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A TECHNICAL STUDY ON CHANGING ORDERS AND ITS IMPACTS ON THE PROJECTS TIME AND COST

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ABSTRACT:

Exchange orders are very common in almost all construction projects today, often leading to a 5–10% contract increase. To understand the effects of this trend, several studies have attempted to quantify the impact of a change order on a project Costs.

Most of the studies aimed at adjustment order estimates were funded by contractor organizations, where statistical models used to measure the impact of change order on project costs were based on data provided to contractors; a situation that could lead to disagreement between the owner and the contractor regarding the measurement method used. In addition, most of the studies focused on commercial and electromechanical work, and very rare subjects focused on the field of heavy construction; a field that suffers from change orders due to errors and omissions, scope of job changes, or changes due to unforeseen circumstances.

The construction business is viewed as one of the principle wellsprings of development and improvement overall. Change is the fundamental justification for the disappointment of the venture. Substitution orders assume a significant part in the development business as they fundamentally affect project costs, plan, quality, security and execution. In this way, the review distinguishes the impact of the change request during the task. Development examination is acted in the RIW strategy.

Monetary issues of workers for hire and proprietors, climatic conditions, deficient drawings, lacking subtleties, changes in project portrayal, authoritative report clashes and insufficient plan are viewed as the key factors that cause changes and results in project time.

The exploration centers around fostering an emotionally supportive network dependent on information to viably oversee change so experts can distinguish the elements that cause changes and their normal impacts on project fruition. Furnishes experts with the information to settle on informed choices and find prompt ways to alleviate future changes.

I. INTRODUCTION

Construction industry is one of the rapid growing sectors in India. A number of construction projects are currently undergoing in various fields of civil engineering. Large and complex projects have been built which attracting contractors and construction companies from all over the country. Most of the contractors and their companies lack sufficient understanding of the local social, cultural and physical environment. During the development phases of any of the construction project, many decisions have to be made based on the incomplete information, personal experiences, assumptions, or generally uncertain conditions, which can lead to adjustment at a later stage of the project. Incomplete information on the project variables at the early stages of projects leads to inadequate knowledge of future conditions,

This situation coupled with inexperienced owners has led to inadequate design resulting in changes to plans, specifications, and contract terms. Consequently, it may result in imprecise estimates arising from ambiguity in project parameters. It may be inferred that the clients' dissatisfaction is likely caused by change orders running through the construction projects. The effort of managing change orders has imposed a huge burden on project management, and it is a nightmare that industry people wished they never have to face.

Changes in construction also cause serious ethical problems and disputes. Change management is a pure application-oriented issue and requires engineering innovation to solve the problem. Based on our investigation of the construction change order process, and a pressing need from industry versus the scarcity of literature and software tools in the domain, poses a promising opportunity for research and development in construction. The following section summarize the various impacts of construction change order process and provides some insightful thoughts on this topic.

1.1. OVERVIEW

Change orders are a vitally important tool for contractors, and if you're not sure why then it's important that you read to the very end of this resource article today. Many contractors and subcontractors start off by offering their services to friends, making verbal contracts, and performing great work while trusting that they'll be paid. Any modifications to the original project are discussed and verbally agreed without a fuss and everyone walks away happy.

Once you're really in business, however, things may not always go so smoothly. Most customers are fantastic to work with, but you'll find a few that always want more done than you've agreed to and may not always be willing to fork over the extra cash to make it happen. You'll have to start clearly defining the scope of work and writing detailed contracts with explicit pricing to protect yourself and your business.

Most notably, companies with green solutions have also improved financial performance, compared to conventional businesses that do not use green applications. Business survival in the current difficult economic times requires efficiency and innovation. As a result, green restructuring and rapid construction become hallmarks of business efficiency.

1.2. CHANGE ORDER IN CONSTRUCTION PROCESS

All construction projects go through changes. Once you're on the job, the project scope and site conditions often turn out different than you expected when you signed the contract. Sometimes the project owner will ask you to do more work or less work. Other times, you realize that the site conditions won't allow you to finish the work for the price you agreed upon. Anytime a change happens to the scope of work in your contract, you'll need to complete a change order – and get the property owner's signature on it.

This article provides a step-by-step guide to change order forms. Completing a change order correctly minimizes risk, improves the chances of approval, and helps contractors get paid faster. The article contains information on how to fill out a change form, key details to include, and pitfalls to avoid during the change order process.

1.3. STRATEGIES TO IMPROVE CHANGE ORDER MANAGEMENT

Change orders remain a major source of frustration and one of the biggest challenges within the construction industry due to the time and cost incurred. In fact, studies have shown that the average cost overrun from change orders is 11-15% of the original contract value in large projects. Meanwhile, the average schedule overrun is 10-20% of the original project timeline.

Proper change order management enables teams to mitigate the significant costs and schedule disruptions in construction. Still, for many construction companies, effective change order management is a major pain point. Preventing change orders from occurring and managing them when they occur requires a cultural and procedural shift.

Nonetheless, through the proper use of technology in the construction industry, good communication and better data collection practices, construction companies can reduce the amount of time and money wasted on change orders.

1.4. PROBLEMS WITH THE TRADITIONAL CHANGE ORDER MANAGEMENT MODEL

Much of the extra expenses associated with change orders comes from the manner in which they are handled by the construction company. Traditional management practices that focus on more of a reactive approach rather than proactive create almost as many problems as they fix. Companies that are committed to the traditional change order model often experience many of the same problems again and again.

Change Orders Costs Increase as the Project Excels

The cost of a change order is directly correlated to the project phase when the change order is initiated. For instance, changes that come up in the design phase are much less expensive changes that surface in the construction phase. With a better proactive approach to change order management starting in the earliest planning phases, projects are less likely to experience significant cost and schedule overruns.

Lack of Data

When a change order is requested, the project manager must estimate the impact on the project's overall time and budget. Overestimates and underestimates are common in traditional change order management because there is a lack of real data to support their analysis. For project managers, without the right access to data and information, they are only further eating into a project's profits.

II LITERATURE REVIEW

- Osman et al. (2009) defined the change as any deviation from an agreed upon well-defined scope and schedule. The words "Change Order" conjure strong feelings of negativity for all involved in construction projects. Owners do not like them because they generally feel they are paying for others mistakes. In some cases, contractors believe that Change Orders disrupt workflow and require additional paperwork and time. In other cases, contractors would find the change orders a mean to improve their outcome of the project. However, it is generally accepted that consultants, contractors and owners agree that projects would be better without change orders. Change Orders strain the relationships of the owners, engineer, contractors, subcontractors, and others involved in the construction process as well as add cost and schedule delay. Changes on one project can also affect other unrelated projects by tying up resources that are committed elsewhere. Negative relationships between the parties are another byproduct of changes on a project. Not only is workflow disrupted, but also trying to get quick responses quotes, shop drawings, and many other things required to get back schedule causes a strain on working relationships (Rashid, et al. 2012,)
- Homaid et al. (2009), investigated 21 causes and 11 potential impacts of change orders. Also, nine practices reported to management and control of change orders. The study identified eleven important causes and seven important impacts. It is further concluded that the consultant is the most responsible party for the change orders. The overall average increase in total cost of construction projects due to change orders was found to be 11.3%. The research concluded that change of project scope due to owner requirements is the most important

cause and cost overruns are the most important impacts of change orders in those projects.

- According to Aljeshi and Almarzouq (2008), Aldubaisi (2000) and Zawawi (2010), changing the plans by the owners is the main source of change orders, change in mind, substituting materials and/or procedures is the second source of change orders and errors and omissions in design is another source. Increase in project cost and duration were founded as the main two effects of change orders. In another study it was concluded that the best way to manage change orders is to reach a negotiated solution between the different parties. The initiation of change orders in a construction project correlated with the level of integration of the services of design and construction (Soares 2012).
- Keane (2012) used a questionnaire survey to identify causes and effects of variations on construction projects and make suggestions on how variation can be avoided or minimized on future projects. Jawad (2009) presented causes, effect, and controls of variation orders in large building construction. The study concluded that the owner is the major source of variation and that most variation is civil and structural. Statistical analysis of causes for design change in highway construction on Taiwan studied by Wu (2005).
- Olsen (2012) reviewed the most common causes of change orders to uncover which divisions of work are most susceptible to the greatest number of changes orders. It is found that design errors were responsible for the majority of changes. The main sources of change orders in Kuwaiti building construction were investigated by Bassioni and Hamza (2005). They found that owners are responsible for 47% of change orders, A/E for 26% and contractor 12%. The study showed that the sources were design changes -owner 38%, design mistakes and error-A/E 24%, problems on site contractor 12% and changes by regulatory agencies 12%.
- Wambek (2011) examined the similarities and differences between craft workers, foremen, and project managers in terms of starting time and task duration variation. He summarized the causes of variation, which account for a total of over 19 hours of variation per week. Variation in public construction projects in Oman was discussed by Alnuaimi (2010). Arain and Pheng (2005) provided an in- depth analysis of the potential effect of variations in building projects. The significance of variation as a cause of cost and time overruns explored by Oladapo (2007). The study showed that changes in specification and scope initiated mostly by project owners and their consultants are the most sources of variation.
- Osman (2009) performed a comprehensive analysis of the potential effects of variation orders in construction projects in Malaysia. The study summarized that the five most effects of variations are: increase in project cost, additional payment for the contractor, and increase in overhead expenses, completion schedule delay, rework and demolition. Even though the majority of the construction projects are owned by government, there is a major difficulty in obtaining such data on the change orders considering the rules and regulations applied within the government entities. Further, although the

execution of all projects – public and private – is conducted by private sector, the release of data with regard to the change orders is also faced with issues of confidentiality considering the high competition in market. Having identified such a serious lack in the data of the change orders, it was then decided to survey the personnel involved in the construction industry representing the three major parties; owners, consultants and contractors. The purpose of the survey is to explore the personal experience of those individuals with regard to the change orders to identify the causes, effects and the measures of controls. In the following sections, the contents of the questionnaire and the scoring system are presented, followed by analysis of the data to identify the most common causes, effects and controls of change orders.

- Charlesraj et al (2004) have studied knowledge management in construction organizations – A lessons learned systems approach. Knowledge management is defined as the systematic and explicit management of knowledge – related activities involving knowledge workers in an organization to improve organizational knowledge related efficiency and effectiveness.
- Abinu et al (2006) have studied construction delays and their causative factors in Nigeria. This study assesses the causes of delays by actions and inactions of project participants and external factors. The study analyzed quantitative completed building projects to assess the extent of delays, and data obtained from a postal questionnaire of construction managers to assess the extent to which 44 identified factors contributed to overall typical project they have been involved with.

III METHODOLOGY

3.1. INTRODUCTION

Data were gathered through a questionnaire and owners, contractors and consultants were further requested to answer questions pertaining to their experience in the construction industry and their opinions about change orders. Accordingly, the data are collected using the 129 questionnaire from engineers working in government entities represented owner, 128 engineers in contractors companies and 128 questionnaires from engineers working in consultant offices. The questionnaire is divided into four sections. Section one is related to information on the Respondent, section two includes twenty causes of change orders, section three lists twelve effects of change orders and section four suggested thirteen control measures to minimize the impact of change orders on the projects. See Table 3.1 for all the elements above. All the elements of causes, effects and controls were selected from the previous studies being the most important.

3.2. EFFECTS OF CHANGE ORDERS

- 1 Increase the cost of the projects
- 2 Increase in duration of individual activities
- 3 Delay in completion schedule
- 4 Delay in payment
- 5 Demolition and re – work
- 6 Decrease in productivity of workers
- 7 Increase in overhead expenses
- 8 Decrease in quality of work
- 9 Delay of materials and tools
- 10 Disputes between owners and contractor

11 Hold on work in other areas

3.3. MANAGEMENT OF CHANGE ORDER

Change orders—they're part of the normal course of a construction project, but they're also a major pain point—the cause of disputes among contractors, owners and designers, and a reason for cost overruns and completion delays.

The industry will never not have change orders, and they will always be a source of disputes. But contractors would find their pain considerably lessened by putting clear, systematic procedures in place for managing change orders from the get-go.

Of course, there are various reasons for change orders. Drawings and design changes, inaccurate specifications, and lack of coordination between contractor and consultant can result in significant change order requests, requiring materials substitutions that can become problematic. Responding in a way that keeps the job moving may also add to material and labour outlay.

They can result in substantial cost to the contractor. Industry data suggests change orders account for 8% to 14% of capital construction projects. One study indicated that they led to project cost overruns of 11% to 15% on average, while they pushed work as much as 20% past scheduled completion dates.

Institutionalize your change order process into the fabric of your organization and operations to most effectively moderate the risks of disputes long term. If undertaken with a collaborative spirit, the process will run smoothly. That means making sure there's shared buy-in to its terms before the project starts—by contractor, owner, subcontractors and consultants—and open lines of communication.

Taking the following five steps will help contractors shape change order management process and improve outcomes.

3.4. METHODOLOGY

The study will be limited to large building construction projects in the southern region of India. It is focusing only on the causes and effects of changes and change order. The study was conducted using questionnaire survey that was sent out to the engineering contractors. The objective of the survey is to obtain more extensive coverage on the issue of change order and claims made by the by engineering contractors on extra works caused by change order. Upon obtaining the data desired, checking and sorting of data were done and followed by data analysis which was the main component of the study. Finally from the data analysis acquired conclusion and recommendation were made. The respondents involved were only the engineering contractors. The suggestion made is only focusing on method to reduce changes.

IV ANALYSIS OF RESULTS AND DISCUSSION RESULTS AND DISCUSSION

4.1. ANALYSIS

This study started off with the problem identification which done through unstructured interview and brief literature reading. Upon obtaining the identified problem thorough literature review of paper case study analysis were conducted to provide in depth understanding on the issues of change order, focusing on the causes and effects.

Causes, Effects, and Controls are scored as follows to come up with an Index to indicate its importance, or utilization as

in the case of controls of each: Very often = 100% Often = 75% Sometimes = 50% Seldom = 25% Never = 0 %

Importance Index, Prevalence Index and Utilization Index of each causes, effects and controls are calculated as follows:

(Never) equals to number (0).

X1: Number of respondents answering (Very often),

X2: Number of respondents answering (Often),

X3: Number of respondents answering (Sometimes),

X4: Number of respondents answering (Seldom) and

X5: Number of respondents answering (Never).

The evaluation of each element is conducted considering the weight age average of the responses.

- **Data analysis about causes are categorized by Importance Index (II)**

- **Data analysis about effects are categorized by Prevalence Index (PI)**

- **Data analysis about controls are categorized by Utilization Index**

In order to eliminate or minimize the impact of change orders, contractors have utilized the following controls:

1. Clarity of the scope of work of the change order.
2. Appropriate approval in writing.
3. Negotiation by knowledgeable people.
4. Review of design changes for feasibility before approval.
5. Team effort among construction parties.

V CONCLUSIONS

A combination of questionnaire survey and in-depth interviews has been used to provide useful information on issues surrounding project control in practice. The causes of change orders, and their effects on project cost and schedule are complex and influenced by numerous interrelated factors. The risk and uncertainties associated with project changes make predictions and planning for changes a difficult task. The objective of this research study was to carry out a literature review and field survey to identify major causes of changes, their effects on projects, and control procedures adopted in large building projects in India. Based on the field survey conducted and the results found, the following as can be concluded and outlined:

- Changing the plans by the owners is the main source of change orders. That is due to lack of involvement in the design development and inability to visualize it while not appreciating the negative effect of it.
- Because of new materials are becoming available in the market or change in mind, substituting materials and/or procedures is the second source of change orders.
- Consultants are the second major contributor to changes by generating conflicting design documents or through change in design afterwards.
- Increase in project cost and duration are the main two effects being noted for change orders.
- Clarity of scope of change orders ranked the first among controls adopted.

It has been observed that financial problems of contractor& owners, weathering conditions are the major factors causing change orders and leading to project delays. The consultant features which includes; inadequate drawings, inadequate details, change in project specification, conflicts in contract documents and inadequate design are key factors causing change orders and leading to project delays. Lack of Strategic Planning by contractor on project, scope change during the execution of the project, possible shortage of

equipment's and contracts unfamiliarity of local conditions are also analyzed to be the cause of change orders and leading to project delays. The authors suggest using an effective system for project management like Building Information Modelling (BIM) to plan, designed and manage the execution of the project. It is being executed in several main projects and clients have started recognizing benefits of a BIM system. Changes that arise in all projects are unique, but by instituting standard actions for documentations, pricing and taking benefit of digital technology; owners will be capable to efficiently manage the change order process. Active communication and teamwork between all parties involved in project is essential for successful projects. This study provides professionals with prerequisite knowledge to make more informed decisions and take proactive measures to reduce potential changes in the future.

FUTURE SCOPE:

It is better to deal with the causes and find a solution so that severity of causes can be reduced. 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.

As per the findings of this study and the conclusion given above, the following can be recommended:

- Make use of 3D models to help owners see their project before construction starts. Animation would be greater!
- Owners to make a good financial planning during planning stage.
- Owners are advised to have PMC to supervise both design and construction to ensure that owner's expectations are met by the design.
- Consultants to specify the materials in a detailed manner or use performance specifications.
- Owners to use the control of "freezing the design" more often to avoid the problem of creeping scope.

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