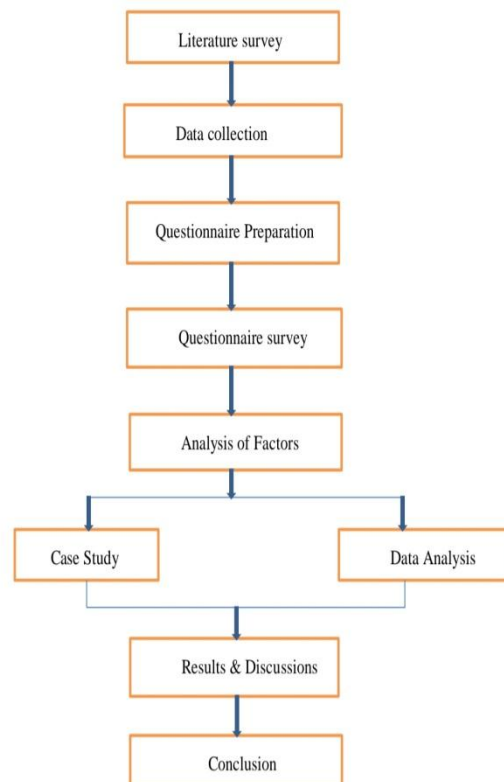


Figure 1 Step by step process of methodology

DATA COLLECTION

From the questionnaire survey analysis all the common factors of change orders are identified. It aimed to investigate the probability of occurrence for each change order factor in construction

industry using 5 point Likert’s Scale as 1 for never, 2 for seldom, 3 for sometimes, 4 for often and 5 for very often. It involved owner, design consultant and contractor organizations for participation to get relevant feedback.

The evaluation of each element is conducted considering the weightage average of the responses. The Relative Important Index (RII) is used to get the weighted average to rank the causes and effects of change orders. Data analysis was carried out using relative important index (RII) method.

Relative Important Index (RII) = $\Sigma (W/AN)$

Where W is the weighting as assigned on Likert's scale by each respondent in a range from 1 to 5; A is the highest weight (here 5) and N is the total number in the sample. The Relative Important Index (RII) percentage for cause of change is calculated as follows:

$$RII = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

Where,

n_1 : Number of respondents answering 1

n_2 : Number of respondents answering 2

n_3 : Number of respondents answering 3

n_4 : Number of respondents answering 4

n_5 : Number of respondents answering 5

ANALYSIS AND FINDINGS

From the analysis of questionnaire responses from the consultant, contractor and owner of the project, the main cause and effect are found out. The result is obtained using the Relative Important Index (RII) ranking technique. The main factor, which related to change order, has the highest RII value. That means, the factor which has the highest Relative Important Index value will be the most important factor.

The causes of change order are varying with respect to each party involved in the project. It can also vary by different projects and its site locations. Table 4.1 shows the top five causes of change orders and its Relative Importance value with number of responses for each option given by the contractor, design consultant and owner.

Table 5.1: Major five causes of change orders

Causes	RII Value	Rank
Change of Project scope by owner	0.71	1
Financial Problems	0.68	2
Environmental & Climatic Factors	0.59	3
Site conditions	0.54	4
Change in Schedule	0.53	5

The effects of change order depend on the causes of changes, type of project, cost and duration of the projects etc. The effects of change order are varying with respect to each party involved in the project. Main effects of changes in

the construction industry are cost variation and delay in completion time. All type of effects depends on these two effects directly or indirectly. Table 4.2 shows the effect of change order and its Relative Importance value.

Table 5.2: Major five Effects of change orders

Effects	RII value	Rank
Cost overrun	0.77	1
Increase in duration of individual activities	0.70	2
Increase in completion time of the overall project	0.70	2
Delay in payment	0.61	3
Additional payment to contractors	0.56	4

The scope of work consisted of construction of a 5 storey apartment building. The building has a total floor area of 7000 square meters. Unit price

contract was used for this project. This contract type contains a detailed list of estimated work

Table 5.3: Summary of case study 1

Site	Causes of change order	Effects of change order	Total cost (Rupees)	Total cost after Change (Rupees)
Suleswaranpatti, Pollachi	Change in economic conditions and change in client's specification	Delay in completion time and cost overrun	2,00,00000/-	2,52,00000/-

The scope of work consisted of construction of a 5 storey apartment building. The building has a total floor area of 2800 square meters. Design and build contract was used for this project in which

the design part and construction part is done by the main contractor. The contract amount was fixed for a lump sum contract of 15lakhs per floor which has to be paid after the completion of each floor.

Table 5.4: Summary of case study 2

Site	Causes of change order	Effects of change order
Anaimalai, Pollachi	Owner's financial problems	Delay in completion date

RESULTS AND DISCUSSION

The causes of change orders, and their effects on project cost and schedule are complex and influenced by many interrelated factors. The risk and uncertainties associated with project make predictions and planning for changes a difficult task. Several contractors, consultants, supervisors, owners, design consultants were requested to answer questions pertaining to their experience in construction industry and their opinion to change orders. To analyze the effect of change orders and to deal with better solutions proper planning of each and every activity should be accurate. If the owner gets involved in the design at an early stage to make sure it meets all requirements, the future changes can be avoided.

From the first phase of my studies it cannot be concluded for change orders in construction sites are change in project scope by owner and financial problems. Change of plan or scope of the project is one of the most significant causes of variation in construction projects. It is due to in adequate planning at the project defining stage or due to lack of involvement of the owner in the design phase. The financial problems can also affect project progress. This may leads to change in work schedule and specifications which in turn affect the quality of the construction.

The other two main effects of change orders in construction sites are cost overrun and increase in project duration. Increase in project cost is regarded as the most common effect of variations. Any alteration or addition is the design during execution of the project may results in demolition or rework which eventually increase the project cost. The process of implementation of variations in construction projects would increase the overhead expenses for all the participants concerned. Variations often hinder the project progress, leading to delay in achieving the target during construction.

It is better to deal with the causes and find a solution so that severity of causes can be reduced. The time and cost estimation of the project should be accurate. If the owner gets involved in the design early stage to make sure it meets all requirements, the future changes can be avoided. It is also better to make adequate financial planning during planning stage to avoid change in plan in later or during construction. It can be concluded that the good performance and success of a building construction project, to a large extent, is determined by the ability and effectiveness of the project team to manage the unnecessary changes during the project.

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