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Factors Affecting Effective Implementation Of Cost Management Process In Construction Industry

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Abstract — *Cost control of a construction project is a vital management assignment which is a key to success of the business. Cost overruns are evidently frequent problems in the construction industries of many developed and developing countries. Even though cost management process is followed widely the cost overrun and escalation still persists. The significantly increasing number of cost overrun cases indicates the need for effective implementation of cost management process. The main aim of this paper is to identify the major factors which affect the effective implementation of cost management process in construction projects. Based on a listing of causal factors derived from literature study and field study the questionnaire survey is conducted. The statistical analysis of the data has performed and the most important factors are identified. Eventually, the chosen key factors are anticipated to assist in completing construction projects successfully.*

Keywords— *cost management, management process, project, factors*

1. INTRODUCTION

The cost management covers the processes related to cost estimation, cost planning, cost budgeting and cost monitoring and control (BIS) so that the project can be completed within the approved budget. Cost management covers the full life cycle of a project from the initial phase towards measuring the actual cost performance and up to project completion. Cost management is a vital part of project management and targeted to achieve satisfactory project cost performance through efficient project planning and execution within the budgeted cost. The ineffective cost management process will influence the performance of the overall project ultimately. Construction cost estimating is the process of forecasting the cost of building a physical structure. Contractors and clients both concern about the financial impact of cost overruns and failing to complete a construction project. Cost budgeting covers the understanding of what costs will be incurred, when and why, and clearly follows on from the estimating activities and the award of the project. Cost control includes examining and understanding the reasons for both positive and negative cost variances. Cost control typically uses detailed plans and schedules which were devised at the early stage of the project life cycle. As all the three processes are interrelated, any deviation in any process affects the final cost of the project.

About half of total investments in India go to the construction sector. Studies reveals that construction costs in India are increasing around 50 per cent over average inflation levels. This cost increase is due to increase in the cost of essential building materials such as steel, cement, bricks, timber, sand, fine and course aggregates and other inputs as well as cost of labour says Jyotheendranath (2015). A construction project is undertaken to create a built facility within predetermined budgeted cost utilizing the planned resources.

2. LITERATURE REVIEW

Sriprasert (2000) in the study of cost overrun signifies that "cost overrun is caused by ineffective construction management and poorly established cost control systems"

V. Sundararajulu (2008) suggested that "effectiveness of various cost escalation management strategies for identified cost escalation factors of Indian building construction projects can be further evaluated in-depth".

M. Ramachandran (2009) signifies that construction projects entail high risk, with long gestation period, high costs and budget constraints.

Yakubu Adisa Olawale et al (2010) concluded that the top five factors inhibiting time and cost control in construction practice in the UK were revealed as design changes; risks and uncertainties, inaccurate evaluation of project time/duration, complexity of works, and non-performance of subcontractors. Design change is the single most important factor considered by practitioners as hindering the ability to control not only time but also cost of construction projects.

George Otim1 *et al* (2011) identified "The problem of cost control is actually the lack of knowledge and inadequate planning for the implementation coupled with the poor management of construction resources".

Anuranjan Kumar *et al*(2015) in their study signifies that Despite the availability of various control techniques and project control software many Construction projects still do not achieve their cost and time objectives. Research in this area so far has mainly been dedicated to identifying causes of cost and time overruns. There is limited research aimed at

studying factors inhibiting the ability of project practitioners to effectively control their projects.

Mohammad Miri (2015) in his study signifies that cost management is one of the key tasks of project manager and its would not be possible without the knowledge of cost structures and management techniques.

Steen Lichtenbergb *et al* (2015) stated that Project Management (PM) and Cost Engineering (CE) have made tremendous advances during many decades. Nevertheless, we still witness all too frequent severe budget overruns and delays.

Ernest Kissi1 et al. (2016) in their study concluded that the barriers to the practice of effective cost planning in construction industry are weak cost planning and knowledge base, poor cost databases and understanding, inadequate designs and planning, External conditions.

Olav Torp *et al* (2016) in their research identified some important factors that contribute for cost escalation in the planning phase (e.g. scope and design change, project complexity, site and location constraint, and the need for special facilities).

Shradha B. Kulkarni *et al* (2017) concluded that BIM model with minor details is very time expensive, but then cost control process is very much beneficial with BIM than a traditional method throughout the project cycle.

3. NEED FOR STUDY

The review of past literatures reveals that, majority of the projects in construction shows constant cost overrun and escalation in spite of following the cost management process. The research study explores vital factors affecting effective implementation of cost management in construction. Interpretation of these factors is helpful for the construction professionals who work on the different phases of construction in order to successfully deliver the project. The principle goal of the research study is to provide crucial information about factors influencing cost management process to the project management teams who qualify the project's success. So this research is focused mainly on exploring the affiliated factors that are prone to affect the project's success.

4. RESEARCH OBJECTIVE

The objectives of this research are stated below

- To identify the critical factors affecting cost management process in the construction projects.
- To statistically examine the impact of factors affecting cost management process.
- To suggest recommendations in order to improve cost management towards project performance.

5. SCOPE OF WORK

The project undertaken by various construction firms differ widely, but the planning system adopted for all the firms are mostly one at the same. The scope of the work is

- To study the extent of implementation of cost management process (cost planning, cost budgeting, cost control).
- To determine the input factors based on data collection.
- To develop analysis based on the factors identified.
- To find and recommend mitigation measures for effective implementation of cost management process

6. RESEARCH METHODOLOGY

This research is done by using questionnaire survey as a tool to collect the necessary data from the respondents. The survey presents 71 factors which have the potential to affect the effective implementation of cost management process. After literature review the pilot study is done by collecting opinions from experts in the field. Then questionnaire survey with the causal factors is conducted. Based on the data obtained from the questionnaire survey the factors are analyzed using statistical software tool called SPSS in three stages based on four distinct backgrounds namely, projects handled, Experience, cost of project and designation of respondents. The analysis is classified into four stages. In the first stage the response from the respondents are entered into SPSS database. The first analysis involves finding the reliability of questionnaire. The second stage of analysis involves finding the overall mean rank of the factors based on the mean of the responses. The third stage of analysis is ANOVA analysis. The fourth stage of the analysis involves regression analysis to find the cause and affect relationship between factors... The less important factors are eliminated and most important factors are listed out after statistical analysis.

7. QUESTIONNAIRE DESIGN

The data collection is done by using Questionnaire survey.

The Questionnaire was distributed to various Organizations through e-mails with Google forms. The questionnaire contains questions to collect respondent's background, organizational background and survey questions regarding factors affecting effective implementation of cost management process. The scale used for measurement of data is five point likert scale. A total of 70 responses were received out of 105 questionnaires sent.

8. INITIAL FACTORS

There are 71 initial factors. In that 25 factors are related to estimation, 20 factors belong to cost budgeting and 26 factors are related to cost controlling.

8.1 Factors Related To Estimation

The factors which are related to cost estimation are Complexity of project design, Incomplete design at the time of tender, Poor communication and coordination between project participants, Escalation of material prices, Unfavorable contract clauses, Inaccurate site investigation, Non availability of drawing/design on time, Unrealistic time schedule imposed in contract, Non availability of accurate cost data, Poor management knowledge of professionals, Lack of understanding of variables to consider in cost analysis, Lack of technical know-how, Non availability of labour cost data base, Lack of professional training, Poor scope definition, Method used in determining contingencies, Unstable prices of construction materials, Frequent changes in inflation, Unwillingness to give out information, Unstable market condition, Regulatory approval requirements, Project location consideration, Discrepancies in contract documentation, Accuracy in estimation of direct and indirect cost, Co-ordination between client and consultant.

8.2 Factors Related To Budgeting

The factors which are related to cost Budgeting are Poor WBS definition, Inaccurate activity cost estimate, Unavailability of supporting details of estimated cost, Inaccurate/ impractical schedule, Schedule variance, Lack of, experience in the type of project, Incorrect planning and scheduling by contractors, Underestimation of project duration, Lack of experience of consultant in construction projects, Practice of assigning contract to lowest bidder, Unavailability of resource calendars, Not having a risk register to foresee respective costs, Inadequacy of the details of cost related items in agreement , Allocation of direct, indirect and joint cost, Not Implementing project management tools and techniques (primavera, MSP, EVA), Not Updating budget after variation or changes, Less contingency allowance, ineffective frequency of project budget updates, Company policies and procedures of cost related items, Co-ordination between client and consultant.

8.3 Factors Related To Cost Control

The factors which are related to cost control are Allowance of numerous variations during project implementation, Change in schedule, Change in construction methods, Weak regulation and control, Conflict between project Participants, Lack of proper training and experience of project manager., Rework at site, Contractor experience in similar project, Level of construction and site complexity, Often changing subcontractors, Poor site management and supervision, Change in Design / scope, Communication errors, Force majeure, Unpredictable weather conditions., Risk and uncertainty associated with project, Low productivity of labour, High cost of labour, Problems associated with overtime, Accidents at site, Unqualified/ inexperienced labour, implementation of management information systems in cost updation, Co-ordination between client and Contractor, Not implementing project management tools like primavera p6 for monitoring and control, Improper/ No Maintenance of records for all types of communications and Delay in progress payments .

9. DATA ANALYSIS

The Data analysis is done in three stages namely,

A) Reliability analysis.
B) Ranking of Factors
C) ANOVA test
D) Regression analysis.

9.1 Reliability analysis.

For internal reliability, Cronbach's alpha was calculated for each scale. This type of analysis was conducted to describe the stability of the collected data measured using Cronbach alpha value. The data is considered as unacceptable if the reliability value is less than 0.3. The value must be in the range of 0.7 to 1.0 only then the data will be reliable. The Cronbach value obtained for the data collected is 0.898 which is good and acceptable.

10.2 Ranking of Factors

Initially the factors were ranked by overall mean in descending order. The factors with mean value of 2.5 and above were selected for further evaluation. Totally 53 factors were selected out of 71 factors for further evaluation.

9.3 ANOVA Test.

The 53 items under each of the background information were tested and analysed through ANOVA respectively. The 5 % significance is considered and taken for discussion under each of the background information of the respondents. ANOVA is done for the following four background information between the three groups. The four background information is,

i) Project handled by the respondents.
ii) Experience.
iii) Cost of individual project.
iv) Designation/ Status.

A total of 14 factors were identified as critical items after ANOVA test. They are,

1. Unrealistic time schedule imposed in contract.
2. Poor scope definition.
3. Accuracy in estimation of direct and indirect cost.
4. Inaccurate activity cost estimate.
5. Allocation of direct, indirect and joint cost.
6. Ineffective frequency of project budget updates.
7. Poor WBS definition.
8. Change in schedule.

9. Weak regulation and control.

10. Often changing subcontractors.

11. Lack of proper training and experience of project manager.

12. Low productivity of labour

13. Implementation of management information systems in cost updation.

14. Not implementing project management tools like primavera p6 for monitoring and control.

9.4 Regression analysis.

Regression analysis is done to find the cause and effect relation between the factors. In simple linear regression a single independent variable is used to predict the value of a dependent variable. From the factors extracted after ANOVA and overall mean value, one dependent variable is selected from each group and regression is done with all other factors as independent variable to find the cause and effect relationship. The dependent variables are.

i) Accuracy in estimation of direct and indirect cost.

ii) Allocation of direct, indirect and joint cost.

iii) Implementation of management information systems in cost updation.

Three groups of results were obtained. From the three groups the most significant positive factors were selected as critical factors. A total of 11 factors were identified as critical factors.

10. RESULTS AND DISCUSSION

After the analysis of data using SPSS, 11 critical factors are extracted which affects the effective implementation of cost management process. The final critical factors affecting effective implementation of cost management process from the study are,

1. Poor scope definition.
2. Inaccurate activity cost estimate.
3. Poor WBS definition.
4. Change in schedule.
5. Unrealistic time schedule imposed in contract.
6. Ineffective frequency of project budget updates.
7. Lack of proper training and experience of project manager.
8. Not implementing project management tools like primavera p6 for monitoring and control.

From the results it is evident that, the problem of effective implementation of cost management process is actually due to the lack of experience in certain type of project and inadequate Co-ordination between client and consultant coupled with the poor scope definition.

Other problems identified, that led to hindrance in implementation of cost management process and subsequent failure to construct within budget included Change in schedule, Low productivity of labour, Inaccurate activity cost estimate, Poor WBS definition, Inaccurate/ impractical schedule, Not Updating budget after variation or changes, Ineffective frequency of project budget updates, Co-ordination between client and consultant, Not implementing project management tools like primavera p6 and MSP for monitoring and control.

11. CONCLUSION AND RECOMMENDATIONS

This paper aimed to improve the cost management process in construction industry by confronting the factors which hinder the cost management process. The final factors obtained after the statistical analysis is listed above. All the factors listed are critical factors which lead to the failure of project to complete within stipulated budget.

The following are the recommendations to be followed in every construction projects to effectively implement cost management process and to avoid frequent budget overruns.

1. The project manager and all members of the construction must have established an understanding of the project's purpose, agreed on goals, selected the best course of action for achieving the goals, created a comprehensive work breakdown structure, and assessed project uncertainties.
2. Relationship between management /client and consultant should be improved and to be established well, by conducting frequent meetings to avoid claims and disputes.
3. The project managers can provide a framework for introducing their teams to WBS concepts and facilitating the involvement of the team in WBS creation. Thereby obtaining benefits not only in schedule and budget development, but also in project communication, risk management and conflict resolution.
4. The quantity surveyors and project managers should be properly trained or experienced prior to undertaking new type of project by a company.
5. The actual budget should be properly and frequently updated. The updated cost flow serves as the basis for calculating both expense flow and income flow, and ultimately cash flow forecasting. It also enables creation of tables listing actual vs. forecast cost flow. This is an important control tool for both contractors and owners.
6. The clients should pay special attention to minimize changes in order during construction so as to avoid delays and cost overrun.

7. Managing skills of the Project Manager should be improved in Cost Management practices with the usage of modern techniques and tools in construction project to improve the efficiency of the cost performance.

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