



Available online at [2019.creative-construction-conference.com/proceedings/](https://doi.org/10.3311/CCC2019-080)

CCC 2019

Proceedings of the Creative Construction Conference (2019) 080

Edited by: Miroslaw J. Skibniewski & Miklos Hajdu

<https://doi.org/10.3311/CCC2019-080>

Creative Construction Conference 2019, CCC 2019, 29 June - 2 July 2019, Budapest, Hungary

Monitoring and Control Process of Construction Projects

Mamoon Mousa Atout

Dubai Electricity and Water Authority

Transmission Power

Dubai, UAE

Abstract

Major causes of delays in construction projects are very common due to many factors caused by main projects stakeholders; client, consultant and contractor. Some of these factors are related to unclear objectives, risk identification processes, planning process, procurement process including tendering, construction process and supervision and lack of experience of performance measurement. Contractor's project managers of construction projects must be aware of work processes to avoid problem that may cause a delay of handing over the project. Some of these processes are project monitor and control. The research objective is to find out why process of project monitoring and control is major and important for project work progress and to determine the best practical techniques that can be utilized to track the work progress of construction project, and to make timely recommendations for required corrective action in response to any delays in the working detailed program. Monitoring project performance is a part of construction management processes that helps project manager to decide if the project can be delivered on time without any complain from the client. Project monitoring and control is important and essential for collecting the necessary information's that help projects managers to reviews progress regularly and help them to take any necessary action to avoid delays. The finding of the study shown the needs and actions required that must be considered by project managers to control internal process including essential techniques e.g. contractor selection criteria, operations of construction phases, control process, cost analysis, and labor and materials management. In the conclusion, internal control process is essential for contractor's project managers through appropriate and suitable effective utilization and adoption to the processes that must be identified at the beginning of the project.

© 2019 Mamoon Mousa Atout. Published by Budapest University of Technology and Economics & Diamond Congress Ltd.

Peer-review under responsibility of the scientific committee of the Creative Construction Conference 2019.

Keywords: *Projects Managers, Monitoring and Control process, Risk Identification, Planning Process. Variances*

1.0 General Introduction

There is big demand on construction projects due to continuous development of that industry all over the world which makes the process of construction regularly change from project to another, that's make project monitoring and control is essential for project managers and they must adopt suitable controlling methodologies and measures to keep projects schedules as planned. In addition to that the resources of project parties must also be monitored to ensure that project will be completed on time. very large range of parties involved in construction projects should be properly controlled to avoid delays. Now a day's project managers are using time, cost and quality and scope as a parameters to measure and control the progress of projects as confirmed by [1]. The reasons and principles of controlling the system of the work is to ensure that goals and objectives of project can be achieved within the agreed time.

Some other factors are considered as a factors attributes to project delays that are not properly monitored such as number of identified risks, number of variations, lack of skilled work force and late delivery of project materials. As per study and analysis the causes of delays in large building projects in Saudi Arabia and identified material related delays as the main cause of project delay [2]. Directors of construction contracting companies are always refer to the approved base line program as a part of monitoring and control process that they adopt where corrective will be considered to cover any occurred delay. The purpose of monitoring system is to check the continuity of work progress against the plan to help in taking any corrective action as confirmed by [3]. Special consideration and attention is required by the project team to complete major mile stones of project on time to ensure that project will be delivered without any delay subject to proper concentration in communication process, documentation process, inspection procedures, control process of risks and changes. The main reasons of the project delays are the changes of the contract document, inadequate supervision, late agreement with the Sub-Contractors and insufficient labor as confirmed by [4].

2.0 Literature review

In construction industry mega projects are the core business of any contracting organizations where project execution team managed by project manager become involved in work progress in day-to-day activities by focusing on the tasks that requires special monitor and control to avoid delays. This involvement leads the organization/ firm to seek the excellence in accomplishing the task/work activity on time as stated by[5]. Proper planning for work activities in advance are leading to project successful. Planning of activities and mile stones can be prepared by project team but must be monitored by the project managers through detailed process and tools where these tools must be available with the project team. Tools availability is critical factors in the productivity of construction team. Monitoring and control is related directly to project management and it is essential to assess and improve the project performance [6]. 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. Some factors contributes to poor monitoring and control in construction projects like process of evaluating work, assessment process, and reporting actual work vs. planned, material management process and the level of accuracy of reported information that leads to a major delay in the project. Old process, manuals, materials management and poor control procedures are some factors attributes to lack of up-to-date, real- time information [7]. Contractors and consultants projects managers must have complete integrated system to control and monitor the project activities that must be agreed and approved by project stake holders during the planning phase of the project. The tools of monitoring could be automated or physical depending on the location, type, 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 as stated by [8]. Reporting method is a part of communication process that should 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. 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 is not matching with the actual work where project manager's action is not reflecting the real action.

3.0 Purpose of projects controls

Monitoring and control applications in construction field are essential where these applications should be updated at the end of each project according to the reports of project managers and if they fail to do so regularly projects might get delayed because this is a part of their roles and responsibilities. A project may be delayed as a result of the direct action of major parties or of their failure to act especially if they have a duty to act [9].

Scheduling and planning techniques in construction projects are not yet considered as a final practical process with respect to the provided information about the activities that has to be planned where some schedulers and planners are thinking to modify some changes in the flow process during the work progress. Scheduling of the project requires the project manager to identify two initial aspects of project activities. First, there are some of the activities which are required to be done in series and in orderly manner, whereas others can be done in the same time [10]. Project managers and planners focus on information recorded in guidelines as a general common method to collect information during project execution phases while the reported information will remain incomplete. It is necessary to establish an effective integrated process to achieve project monitoring and control system that helps of enhancing project performance to reduce potential risks and delays. In projects, projects managers, schedulers and planners must recognize that efficiency of skilled manpower in sites can also be monitored where productivity 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 [11]. Process of monitoring and control in construction projects keep an eye on and focus in all responsibilities of developing metrics to ensure that the work progress of the project is within the scope and the budget so that unexpected potential problems can be reduced. Corrective action is one of the major important tasks that project managers must take based on the comparison between the planned progresses and actual mainly if they determine the deviation part that caused a problem. Project control are the data gathering and analytical process used by the project team through the communication of information transmitted based on proper facilities and by a designed templates that complies with the nature of the project to assist the project leaders in decision making. The project members should be provided with the best facilities so that they can work in a manner in which the project can be executed without a delay as stated by [12]. A part of project manager responsibilities is comparing the planned results with the actual to ensure that the project activities are in progress without a delay, a corrective action can be considered by project manager for any deviation. Identifying the reasons of problems that caused the deviations should be recorded as a learned lesson. Project managers are concentrating on important points through monitoring and controlling to maintain progress, some of these points are reviewing and tracking project progress, forecasting completion date of some activities, updated schedule, actual cost up to date, potential records of risks and change management plan. 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 [13]. The accuracy of the data collection process can be influenced and maintained by accomplishment of certain practical actions through committed project team. They "project team" who presents client, consultant and contractor must agree at the beginning of the project about recording system of data related to monitoring and control of activities which is a part of construction process. The sources of delays caused by Client, Consultants, Contractors, Sub-Contractors and those which are not caused by these parties to the design and data of construction process[14]. It is necessary that project team members must prepare a mechanism to maintain the value of the data during mobilization period of the project. The data must be clear, readable and measurable.

4.0 Aims and Objectives of Study

Aim of that research is focused on the implementation process of practices of monitoring and control in construction projects and its effect on the completion of the project on time. Assessing the impacts of failing of utilization the tools

of monitoring and control has been investigated in this research to find out the necessity of these factors that are essential to be adopted by projects stakeholders mainly projects managers and planners.

5.0 Methodology

Full inclusive methods have been adopted in this research to accomplish and carry out the purpose of that study e.g. literature review, questionnaires and data analysis. This section explains the process and methods that helped the author to come out with necessary required analysis to conclude the study.

5.1 Research Approach

Two approaches of data collection, qualitative and quantitative analysis has been approached to help the author developing proper analysis of the collected data through a detailed methodology.

5.2 Quantitative and qualitative analysis

Quantitative analysis is the assessment of data collected by means of survey techniques through statistical methods with the purpose of ensuring that the collected data are both reliable. For the qualitative, analysis 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 [15]

5.3 Data Collection

Primary and secondary data is the main types of data that has been collected by the researcher with the intention of developing the results that he needs. Collected data has been dealt with in turn in order to explain its necessity for that research. Author has generated primary data based on the combination of finding the analysis of literature review and other different sources that has been approached through meetings, interviews and questionnaires.

6.0 Design of questionnaire survey and data analysis

Questionnaire surveys are one of the methods to gather the information's /data. 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. Project managers requested to answer questions listed in the questionnaire form. 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 as stated by [16].

Apart of project manager responsibilities is to monitor, follow and control the construction activities of the project where a list of major points are listed in table 1, where survey is prepared to evaluate the perceptions of project managers to the applications of internal control process. The questionnaire is developed based on five important processes that have been founded in the literature review of that study. Participants requested to identify the level of meaning of each process which is:-

- Developing base line for assessing project performance
- Quantifications of project variances

- Measuring potential impacts of variances on baseline and cost of the project.
- Assessment of proposed corrective actions in case of occurred problems
- Evaluating the impact of the associated works resulted from the implemented action on the project

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

S N	Question/process	Validi ty	Mea ns	Renderi ng	Standard deviation
1	Developing base line for assessing project performance	100	2.98	57%	1.630
2	Quantifications of project variances	100	3.25	59%	1.992
3	Measuring potential impacts of variances on baseline and cost of the project.	100	3.95	68%	2.711
4	Assessment of proposed corrective actions in case of occurred problems	100	3.09	58%	1.859
5	Evaluating the impact of the associated works resulted from the implemented action on the project	100	2.40	52%	1.426

7.0 Data analysis and findings

One hundred project managers and schedulers working in five big contracting organizations responsible for construction projects requested to fill hundred distributed questionnaires. In each organization project managers were requested to respond to ten questionnaires and schedulers were requested to fill other ten forms. Participants have confirmed that most of the listed tasks are a part of their daily tasks. They regularly are informed about issues, potential problems and potential risks through regular reports submitted to them by schedulers and project engineers. Many of them has reported that they instruct some members of the project team to follow up with issues related to problems because they always busy in meetings with projects stakeholders to finalize all pending subjects related to work progress and to continue positive contractual relationship with them for future projects. Based on calculated results recoded in table 1, the standard deviations, calculated frequencies, means for providing and analyzed regression founded on the estimated relationship among the variables the analysis has been prepared and developed. The rationale of the collecting and analyzing the data is to observe the level of the obligation of project managers and their schedulers in monitoring and control process and to determine the impact of ignoring these implications including best practices to ensure that projects are monitored and controlled.

It is noted for item no. 1 that the base line development, the value of standard deviation is 1.630, means that the variables are notably increase across the mean 2.98. As rendered based on Table I that 57 % concerned about developing the baseline program covering all activities. Quantifications of project variances which is a part of the important tasks of projects managers, the value of standard deviation is 1.992 showing that the results are greatly spread across the mean value of 3.25, suggests that around 59 % of the respondents confirmed that projects managers are monitoring but not to the required level because they have some other tasks to follow with other projects stakeholders members. Regarding item no. 3 recorded in table 1 which is measuring potential impacts of variances on baseline and cost of the project. it is noted that the standard value deviation of this factor is 2.711, shows the results spreading across the mean value of 3.95 as where 68 % of the respondents stated that measuring potential impacts of variances is always checked by the project team. Regarding the assessment of proposed corrective actions in case of

occurred problems the results are spread across mean of 3.09 as shown in Table I and standard deviation is 1.859 where 58 % of respondents reported that assessment of corrective actions are considered by schedulers through the software's programs. They reported that it is project manager responsibility to find out the financial impacts of any corrective action they are taken. For the means of the last item of table 1 that is evaluating the impact of the associated works resulted from the implemented action on the project is 2.40 and the standard deviation is 1.426 which indicates that 52% of the participants evaluating the impact of associated works of implemented actions.

8.0 Conclusion:

Process of project monitoring and control is one of the important tasks that project manager must consider at the beginning of any project. Project team should be familiar with the standards of the application process of monitor and control where results of these applications must be presented on weekly /monthly reports they prepare for projects managers. He/ she must directly reporting to the higher management on regular basis explaining the status of the project where project variances, potential issues, deviations problems and required actions are a part of the report

Assessment of measuring cost performance to ensure that the planned budget is adequate and enough to deliver the project on time is essential and measuring the schedule performance to ensure that the planned schedule and dates can be accomplished. Moving ahead or proceeding in advance for required necessary actions of variances exceeds the planned duration by 15-25% percentage is essential where project team must always plan for that action. Any deviation from the base line should be considered as of the highest priorities where project manager must take necessary action to control it. Submitting a change request with full cost associated report for any required action is a part of preventive action to reduce cost and causes of change orders considering that changes can be implemented in a performed integrated manner to come out with an appropriate evaluation for the changes impacts to reduce risks of changes. Follow-up approved implementation process of quality plan helps the project manager and his team to monitor quality assurance and control till project is completed. Adopting risk module analysis help project team controlling all potential and anticipated risks during the work progress. Monitoring the productivity and resources utilization of each project activities can be monitored by the project team to ensure that mile stones can be completed on time.

9.0 Recommendation:

Successful implementation of process of project monitoring and control attributes to the success of projects. Adopting these processes validate the performance of the project and solve any potential problem faced that may affect time, cost and quality or other problems faced to follow the planned schedule. Proper system of monitoring and control must be established at the beginning where that system can be implemented and monitored through the life of the project. This can be achieved through the experienced projects managers and committed project team who should be familiar with these process /system of control of the project which depends upon the kind, value, size and location of the project itself. Regular assessment of information e.g. variances must be directed in successively at greater level of details to catch the problems in the project and how they affect the schedule. Assigning committed team members working in the project to follow-up the recommended actions of recovery plans and to monitor the required actions to close the identified risks is essential where that team must report directly to the project manger and must be supervised by him as well.

References

- [1] Semple C; Edwin H. ; Ann T., "Contract Strategy for Design Management in the Design & Build System", International Journal of Project Management, 23 (2005) 630-639 P. Published by E1 Sevier Ltd, U.K, 2005 <https://doi.org/10.1016/j.ijproman.2005.05.004>
- [2] Assaf, S.A. and Mohammed A.H. "Causes of Delay in Large Building Construction Project" *Journal of Construction Engineering & Management* Vol. 2, Issue No.11, Page 45-62 1995 [https://doi.org/10.1061/\(ASCE\)0742-597X\(1995\)11:2\(45\)](https://doi.org/10.1061/(ASCE)0742-597X(1995)11:2(45))
- [3] Kumar Neerag, Project monitoring and control system, Construction project management-theory and practice, ch. 16, 2011, p. 495 ISBN 978-81-317-3249-6 published by Dorling kind. India
- [4] Scott S., "Delay Claims in U.K. Contracts" *Journal of Construction Engineering & Management* Vol. 123, Issue 03, [https://doi.org/10.1061/\(ASCE\)0733-9364\(1997\)123:3\(238\)](https://doi.org/10.1061/(ASCE)0733-9364(1997)123:3(238))
- [5] Oncu Hazir, A review of analytical models and decision support tools in project monitoring and control. International journal of project management, p.808, 33(2015), pp 808-815 <https://doi.org/10.1016/j.ijproman.2014.09.005>
- [6] Goodrum, P.M., McLaren, M.A., The applications of active frequency identification technology for tracking in construction job sites. Autom. Construction.2006, 15, 292-302 <https://doi.org/10.1016/j.autcon.2005.06.004>
- [7] Navan, R. and Haskaya, Is detailed progress monitoring possible without designated manual datacollection?, Construction management and economics, 2006, 24(12), 1225-9. <http://dx.doi.org/10.1080/01446190600999097>
- [8] Azimi, R., Lee, AbouRizk, S., A framework for Automated and integrated project monitoring and control system for steel fabrication projects. Autom. Construction, 2011, 20(1)88-97 <https://doi.org/10.1016/j.autcon.2010.07.001>
- [9] Bramble, B.B. "Construction Delay Claims" *Engineering and Project Management* Vol. 132, No.07, Page 667-685, 1992
- [10] Hamilton Albert (2004). Handbook of Project Management Procedures. TTL Publishing, Ltd, pp. 25-36.
- [11] Shabtai, Isaac and Ronie Navon, Can project monitoring and control be fully automated? Journal of construction management and economic, Vol. 32. Nr.6, 2014, pp 495-505 <https://doi.org/10.1080/01446193.2013.795653>
- [12] Cooke-Davies, T.J. & Arzymanow, A. 2003. The maturity of project management in different industries: An investigation into variations between project management models. International Journal of Project Management, 21, pp. 471-478. [https://doi.org/10.1016/S0263-7863\(02\)00084-4](https://doi.org/10.1016/S0263-7863(02)00084-4)
- [13] Maurits Gerver, Project Monitoring and control, cost and value, 2015, P.22
- [14] Ajibade A. and Henry A. "Construction Delays and their Causative Factors in Nigeria" *Journal of Construction Engineering and Project Management* Vol. 132, No.07, Page 667-685, 2006 [https://doi.org/10.1061/\(ASCE\)0733-9364\(2006\)132:7\(667\)](https://doi.org/10.1061/(ASCE)0733-9364(2006)132:7(667))
- [15] Davis, M.B, Doing a successful research project, Palgrave Macmillian, 2007, Newyork
- [16] Naoum, S. G., Dissertation research and writing for construction (10th ed.). 2004, Oxford: Butter Worth-Heinemann