

Effective Project Control Techniques Assessment in Saudi Arabian Construction Industry

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Abstract

Project performance is determined to a great extent by effective cost and time control. The method of control and monitoring is crucial in project construction management. Construction contractors must incorporate the most sophisticated monitoring and control methods to achieve project goals. This research study analyzed project monitoring control methods implemented by the organization in the Saudi Arabian Mega Projects. For the data collection, a questionnaire survey was conducted with clients, engineers, contractors, and subcontractors on the project with minimum 5 years of experience in implementing the project monitoring and control techniques. The Analysis was conducted using the relative importance index (RII) and ranking the factors based on the percentage of relative importance. According to the data, the method of project management used by a construction company is correlated with project progress or success. It was also concluded that using a project control system like CPM combined with EVM as implemented by the organization in Maga projects work exceptionally well in achieving project goals. The conclusions led to many recommendations. The monitoring and control activities should be seen as necessary to the project team since it is part of the organization's project. Qualified professionals should be responsible for managing project management controlling tools and techniques to achieve the desired goals.

Keywords: Project and Construction Management; Project Monitoring and Controls.

1 Introduction

The project has a precise start and end date and a defined approach for utilizing resources to achieve results ((PMI, 2021). The project is an excellent platform for organizations and people to achieve their business and non-business goals more effectively. Dinsmore (2005) characterizes Projects vary from business to normal or operations in that they are repeatable, permanent, or semi-permanent functional tasks that generate goods or services.

Project control is a vital function of project management since it supports the project's overall objectives, reassures stakeholders of the project's progress, and serves as a focal point for communication between project team members. It is often explored as a procedure, strategy, and challenge (Shimanovich, 2021). Many skill sets are required to assess, evaluate, record effectively, and re-track projects, resulting in the agreed-upon concept becoming

challenging to reach.

Project control and monitoring is an integral aspect of a project management approach (Bragadin,& Kähkönen 2016). The project management and control mechanism is set in place to ensure that everything continues according to schedule. In other words, it finds gaps, manages transition, and offers continuous input to improve and refine the strategy (Jack et al., 2016). The construction project monitoring and control management is not a new tool; instead, it is the continued advancement of an already existing definition. Bringing together validated project control methods is what makes the project more successful (Shanmuga,2019). When presenting the project monitoring and control system, one should use the following statement: project control and monitoring system works to reduce discrepancies from the project schedules and consists of defining and documenting the

project's progress, matching it with the schedule, and then enforcing necessary corrective measures. Hence, it contains the collection of strategies, approaches, and tools to help accomplish the project's objectives (Hazir, 2014).

As a result, since the specific combination of control techniques differs greatly depending on each project's needs, no single project controlling system is suitable for all construction project environments. It is essential for all project clients, contractors, and consultants to be knowledgeable about implementing the most appropriate project control strategy, and all projects must meet such requirements. (Pellerin & Perrier, 2019).

Project control aims to ensure that tasks conclude on schedule and under budget and fulfill all project goals. It is a dynamic mechanism that project managers have to handle regularly, including continuously monitoring success, reviewing strategies, and taking corrective steps as necessary (Kenley & Harfield 2015).

According to Nicholas (2015), Over the last few decades, many techniques have been adopted for project schedule control and monitoring, such as the Program Evaluation Review Technique (PERT), Critical Path Approach (CPM), Gantt Bar chart, and Program Evaluation Review Technique (PERT).

A project is a series of tasks with a specific goal in mind. Project management encompasses the different aspects of project preparation, tracking, and control. In project preparation, it involves the specification of work, calculating how much work there will be, and estimating the necessary budget. Project management is the most noticeable field of time and expense management operating together. One of the first-time management tasks is to monitor schedule and layout plans, networking, etc. A somewhat different concept of time management is given by Mackenzie (2018): an ample amount of time allowance for the project over the whole project life cycle, i.e., design, creation, implementation, and ending." planning methods such as time calculation, time management, and control the schedule. Project management needs tools and procedures for estimating project progress reporting. Both the employee and team processes must use the resources to accomplish their tasks (Gopang,

2020).

Harfield and Kenley (2015) undertook a research study for the "Construction Project Management Methodologies and Efficiency Improvement." The research's primary goal was to uncover the different project control techniques companies use to maximize production performance. Using the critical practicality approach for their exploratory study and numeral analysis for data definition, they discovered that project management contributed to project performance and reported various cost and schedule control models that confirm their research findings. As a result, they determined that managing internal and external instability is a central part of every project, which is expected to deliver increased overall project efficiency.

Shanmuganathan and Baskar (2016) conducted another research study to define the efficient time and cost management methods and tools implemented for monitoring construction projects. The study concludes that a time management program has been shown to help track and check when the project is going in the right direction. Their study discovered that methods like forecasting cash flow and planning management of cost are critical for reducing costs. In contrast, techniques like CPM and PERT are the most efficient techniques for managing time in the construction industry.

Thus, this research aims to recognize different monitoring and control strategies and their effect on construction project delivery/success. The case study of the Riyadh Metro is used to accomplish this.

2 Methodology

Riyadh Metro construction project in Saudi Arabia is serving as a primary source for this study. The number of respondents in the survey was 84 members of the metro project's project management team. The respondents include the project Client, Engineer, and Contractor. The research demographic was selected to include only project management team members from construction companies to gather the required information for the study's stated aims.

The Data was primarily derived from the quantitative questionnaire survey method, the main instrument used in the survey. This was

done by using a structured questionnaire constructed according to the study's conceptual framework and administered by the researcher to indicate the degree of the aspect being measured; responses were graded on a 5-point Likert scale to know practitioners' insight. The gathered data were analyzed with descriptive statistics, specifically percentages and the Relative Importance Index (RII).

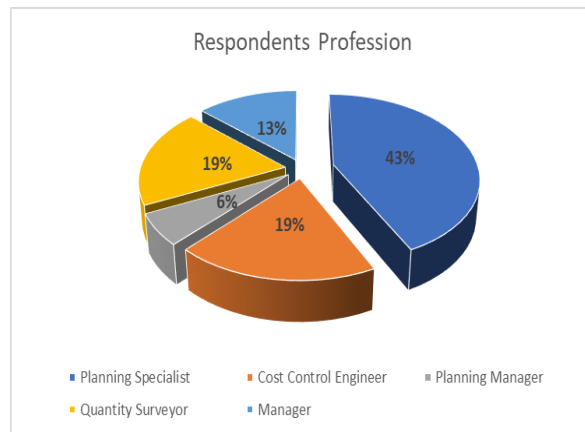


Figure1- Profession

Figure1 shows 43% (36) were Planning Specialist, 19% (16) were Cost Control Engineer, 6% (5) were Planning Manager, 19% (16) were Quantity Surveyor, and 13% (11) were Manager. The Planning Specialist was prominent in this research study.

Figure 2 shows that 18% of the respondents have 6-10 years of experience, 51% of practitioners have 11-15 years of experience, 14% have 16-20 years of experience, and 17% have more than 20 years' experience. Based on this, we can conclude that the respondents have a lot of industry experience in construction.

3 Results and Findings

The questionnaire's first two questions were about practicing profession and about a year of experience in the project control and monitoring field. The following figure 1 shows the results.

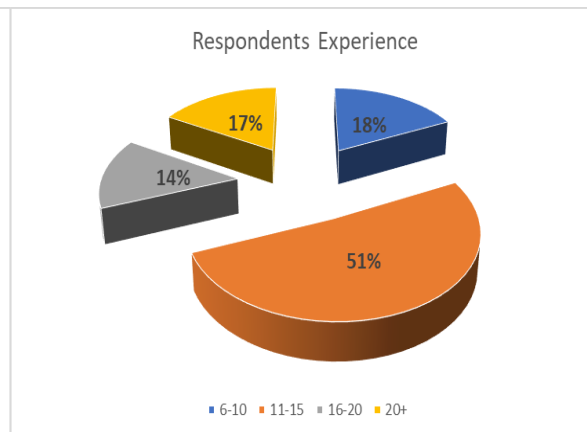


Figure 2- Experience

In this study, the respondent was asked to respond through questionnaire survey monitoring and control techniques on their organization for project progress. The respondent is a member of their organization's project management team and responded to the questions.

3.1 Assessing Time/Schedule Control Technique

The first question was asked about the Schedule monitoring and control method implemented in the organization; the following Table -1 shows the frequency of responses:

Table 1: Schedule Control Technique

Schedule Control technique	Overall					Client Engineer Contractor			
	5-point Likert scale					RII	RII	RII	RII
	5	4	3	2	1				
Critical Path Method (CPM)	36	30	18	0	0	84%	83%	85%	84%
Program Evaluation and Review Technique (PERT)	30	27	23	4	0	80%	78%	83%	76%
Milestone Chart	33	28	22	1	0	82%	82%	82%	82%
Gantt Chart	26	27	20	9	0	75%	76%	79%	69%
Precedence Network Diagram (PND)	26	27	23	8	0	77%	71%	78%	80%

Referring to Table 1, the shows the time control and monitoring methods implemented at the project with relative important index (RII). The practitioner at the project ranked Critical Path Method (CPM) as 1st rank with 84% of RII. In the CPM process, massive project tasks are made easier to navigate. When project deliverable is broken down into a series of smaller activities, success can be assessed, and see whether delays are impending, or resources are being unexploited. It also explains how to use more tools to expedite return to plan by finding other courses or using float and using it to "crash"— or re-date—the driving path.

The 2nd ranks technique in Schedule was Milestone chart with RII equals to 82%. With regards to project timeline variation, the management leadership scrutinizes critical targets. The team looks at events associated with missing milestone completions to determine explanations for real results. Corrective steps are then devised, and a new estimate of work are made for the project manager to carry out.

The RII equals 80% of Program Evaluation and Review Technique (PERT) and ranked 3rd in the list. A PERT diagram permits you to plan out the project's goals. It also helps for any potential consequences or challenges that a project can pose during each goal. Consequently, PERT provides an opportunity to fix or plan to help the project remain on track.

The RII of Precedence Network Diagram (PND) was 77% with 4th rank. In a network diagram, as actions are explicit, it will be easier to see which depends on which activities. During the monitoring, it would be much easier to see in the project network diagram what has been completed and what must be included in the remainder of the project. Lastly, the Gantt Chart technique ranked 5th in the list with RII equals to 75%.

The part of the questionnaire on the schedule technique was on their importance, effectiveness and accurate. The table 2 depicts the responses from the practitioners

Table 2: Assessing Time/Schedule Control Technique

Schedule monitoring and control technique	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	RII
Time/schedule control and monitoring technique are successful at defining critical project activities?	48	29	6	1	0	90%
The monitoring and control technique for the schedule is effective for actual versus planned	39	38	5	2	0	87%
Would you assume that the time/schedule tracking and control methods are successful and accurate in achieving project completion dates?	34	42	7	1	0	86%

Referring to table 2, The respondents answer the question about the effectiveness of the time/schedule control and monitoring method used to categorize the project's critical activities with RII equals to the 90%. However, 57% (48) of respondents strongly agreed, and 37% (29) of practitioners agreed that the method employed is useful, while 7% (7) respondents were neutral or not agree.

In response to the project's success, schedule

control and monitoring method used for monitoring actual against planned progress with RII equals to the 87%. However, 46% (39) of respondents strongly agreed, and 45% (38) agreed to its effectiveness, whereas 6% (5) were neutral, while 2% (1) disagreed.

Lastly, the respondents on schedule monitoring and control technique question the effectiveness & reliability for hitting project completion dates with RII equals to the 86%.

However, 40% (34) strongly agreed, and 50%(42) agreed to its effectiveness & reliability. In comparison, 9% (8) of people were neutral or disagreed.

3.2 Assessing Cost Control Technique

The first question was asked about the Cost monitoring and control method implemented in the organization; the following Table -3 shows the frequency of responses:

Table 3: Cost Control Technique

Cost Control technique	Overall					Client	Engineer	Contractor
	5-point Likert scale					RII	RII	RII
	5	4	3	2	1			
Cash flow forecasting	34	27	22	1	0	82%	82%	85%
Cost Estimating	35	27	22	0	0	83%	83%	84%
Construction Cost Planning and Control	33	29	22	0	0	83%	81%	83%
Earned Value Management	37	30	17	0	0	85%	85%	86%
Cost Reporting	28	25	22	9	0	77%	76%	78%
Cost Coding System	33	29	19	3	0	82%	80%	81%
Judgement	28	27	20	9	0	78%	79%	79%

Table 3 depicts the controlling techniques of cost that were implemented in the project. The practitioner at the project ranked Earned Value Management (EVM) as 1st rank with 85% of RII. By this technique This cost-accounting technique that has been effective in following progress monitoring and reporting on the spending of budget on the tasks. It examines cost, time, and progress on the project all at once.

The 2nd and 3rd rank technique in Cost monitoring and control were Construction Cost Planning and Control also Cost Estimating with RII equals to 83%. Cost planning technique is a critical to the overall project management process. managers must keep an eye on the total project costs in order to balance the resource

demand

The 4th and 5th ranks technique in Cost monitoring and control were Cash flow forecasting and Cost Coding System with RII equals to 82%. Cashflow Forecasting technique will show whether unexpected cash needs time and facts to help manage projects, and it will deal with any issues prior to the cash flow before they emerge. However, Cost coding techniques aids practitioners in determining project costs, which are delegated to separate departments, by separating costs into sections so that they can see what positions or activities have been calculated and how much they've cost in actual expenses compared to the budgeted costs.

Table 4: Assessing Cost Control Technique

Cost monitoring and control technique	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	RII
Are the controlling and monitoring strategies for cost overruns and underruns effective?	46	31	7	0	0	89%
Improvements to a project can be easily tracked and managed using a range of cost-monitoring and cost-control strategies.	42	37	3	2	0	88%

Can you say that project cost management strategies are efficient and successful in keeping projects completed on schedule and under budget?

32 47 4 1 0 86%

According to Table 4, The respondents answer the question about the usefulness of the cost control and monitoring technique used in the project for recognizing possible overruns in the budget. The first question was about the efficiency of the cost control and monitoring technique used in the project to identify possible overruns in the project's cost and RII equals to the 89%. However, 55% (46) of the respondents strongly agreed, and 37% (31) agreed to its usefulness; however, 8% (7) respondents were unsure of the usefulness of cost control and monitoring technique.

The second question on the cost control and monitoring techniques was how tangible are the

3.2 Measuring Project Delivery Controls

Table 5 describes clients' approval and the importance of the controlling and monitoring approach adopted in the research study.

Table 5: Clients' Satisfaction and importance of project monitoring and control

Clients' Satisfaction and importance	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	RII
Clients are immensely satisfied with the above-mentioned project monitoring and control techniques.	36	28	18	2	0	83%
Construction projects necessitate careful monitoring and control for good decisions to be made.	44	32	8	0	0	89%

On the satisfaction of the client's question for monitoring and control technique, the response was 43%(36) Strongly agree, 33% (28) agree, while 24% (20) of the respondent were neutral or disagree and RII was 83%. Similarly, the for the importance of monitoring and control technique question, the respondents choose 53% (44) Strongly agree, 38%(32) agree, while 10%(8) were neutral on the questions and RII was 89%.

4 Conclusion

This research study was conducted on the project management and control protocols that

strategies to improve the project budget controls. The respondent's data shows that RII equals to the 88%. However, 50% (42) strongly agreed, and 44% (37) agreed on the approaches, whereas less than 6% (5) were neutral or did not agree on the listed approaches.

The last question was about the cost control strategies' effectiveness to minimize cost overrun in the project. The respondent's data demonstrates that RII equals to the 86%. However, 38% (32) strongly agreed, and 56% (47) agreed on the listed approach adopted to minimize the overruns, whereas 5%(4) were neutral or not agree.

were employed on the Saudi Arabian construction project. The assessment discovered that the most commonly used method for time/schedule monitoring and control is Critical Path Method (CPM) and Earned Value Management technique (EVM) is adopted for the cost monitoring and control of the project. These techniques help in timely project execution and reduce cost overruns.

Additionally, the outcome of the evaluation that was conducted to evaluate the importance of project monitoring and control for the construction organization on the project shows

that project management is crucial to project implementation and progress. Based on these research findings, it is also advised that construction firms should provide or develop project control and monitoring divisions within their organization, because it is vital for the effective project implementation and completion.

Additionally, construction organizations can also use CPM for time management and EVM for cost management and other appropriate monitoring and control strategies or tools, as expressed in the study. Finally, the focus should be on managing "cost" since it is a very dynamic and fragile part of any project.

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