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Effective Process of Project Monitoring and Control

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Abstract

Cost overrun, potential risks and delay are very common in construction projects due to many factors caused by project participants mainly during construction phase. Effective project monitoring and control is considered one of main factors that contractor's project managers must adopt to track and assess the progress of any construction project. The objective of the research is to determine why project monitoring and control is important for project progress, and what are the best practical techniques that can be used to monitor and track the work progress for any project, and to identify and make timely recommendations for necessary corrective action in response to any schedule delays. Monitoring and control is directly linked to the project management and construction management process to evaluate the project performance that will help the project manager to determine and decide if the project will be completed and delivered on time without any delay. Monitoring is concerned primarily with the ongoing collection of information's and reviews them on regular basis.

The results of the study revealed the necessity of needs that must be focused on internal control process and techniques e.g. contractor selection, construction phase, internal control process, job costing and labor management, part of the results are developing the necessary smart effective project controls before starting the execution stage. In the conclusion, good internal controls are vital for contractor's project managers through proper effective utilization and adoption to monitoring and control process of construction process including the available techniques that must provide and improve the efficiency of tracking tools.

Keywords: *Contractor Project Manager, Control process, Monitoring process, Planning, Risk control.*

1. Introduction:

Construction project works in a changing and dynamic environment, therefore it is extremely important to monitor and control the project work phases regularly and adopt suitable controlling methodologies and measures to keep it as planned. So the system should be in the place to avoid any delays. Many construction firms use time, cost and quality as a parameters to measure and control the projects. The purpose of control system is to ensure that project objectives within cost and quality are achieved within the approved/agreed time. Many other parameters must be considered to in addition to the traditional once time, cost and quality such as variations, delivery of materials, risk identification, availability of resource, numbers of claims and numbers of accidents. Senior management refer always to the approved working program once they get the feedback from the project managers through monitoring and control process, in case of any deviation of the work progress a corrective action should be taken to cover the impacted delay. The purpose of monitoring system is to check the continuity of work progress against the plan to help in taking any corrective action. Basic objectives of monitoring are to monitor projects by measuring physical progress according to [1].

Keeping the project with respect to schedule, budget and performance specifications requires special attention and focus by the project team mainly project manager through proper specific parameters like changes, communication, follow-up, meetings, inspections, performance, earned value and number of changes. More complex monitoring

involves collecting data from individual participation of the team or through developed forms as stated by [2.] Monitoring is concerned with the ongoing review of information on the project execution, by collecting information regularly through project phases a project monitoring system can be developed to evaluate the quality of project objectives.

2. Literature review:

One of the major components of any construction/contracting firms in construction industry is the project especially huge and mega projects that creates big completion in the work environment to stake holders and other project execution team who become involved in work progress and daily operations by focusing on the activities and tasks that requires special monitor and control. This leads the organization/ firm to seek the excellence in accomplishing the task as confirmed by [3]. The successful project execution always start with proper planning for the activities that must be completed including the process of execution for these activities. This has to be monitored by the project managers through specific tools. Tools availability is critical factors in the productivity of construction team as stated by [4]. Most of construction projects are not performing to the level of expectations of the stakeholder and the project team due to many factors where some of these factors are lack of monitoring. Almost no construction project performs totally as planned as dynamic changes are frequently needed, these changes can be ascribed to the high uncertainty based on statement of [5].

Projects managers of contracting sectors required to have a certain level of skills to monitor and control projects at various stages of projects life cycles. Controls serve a particular purpose for each project phase. Professional quantity surveyors can use construction auditing skills at various stages of project life cycle to reduce the cost as stated by [6]. Project managers should have integrated system to control and monitor the project that must be agreed and approved during the planning phase of the project. The tools of monitoring could be automated or physical depending on the type and the size of the project and the capability of the contractors firms. Automated and integrated project monitoring and control frame work that facilitate decision making by project managers to take corrective actions after deviation occur referring to [7].

Many common methods are being in use for monitoring and controlling projects that leads to maximum achievement of objectives. Some of these methods have been investigated to find out the effectiveness of some commonly used monitoring system, in detecting deviations from the planned cost and performance as confirmed by [8]. Many factors are attributing to poor monitoring and control in construction projects like method of evaluating and reporting actual work vs planned, lack of information of material management and the inaccurate reported information that leads to a major delay in the project. Current, manuals, materials management and poor control procedures are some factors attribute to lack of up-to-date, real- time information as stated by [9]. Monitoring and control is related directly to project management and it is essential to assess and improve the project performance. It helps project managers to evaluate the status of the project whether the objectives are being met. Monitoring can identify the operational constraints that affect the performance of the project.

3. Overview of projects controls:

Potential applications of knowledge and information based expert system in the field of construction project monitoring and control are essential where these applications should be developed and updated at the end of each project according to the reported learned lessons of project managers. Applications and systems could be physical or software's programs performed by highly skilled people as long as it serves the achievement of project objectives. The applications are useful to identify and make timely recommendations for corrective action in response to the anticipated schedule delay. Implementing of the reported information in flexible process modeling approach like process configuration method enhance an alternative process planning where software system can be developed to minimize manual inputs and enhance data acquisition as recorded by [10]. Benefits of software are to make project managers and planners anticipate and identify schedule delays and expectation early before they happen. Analysis of the data collected and quality diverted items can be transformed into categorized factors. New technology mainly

sensor technology provides the increased opportunities for automation and improvement the acquisition and construction process referring to [11].

The practical process of planning in construction project is still conflicted with provided information about of current process and necessary changes in the process flow must be adjusted during project execution. In practice, project managers and planners still depend on manual process methods to collect information during project execution. Accordingly, the information of actual construction process will become incomplete. It is extremely important to consider and establish an effective project planning, monitoring and control system to enhance project performance in order to minimize or avoid potential delays. Projects managers and planners must be aware that productivity of the human resources in construction can also be monitored and controlled but still productivity still can be improved. A framework for semi-automated project monitoring and control has been proposed where the collected data can be incorporated taking into account the impact of productivity of existing deviations from the planned performance and the controlling actions proposed to deal with these deviations based on what has been stated by [12].

Monitoring and controlling process in construction projects oversees all necessary tasks and metrics to ensure that the work progress of the project is within the scope, time and the budget so that potential risks can be mitigated. A part of the process is the comparison between the planned and actual for taking the corrective action to complete and handover the project on time especially if any deviations are occurred. Project control are the data gathering and analytical process used by the project team through the communication of information transmitted by a designed templates that complies with the nature of the project to assist the project leaders in decision making. Controlling the work can also be expressed as those measures that are necessary to make sure the expected happens. The project control with respect to the schedule, cost and quality is very important to project success that must be supported by the entire project staff referring to [13]. Project control can be achieved by developing a policy of understanding cost, time and quality through spreading their importance.

4. Current processes of Project Monitoring and Control:

Assessment, evaluation and comparison of actual results against the planned are essential in construction projects to ensure that the project activities are in progress. If there is a variance a corrective action by the project manager must be taken to keep the project within the time and the cost to prevent any delay. This can be achieved by checking regularly the project plan and weekly/monthly report that covers the collected data from other project team mainly the planners. A part of projects manager's responsibilities is to identify the reasons of problems that caused the deviations and to take corrective action. Reporting method that is a part of communication process must be approved at the beginning of the project by all stakeholders. If reporting method/plan is not sufficient, project can't be monitored and controlled properly. Control process and framework is different from a project to another depending on the size and type of project where different levels of management are involved. Project data and information must be always available on time. In construction projects actual data from construction site is not always available in real time, thus counter measures to offset unforeseen events are not triggered until it is fairly late, leading to costly delay in progress as recorded by [14].

There must be an approved control system for collecting the data where if the system is complex many potential issues will results that increases the cost and errors in working process. The accuracy of the data collection process can be influenced and maintained by accomplishment of certain practical actions through committed project team. Project team are always addressing the how the execution of activities will be monitored and how progress will be reported. Maintaining up-to-date time sheet and records of activities they are involved has to be reported regularly to the project manager to identify any potential issues that may cause a delay to project. The quality of the data and information should be performed to the highest level of efficiency. Many projects are getting delayed because of the lack of accuracy of the reported progress that are not matching with the actual work where project managers action is not reflecting the real action. Therefore the project team members must develop certain actual attitude towards the value of the data at early stage of the project. The collected information and the data must be readable, measurable

and objective; monitoring the work progress of the tasks in construction projects should not be judged or evaluated in percentage wise.

Most of project managers are focusing on some points during monitoring and controlling to obtain regular progress and status reports, these points are Tracking, reviewing and regulating project progress, Progress measurement, forecasting, reports on scope, schedule, cost resources, quality and risks, Project document changes, Formalizing acceptance of deliverable during handing over, Records of quality control results and Implementing risk management plans. This requires a pro-active approach and full commitment by the project team and project manager. It is important to realize that scheduling requires a pro-active approach to ensure all relevant inputs are captured and there is a good understanding of the execution assumption and schedule risk referring to what confirmed by [15].

5. Aims and Objectives of Study:

This paper is mainly focused on the best practices and implementations of project monitoring and control that must be adopted by the project manager and his team. Construction project is considered to as of the achievement of a specific objectives that involves a series of activities and tasks that consume resources and time; the project manager should be ready to monitor the activities through a certain approved plan with the project team. The impact of failing of adopting the best practices of monitoring and control processes will be assessed and analyzed in this study where recommended actions has been demonstrated to show the necessities of adopting the process.

6. Methodology

To achieve the study objectives of this paper, a mixture of comprehensive methods were adopted in this study including literature review, questionnaire, and quantitative and qualitative data analysis. The theoretical background, literature review and overall objectives of the study have been reviewed, where overall processes of the study and adopted methods of analysis has been demonstrated. This part aims to describe the various methods that are available to the author during the study

6.1 Research Approach

The study method is prepared based on the analysis of the two main approaches of data collection: quantitative and qualitative analysis, both are identified below in order to allow the author a satisfactory understanding of how these methods are utilized in order to develop a detailed methodology of analysis.

6.2 Quantitative analysis

In short, quantitative analysis is the examination of data collected via survey techniques through statistical methods in order to ensure that the data collected is both reliable and significant.

6.3 Qualitative Analysis

The qualitative approach to research as the study of things in their natural setting, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them as confirmed by [16].

6.4 Data Collection

There are two main types of data that can be collected by researchers in order to develop the results that they require. These are primary and secondary data, and each will be dealt with in turn in order to describe how each type of data will be collected.

6.5 Primary Data Collection

Primary data are generated by the author who designed questionnaires and collected the data and did the required analysis. The author has described why and how the data were collected and explained about the method used for analyzing the data. Primary data has been collected from various sources; the author is responsible for the interpretation of the data. The primary data collection approaches are observation, experimentation, questionnaire and interviews.

6.6 Questionnaire

Questionnaire surveys are one of the methods to gather the information's /data where project managers are requested to fill the forms of questions. It includes list of questions related to the study topic. Questions mainly are selection base. This form of data collection is the most widely used source of primary research amongst researcher as it provided access to a wide range of professionals which would normally be beyond the reach of most researchers based on[17].

7.0 Design of questionnaire survey and data analysis:

Questionnaires are developed to collect the required information's to identify level of implications of processes that adopted by project managers and his team to monitor and control progress of the work at very effective method. Table I. shows the eight important points that should be followed by the project managers to monitor the work. The questionnaire survey is designed to evaluate and review the perceptions of project managers to the applications of internal control skills on construction projects. The survey was designed based on important eight processes that have been investigated in the literature review of the study. Participants have been requested to point out the level of significance and meaning of each process. The points are:-

- Establishing baseline that must be developed representing expecting performance
- Monitoring status in terms of performance that must be measured regularly against baselines
- Forecasts that present projections that will be made predicting future performance
- Variances through predicted performance variances that must be quantified
- Analysis based the analysis of the potential effects of variances on final cost and schedule
- Alternative options through corrective actions that must be evaluated and compared
- Implementation of corrective action that should be implemented by modifying work plan
- Assessment of remedy based on the associated work with the corrective action that must be monitored to assure its success.

Table 1. Several Important actions to be considered by project manager and his team

SN	Question/process	Validity	Means	Rendering	Standard deviation
1	Establishing baseline that must be developed representing expecting performance	100	2.94	56%	1.530
2	Monitoring status in terms of performance that must be measured regularly against baselines	100	2.95	56%	1.542
3	Forecasts that present projections that will be made predicting future performance	100	3.84	63%	2.733
4	Variances through predicted performance variances that must be quantified	100	3.89	66%	2.859
5	Analysis based the analysis of the potential effects of variances on final cost and schedule	100	2.30	51%	1.432
6	Alternative options through corrective actions that must be evaluated and compared	100	4.89	73%	2.896
7	Implementation of corrective action that should be implemented by modifying work plan	100	3.87	67%	1.677
8	Assessment of remedy based on the associated work with the corrective action that must be monitored to assure its success.	100	3.41	60%	1.595

8.0 Data analysis and findings:

One hundred questionnaires were distributed to 100 contractor's project managers and schedulers working in five different contracting companies specialized in construction projects. Ten questionnaires were filled by project managers and the other ten was filled by schedulers in each company. Participants were very interested in the topic and the types of implications of project monitoring and control mainly Processes and actions listed in Table 1. they all confirmed that they are willing to respond to this study because the listed items is a part of their daily tasks in projects but not the expected level due to other daily tasks they are handling, most of them have confirmed that they depend on the recommendations reported by the scheduler on weekly basis because many of them are busy in solving contractual issue, meetings and follow up with sub-contractors. This part of the study is to find out the act upon the responses analysis that rendered through the questionnaire.

The analysis is prepared based on analyzed regression founded on the estimated relationship among the variables and the calculated frequencies, standard deviations, means for providing the responded participants view to a particular question. The purpose of the collecting and analyzing the data is to find out the level of the commitment of project managers and their schedulers of implicating monitoring and control process and to find out the impact of ignoring these implications and the best practices required to ensure that project is monitored and controlled to the maximum level as recommended at the end of that study. Establishing based line factor, it is observed that the value of standard deviation is 1.530, means that the variables are notably increase across the mean 2.94. As rendered based on Table I that 56 % do care about developing the baseline schedule that covers all activities. Monitoring the status against the baseline of each phase of project that is a part of responsibilities of the project team as listed in Table I, value of standard deviation of 1.542 shows that the results are greatly spread across the mean value of 2.95, suggests that around 56 % of the respondents confirmed that project team are monitoring but not to the extent required level due to other activities.

Factor of forecasting projection of evaluating the performance, the standard value deviation of this factor is 2.733, shows the results spreading across the mean value of 3.84 as shown in Table I where 63 % of the respondents stated that forecasting projection of the project is always investigated and checked by the project team. For the item of quantifications of variance the results are spread across mean of 3.89 as shown in Table I and standard deviation is 2.859 where 66 % of respondents reported that variances are considered by schedulers through the available software's like primavera. They also believe that it is the responsibilities of the project manager who deals directly with finance and budget department. They are not involved in financial issues because they focus to complete the task and leave financial issues to project manager.

The mean of the activity of analyzing of potential effects of variance is 2.30 and the standard deviation is 1.432 which indicates that 51% of the participants are doing approximate analysis for the effects and impacts on the variance. Scheduler and project manager are taking care of that activity on monthly basis based on generated reports of available software's in the project. 73% of respondents confirmed that considering alternative option through corrective action is one of the essential tasks that considered and discussed by the projects managers and his team based on the risk analysis at the beginning of the project. the standard deviation of this activity is 2.896 where its mean is 4.89. The implementation of corrective actions its standard deviation is 1.677 because 67% of the respondents stated that it is very important activity that must be monitored and controlled to mitigate any issues based on the order of project managers. This activity is controlled to maintain quality, time and cost of the project. 60 % of respondents stated that activity of assessment of remedy based of the associated work with the corrective action that its standard deviation is 1.595 and its mean is 3.41 must be regularly monitored to assure its success. Specific team will be assigned temporarily to ensure that work will be implemented on the agreed specific time.

Conclusion:

Due to fast growth of construction industry projects and fast development of real-estate projects at global level made project monitoring and control procedure very essential for project manager's, planners and schedulers. Project team must be familiar with project management knowledge and applications including the standards and methods that

must be adopted and applied on day-to-day activities. These coupled with the critically of completing projects according to the agreed scope, time and cost as stated by [18]. Senior management of construction organizations must make sure that all of their projects managers are adopting the necessary best practices of project monitoring and control that help to keep the project on track during each phase. Monitoring and control activities keep checking if any deviation accrues during the work progress. Some of the important activities are taking action to control the project through necessary steps and control points that must be monitored to provide if the project is deviating from the baseline. Measuring the cost performance to check if the planned budget is sufficient to deliver the project and measuring the schedule performance to ensure that the planned schedule and dates can be achieved. Preparing in advance the necessary actions for variances exceeds the planned duration by 15-25% percentage. Taking a preventive action to mitigate factors affecting the causes of changes. In case of deviation from planned values, project managers must raise a change request to meet the planned values; in addition, changes must be implemented in performed integrated manner to come out with a proper evaluation for the changes impacts to reduce risks of changes. Checking the quality plans of the activities to ensure that of quality assurance and control are implemented for activities and final project components. Documenting all anticipated risks after categorizing and analyzing them, risk response strategies for each risk must be planned where action must be monitored and followed till the risk is closed. The proper administration of the necessary equipments, tools and sub-contracting resources must be properly monitored by purchasing managers who should communicate regularly with the project manager through regular weekly reports.

9.0 Recommendation:

On large scales of construction projects, monitoring and control process must be practiced to the highest level by the project team and project manager. During the work progress, project reports and data must be analyzed regularly at different phases of project. Analysis and assessment of much information including variances should be directed in successively at greater level of details to find out precisely the problems in the project and how they affect the schedule. The project manager has to determine who has responsibility for dealing with the problem and time should be fixed to recover it based on the decided corrective action. Evaluation and comparison of actual measured results against planned is the fundamental of project monitoring and control where corrective action is required if there is a variances to keep the project on schedule all the times. Progress report should be very accurate because it contains data collected from the site based on actual progress where the project manager has to collect measure and assess and re-plan (if necessary).

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