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An Analysis of Variation and Change Orders in Real Estate Projects

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Abstract : This study investigated the impact of variation and change orders on project performance in order to take proactive measure to reduce them. The study had the following objectives, namely to investigate the prevalence of variation and change orders on real estate projects, to determine the cost impact of variation and change orders, to examine to what extent variation orders added value to construction projects, to identify the predominant origin agent as well as the causes of variation and change orders; and to establish the nature and extent of the impact of variation and change orders on overall project performance. Literature relative to the research area was extensively reviewed. The data gathering approaches included an exploratory study on costs of variation orders on construction projects, interviews with the top management personnel in construction contracting companies, the audit of site instructions with regard to waste and their value-addedness and self-administered questionnaires. Variation orders impacted project performance with regard to cost and time overruns and disputes between parties to the contract. Most variation orders involved additional works. The complexity of works was the most predominant factor influencing the occurrence of variation and change orders.

The reduction of the occurrence of variation and change orders was traced back to the pre-contract stage given that the most predominant origin agent of variation and change orders was the client and then due to an unclear brief of works to be executed. Suggestions regarding the reduction of variation and change orders were given.

Keywords : Variation and change order, Client, Consultant and Contractor.

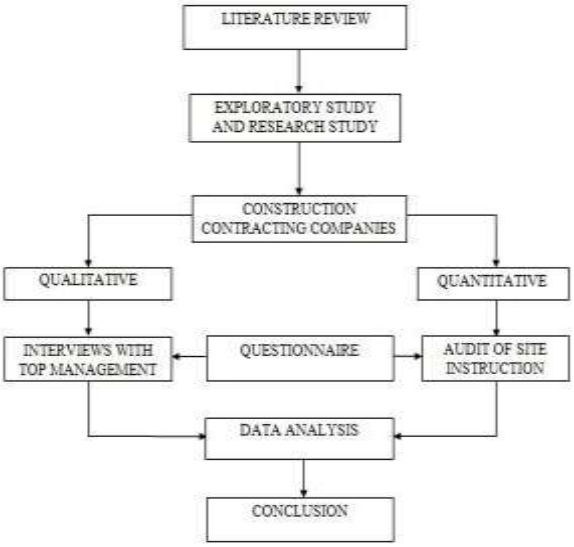
1.0 Introduction

India has an economic growth rate of 6.9% in the year 2015-16 and it is projected that it will increase steadily to 7.4% in the fiscal year 2016-17[2-6]. Indian economy can be divided into 3 sectors namely: agricultural, manufacturing and service sectors. Construction industry comes under the service sector and it makes a sizeable contribution to the GDP[8,9]. Since India is a developing country, the construction industry indeed is one of the fastest growing part of the service sector and so its disturbances must be critically checked. This is the only industry which is prone to last minute alterations and changes. Though these changes may not be entirely prevented we can find a way to minimize the cause and effects of these alterations. Technically, change orders are alterations which are done to already approved design, plan and method of execution and variations are defined as the difference between what was planned and what actually happened in terms of duration and money [6,12]. The prime objective of this project is to delineate the main causes of such change orders and their corresponding effects because of the variations.

2.0 Objective

- To investigate the prevalence of variation and change orders on real estate projects.
- To determine the cost implications of variation and change orders.
- To examine to what extent variation and change orders affects the construction projects.
- To establish the nature and extent of the impact of variation orders on overall project performance.

3.0 Methodology



4.0 Causes and Effect Analysis

4.1 Causes of Variation and Change Orders

The main aim of the developer is to constantly work for the betterment of the project and thus improvisations and innovations in the projects are inevitable. The impacts of these variation and change orders can be ascertained only if the reason for the occurrence of the variation and change orders is categorically analyzed. After categorizing the causes of occurrences of variation and change orders the useful and futile changes must be differentiated in order to render a project without major cardinal changes. Variation and change orders occur due to the sudden change of design or specification or methodology or technology that was planned to be used in the proposed project.

4.2 Factors Influencing Variation and Change Orders

The main factors that influences variation and change orders are

- Nature of works
- Complexity of work
- Procurement method

Nature of works

- The method of doing the job may be improvised half way through the work depending upon the performance of the methodology initially proposed. Usually, any change to the nature of work will be a cardinal change as it may change the entire scope of the project.

Complexity of work

- The project planners sometimes design the structure or adopt a methodology without doing proper field study and approve the plan without giving more concerns about the current environmental, structural, geological and transit situations at the work site. So, as the project progresses the flaws in the planning is found out and accordingly variation and change orders are issued.

Procurement method

- The procurement method adopted for the project will also decide the occurrence of the change orders. This is because it affects the project indirectly through logistical and financial difficulties and that is why the procurement strategy of the project must be carefully selected by foreseeing the future strategies of all the stakeholders involved in the project.

4.3 Origin Agents of Variation and Change Orders

Origin agents are the factors which are considered to be the causes of variations and change orders in the construction industry. The following are some of the main origin agents of variation and change orders

- Change of plans or scope
- Change of schedule
- Financial problems
- Inadequate project objectives
- Replacement of materials or procedures
- Change in specifications
- Change in design
- Errors and omissions in design
- Technology change
- Design complexity
- Ambiguous design details
- Design discrepancies
- Differing site conditions
- Lack of communication
- Weather conditions
- Health and safety considerations
- Change in government regulations
- Unforeseen problems

15. Parties Responsible for the Variation and Change Orders

The variation and change orders are generally issued by the client on the request of the consultants and the contractor is liable to do it as these changes are done for the enhancement of the construction project. The contractor may or may not be reimbursed for these changes depending upon the scale and degree of change made to the already planned method statement.

The variation and change orders may be issued due to improper work of the contractor. This might be due to miscommunication or ambiguous and improper design detail/methodology. However, it is the responsibility of the contractor to check the required details before proceeding with the project.

4.5 Effects of Variation and Change Orders

The various effects that have been found out due to change orders and variations in construction projects are as follows:

- Time overrun
- Time reduction
- Dispute between parties of contract
- Cost overrun
- Optimum cost reduction

These are some of the effects which have been identified after going through various research papers.

5. Analysis of Responses

The survey data has been analyzed using Microsoft Excel software and the interpolation of the data is as follows

5.1 Profile of the Respondents

It is very essential to know the composition of the stakeholder surveyed considering the fact that real estate sector is very dynamic to changes. The Figure 5.1 illustrates the profile of the respondents surveyed.

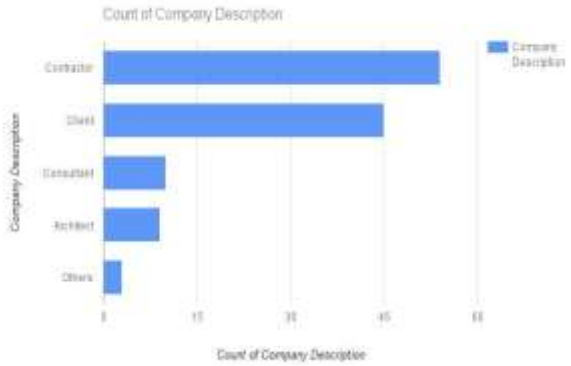


Fig.5.1 Profile of the respondents surveyed

Inference:

From the Fig.5.1, it is observed that the majority of the respondents surveyed are contractors who are mainly responsible to undertake the changes. Also equally client group were surveyed in which around 44 were client and around 12 were consultants.

5.2 Designation of the Respondent

The designation of the respondent will help to know the authoritative power that rests on the stakeholders and his stance on the questionnaire can be weighed. This will also provide more information while carrying out statistical analysis on the data obtained through survey. The profile is shown in the Figure 5.2

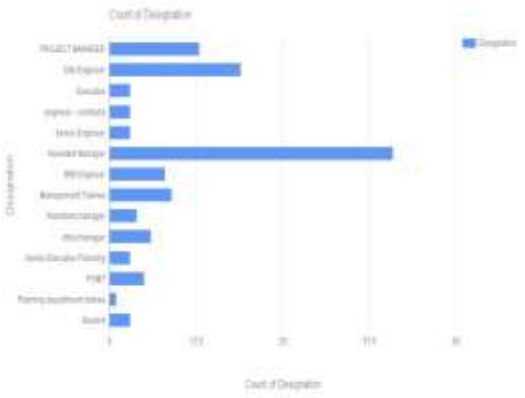


Fig.5.1 Designation of the respondent

Inference:

Fig.5.2 implies that majority of respondents are Assistant manager wherein 53 numbers have responded. The Assistant manager is well aware of the occurrence of change orders and variation orders and they will have much knowledge of the impact that it has on the progress of the project. Next is site engineer profile which are about 20, since they are on the field, executing the work they will have a better idea and knowledge regarding the occurrence and impact of change orders and variations.

5.3. Record of Variation and Change Orders

This question is asked to estimate about how many of the surveyed companies record the occurrence of variation and change orders. It is said that only 10% of the companies in the construction industry are actually recording these variations and change orders and value their significance. The remaining 90% take this issue very lightly, and so it was important to know what is the stance of the company to which the respondents belong. The data obtained is shown in Figure 5.3

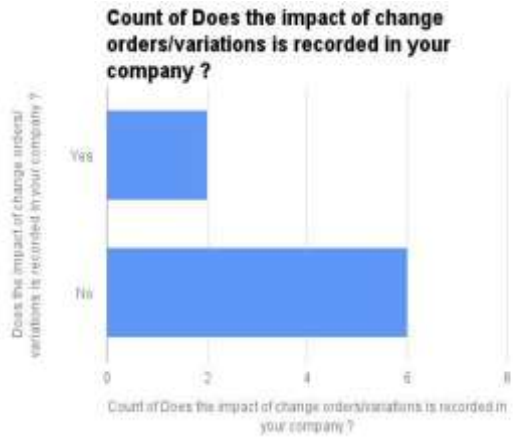


Fig.5.2 Data

Inference:

Fig.5.3 indicates that only very few companies record the impact the change orders/variations in the company. However, 57% of the respondents have also reported that such a system does exist in the industry.

5.4 Data Analysis

5.4.1 Causes of Variation and Change Orders

5.4.1.1 Cchange of Plan or Scope

The question is asked in order to find out which stakeholder is responsible for issuing change order due to change of plan or scope of a particular work or the entire project. The figure 5.4.1.1 illustrates the response obtained from the survey.

Fig.5.4.1.1 Response obtained from the survey

Inference:

Fig.5.4.1.1 indicates the majority of respondents feel change of plan or scope by the client is main cause of change orders wherein 90.9% respondents have selected. However, a few have also suggested that such changes are also induced by the consultant and others wherein 5.4.1.1 respectively have indicated.

5.4.1.2 Change of Schedule

This question is to analyze who is responsible for the change in the schedule of the project as it might also lead to issuance of variation and change orders. The schedule becomes an important factor to analyze as it can affect the successful completion time of the project and thus it is possible to relate it to the time overrun due to extended schedule. Refer Figure 5.4.1.2 to see what the survey infers.

Fig. 5.4.1.2 survey infers.

Inference:

Fig.5.4.1.2 indicates that it is contractors who are more responsible for changes in schedule and this change order needs to be initiated. About 47.1% respondents feel that the contractors arenresponsible and 33.1% feel client are responsible for changes in schedule of the work which lead to change orders.

5.4.1.3 Financial Problems

It is imperative to know who is responsible for financial fluctuations in the project. The source of finance and the healthiness of cash flow in the project also determines the occurrences of variation and change orders. The Figure 5.4.1.3 indicates what the respondents feel.

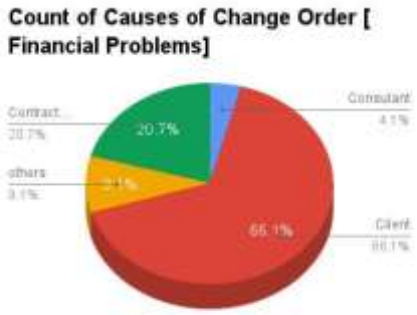


Fig.5.4.1.3 Financial problems

Inference:

Fig.5.4.1.3 indicates that 66.1% of respondents feel that client is responsible as he maintains the cash flow in the project and about 20.7% feel contractors are responsible for change orders due to financial problems.

5.4.1.4 Omissions in Design

This question was asked to know if the careless attitude of the stakeholders due to ignorance or omission of design detail might result in variation and change order. The fig.5.4.1.4 explains the observation of the respondents on this factor.

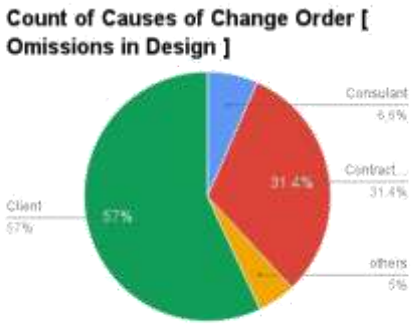


Fig.5. 4.1.4 Observation of the respondents

Inference:

Fig.5.4.1.4 indicates that clients are majorly responsible for omissions in design which lead to change orders. About 57% of respondents feel that clients are responsible and 31.5% feel that contractors are responsible for change orders due to omissions in design considerations. Delay in sending the approved drawings and specifications are the root cause of it. The client and the consultant must know what is the work happening in the site and they must accordingly give away the approved drawings and specifications at the right time. Also, the contractor must wait for the approvals and must not do the works even if the drawings are typical. They must request the clients for the required documents for reference before starting the work.

5.4.1.5 Ambiguous Design Detail

In order to know if there could be any delay on the account of ambiguous design detail this The design which we are giving for the contractor must be very clear. All the points must be clearly stated and the corrections in the design must be communicated then and there in order to avoid the confusion. Refer figure 5.4.1.5 to understand the results of the survey.

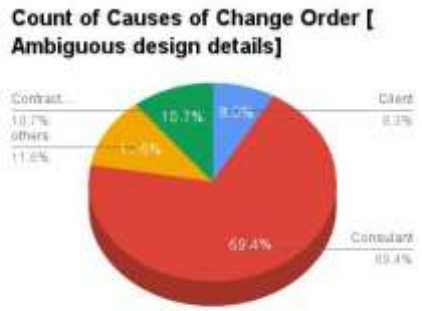


Fig.5.4.1.5 Ambiguous design detail

Inference:

Fig.5.4.1.5 indicates that the consultants are most responsible for ambiguous design detail because of which the change orders take place as they miss out the details of the site and the constraints associated with the site in the design. About 69.5% of respondents feel that consultants are responsible for ambiguous design details due to which change orders take place.

5.4.1.6 Lack of Communication

This is one main reason for the occurrence of variation and change orders and this question was asked in order to know who is to blame. The priority one for any project manager is to take care that the information flow is streamlined and structured. He should resolve the disputes then and there and enable the employees to work in harmony by establishing stability between different parties of the project. The figure 5.4.1.6 illustrates the responses from the survey.

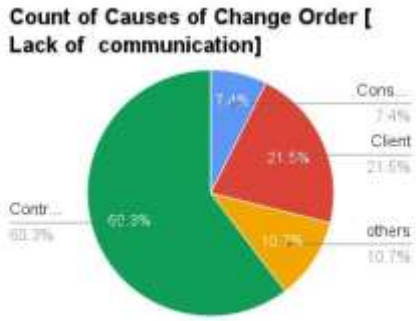


Fig.5.4.1.6 Lack of communication

Inference:

Fig.5.4.1.6 indicates that about 60.3% respondents feel lack of communication by the contractors is the main reason for change orders. Consider a situation for instance where the client does the change and not send the modified design detail and delay the approval process or the contractor might not study the design properly and might construct using the ambiguous design which he was given. Yet it is the duty of contractors to communicate with client in order to get the work done in best possible way.

5.5 Effects of Variation and Change Orders 5.5.1 Time Overrun

This question was asked in order to understand how many of the respondents say that time overrun is the major impact of variation and change orders. The project will proceed in a proper phase but due to the variation and change orders there might be unnecessary confusions in the flow of work. For instance, the said work might already be completed but due to the change orders they must be demolished and reconstructed again, thus consuming lot of time. Time overrun may be caused mainly due to differing site conditions and unavailability of the required construction materials.

Fig.5.5.1 Time overrun

Inference:

Time overrun is very harmful for construction industry as its main objective is Time is the essence. From fig.5.5.1, it is evident that the majority of the respondents feel that the project suffers from time overrun due to variation and change orders.

5.5.2 Time Reduction

This question is to check how many of the respondents have positive perspective that the variation and change orders might in fact reduce the duration of the project. As said earlier, the variations and change orders also has positive effects on the project. In some cases, the variations and change orders will help the project to complete before scheduled. This may be due to the technology change that is being incorporated in the project. The illustration fig.5.5.2 indicates the results obtained from the survey.

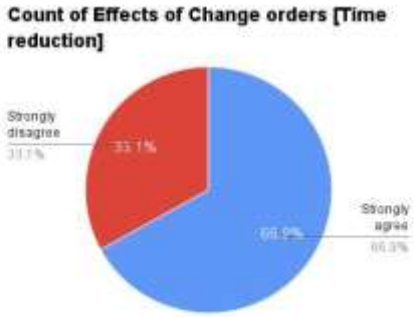


Fig.5.5.2 Time reduction

Inference:

The pie chart above implies that 66.9% of the respondents share this opinion that variation and change orders reduce the duration of the project. Nowadays the project planning and scheduling is done by considering provisions for variation and change orders and other contingencies and if at all a change order is issued it will be for the betterment of the project. Similarly these changes have a impact on time degradation as well.

5.5.3 Dispute Between the Parties of the Contract

These variations and change orders will affect the relationship between the parties of the project. A party might have prepared themselves for a work but when the other party gives a change order after that will put the other party under stress. Thus it will lead to misunderstanding between the stakeholders. Fig.5.5.3 will illustrate the stance of the respondents cumulatively.

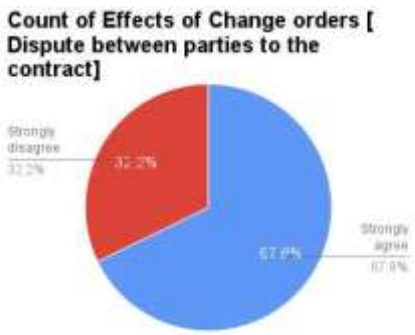


Fig.5. 2.3 Dispute between the parties of the contract

Inference:

By fig.5.5.3, the fact that misunderstandings and disputes will arise between the parties of the project has been accepted by 67.8% of the respondents.

5.5.4 Cost Overrun

Another important effect to be analyzed is the cost overrun that these change orders might induce in the project. This is a serious threat for the project and it may lead to highly critical stage of stalling the project. The financial analysis of the project must be done before starting any project with considerations of the possible variation and change orders. Fig.5.5.4 implies the results of the survey.

Fig.5.5.4 Cost overrun

Inference:

Fig.5.5.4 implies that though variation and change orders are for the improvement of the project, about 85.1% of the respondents share the fear of cost overrun due to it.

5.5.5 Optimum Cost Reduction

This question is to analyze how many of the respondents embrace the fact that variation and change orders also have a positive impact on the project. The change orders might reduce the cost of work or it might implement the use of a new material which is actually cheap than that of the earlier. Technology change often leads to this effect on the project.

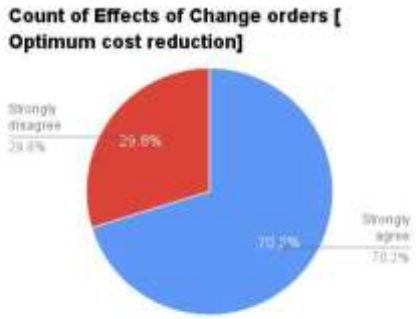


Fig.5.5.5 Optimum cost reduction

Inference:

Fig.5.5.5 illustrates that 70.2% of the respondents believe that variation and change orders helps to optimize the project cost. It is said on the view that although the duration of the project is extended, the cost can

be controlled in most of the cases. This result supports the fact that not all the variation and change orders have negative impact on the project

6.0 Conclusion

The survey cumulatively reflects the perspective of the different stakeholders involved in the project and the findings of it are listed below

- The clients and consultants are majorly responsible for variation and change orders in the construction project. These changes arise due to sudden improvisations in the design or methodology. However, variation and change orders because of contractors' negligence and ignorance.
- About 85.1% of the respondents say that the major impact of these variation and change orders on the projects are through time overrun and cost overrun. This situation arises mainly due to lack of communication and ambiguous design details that are issued. Though it is the contractors responsibility to see that this does not happen, it is the duty of the clients to establish a streamline the communication structure and render harmony in the work site.
- Also, about 70.2% of the respondents indicate that these change orders and variation orders do have a positive impact on the project by saving the time and expenditure of the project. Technology change or usage of new/innovative materials for construction helps us to save cost incurred and reduces the duration of the project.
- The survey warns that 77.7% of the respondents fear that frequent occurrence of variation and change orders affect the professional reputation of the organization.
- Variation and change orders mainly affect the progress of the work by arising disputes between the parties and 67.8% of the respondents support this fact through the survey.
- The health and safety conscience of the worker and the quality of construction is also jeopardized by frequent variation and change orders. 77.7% of the respondents share this thought.

Through the analysis, the thesis renders few recommendations that might reduce the impacts of the variation and change orders over the construction process

- The change orders and variation clauses in the contract document must be clear and all the parties must discuss it before commencing the project.
- The method statement and design specifications must not be vague. The contractor must clarify the doubts, in case he has, before proceeding with the work.
- Proper communication structure must be established among the stakeholders. This structure will enable a channelized information flow and will reduce unnecessary confusions in the middle of the project.
- The clients must communicate the improvisations done to the project much before that phase of the project so that the contractor can arrange necessary resources to tackle the change. Issuance of sudden changes to the planned process always causes some confusion.
- The contractor must foresee the schedule of work and the approved methodology and must clarify any doubts or ambiguous data before starting the work.
- All the stakeholders are recommended to visit the site periodically in orders to be updated with the progress of the project and also to improve the relationship between the parties. The ideas/suggestions that is shared during such visits will reduce the occurrence of the variation and change orders.
- We must have good links with the government authorities in orders to be updated with any legislative change that might happen during the course of the project. This enables the parties to avoid any major changes and renders a pragmatic contract document which will feed all the future needs of the project.

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