King Fahad University of Petroleum and Minerals
College of Environmental Design
Department of Construction Engineering and Management

CEM 510: CONSTRUCTION PLANNING AND SCHEDULING

Planning & Scheduling Techniques Used By Saudi Saipem

Submitted to

Dr. Soliman Al-Mohawis

By

Yasir M. Al-Khalifa	**990527**
Abdulrahman Al-Amer	**947618**
Abdulmunem Al-Buali	**923741**
Bathan Al-Shehri	**942061**

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TABLE OF CONTENT

Abstract _____ *3*

Introduction _____ *4*

Contractor's Organization _____ *5*

Contractor's Major Projects _____ *6*

*Project Management Techniques*_____ *7*

Work Breakdown Structure (WBS)_____ **7**

Scheduling_____ **8**

Resources _____ **9**

Budgeting _____ **10**

Project Control and Monitoring _____ **11**

Subcontracting Control _____ **12**

Effectiveness of Saipem Project Management Techniques _____*13*

Conclusion _____*14*

*APPENDIX*_____*15*

Abstract

There are numerous methods being used to plan projects, many of which are old in origin. This study sheds light on the project management techniques (specially planning and scheduling) used by ***Saudi Arabian Saipem***. It explains the process followed by the contractor to achieve a well functioning management system. The study also, discusses the effectiveness of the project management techniques utilized by the contractor.

Introduction

There are numerous methods being used to plan projects, many of which are old in origin. Most persons are acquainted with the type of schedule which is prepared by management and consists basically of a list of dates on which certain items are to take place or to be completed. Most are familiar with the Gantt chart which supplies additional information by showing the beginning and ending of each portion of the work as well as the total scope of the project. The decision concerning the method to be used for the planning of a project rests with the project manager, or planner, and the supporting staff. Success or failure depends in large part upon the knowledge of available procedures and the ability to choose the method which will be of maximum benefit to the company. Whatever choice is made for planning the project the decision will involve gathering as much information as possible on the following items: materials, equipments, manpower, money, and time.

This study sheds light on the planning and scheduling techniques used by a construction contractor performing projects locally (within Saudi Arabia). The targeted contractor is ***Saudi Arabian Saipem*** which is affiliated with the mother company ***Italian Saipem***.

An interview was conducted with the regional Project Director, Deputy Projects Director, Construction Manager, and scheduling engineer to discuss the following subjects:

- The projects the contractor has built; their type, size, cost, and location.
- Management techniques used for planning, scheduling, and control.

The purpose of the interview was to answer how does the contractor manage his projects? What techniques is he using? Why is he using these techniques? And how effective are they?

Contractor's Organization

Saudi Arabian Saipem is headed by a regional Project Director (Mr. R. Fregoni) who acts as a Chief Executive Officer (CEO). He is responsible for all company projects performed within the Kingdom of Saudi Arabia. A QA/QC manager, a safety & environmental engineering manager, and a Deputy Projects Director (Site Manager) report directly to the Project Director.

The Deputy Projects Manger (Mr. A. Palma) utilizes the Security Manager, Subcontracting Administration Manager, Logistics Manager, Commissioning Manager, Training Manager, Project' Material Coordinator, Personnel Manager, Site Control Manager, Site Administration Manager, and the Field Engineering Manager to ensure that all required resources (Material, Equipment, Labors, Subcontracting, Purchasing….) are available for the Construction Managers to complete their projects with minimum cost and duration.

The Construction Manager employs Site Superintendents from different disciplines to manage the daily construction activities. (Refer to appendix for a schematic organization chart). He coordinates daily with the Site Control Manager to update him about the daily progress and to forecast upcoming activities. They also, identify any problem areas which may require corrective action or higher management involvement.

Contractor's Major Projects

Saudi Arabian Saipem has completed many projects within the Kingdom since 1991 under different contractual agreements (Lump Sump Turn Key, Lump Sum, and Unit Rate). All of the completed projects were industrial plants, pipelines, or well sites constructed for different clients as Saudi Aramco, SCECO, and SWCC. The projects' values ranged from $ 8,000,000 to $ 224,000,000. (A list of the projects is attached in the Appendix.)

The major projects Saudi Arabian Saipem is currently working on are the Khuff gas projects which contain construction of gas well sites, flow lines, gas remote headers, and manifolds. In addition to those projects, Saipem is the general contractor for Saudi Aramco in the project of shifting the 36 inches natural gas pipeline to crude pipeline; the contract value of this project is $44,000,000.

Project Management Techniques

A project is born once estimated, and upon award becomes its own entity. At that time a Project Management Team which comprises of a Project Manager, Construction Manager, Cost Control Engineer, Planner Engineer, Quality Manager, Safety Coordinator, Material Specialist…etc is formed and assigned the responsibility of managing the project and completing it within schedule and with minimum cost. From there, the project can follow many paths, and delays could occur because of many things.

Saipem employs a number of well established project management techniques. Below is a list of those techniques and why they are used:

Work Breakdown Structure (WBS)

Saipem uses the Work Breakdown Structure (WBS) technique to organize and comprehend projects by breaking them into progressively smaller pieces until they are a collection of tasks or work packages depending on the nature of the project. The WBS is not a work schedule; it does not contain any information as to when or in what order or precedence tasks will be accomplished.

Subsequent to breaking down the project into pieces, those pieces are organized in a logical sequence depending on how compatible the work will be done and how cost and schedules will be managed.

Successful WBS's are built as an iterative process by examining a project's goals, deliverables, constraints, and technical attributes. In addition to identifying the project deliverables, the WBS should also identify activities related to the management of the project. These include tasks related to project startup, management, and closeout. For example, the WBS should include testing and quality assurance activities; it should also include items necessary for the successful pursuit of project tasks as obtaining legal permits.

Why use WBS?

The intent of WBS development is to keep performance measurements at a reasonable technical data information level using common sense. Moreover, WBS is often the source for project Gantt charts, which are used to establish a work schedule. By breaking tasks down to their granular level, you can see exactly what work is necessary to hit a project milestone.

WBS is used to identify the functional pieces of the current system and areas for improvement. Then, the areas that need improvement are developed into a project plan.

Scheduling

Saipem uses the WBS and the sequence of the activities to develop a comprehensive network of the project's activities. They utilize their historical productivity records to establish the required time and resources (manpower and equipment) to complete each activity in the network.

Upon completing the network and activities duration, the Critical and the Secondary Critical Paths are identified (contractor uses the CPM to manage projects' schedules).

CPM schedules and bar charts are being used by Saipem for developing three schedule levels: summary schedule (less than 100 activities), detailed schedule (between 100-5000 activities), and look ahead schedules (less than 30 activities). All schedules are updated weekly.

Why use CPM?

- It logically determines activities that should be adjusted (time and logic) to complete the project on time.
- It pinpoints trouble spots before they occur
- It provides selectivity of important activities to control

Resources

Based on the developed project schedule, the scheduler determines the required resources throughout the project's duration to achieve the completion data required by the owner. Then, he passes on the requirements to the construction manager who - in his part - coordinates with the projects control manager to ensure that the needed resources are available. If there is a lack of resources, the schedule completion date is looked into and the activities are shifted according to the available resources. If that exercise does not solve the problem, the issue gets raised to the Deputy Projects Director and the Projects Director who take immediate action to acquire the additional manpower required.

On the other hand, and because Saipem is a well established contractor in its field, available equipment are usually sufficient to cover progressing and new projects. Only a minor amount of small inexpensive equipment is required for a new project. Furthermore, special equipment needed for special and limited activities which are too expensive to own, are usually rented from local or international agencies.

Another part of resources, which requires excessive planning and forecasting, is material procurement. Saipem dedicates a Material Engineer and a Site Material Controller for each project. They are responsible for the acquisition and planning for the material to be on site when it is needed according to the schedule. Material coordination is considered vital to any project because any shortcoming could cause a drastic delay of the project.

Furthermore, it is the duty of the Project Control Manager to insure that all required resources are available for each project the company is performing. He is, also, responsible to ensure that all available resources are utilized to minimize stand-by-time of equipment and personnel which minimized overhead to the company. This is done by leveling the required resources not only for one project but for all the projects of the company.

Why level resources?

- Minimize manpower and equipment stand-by-time.
- To have the required resources when they are needed to avoid delaying planned activities.

Budgeting

The project schedule and distribution of resources allow the Cost Engineer to calculate the amount of overdraft required by the project. Then, the Projects Control Manager ensures that there are sufficient funds from within the organization to cover the required overhead. In the case of large projects, the company may resolve to taking loans from banks to cover the difference between outflows and inflows of money (overdraft).

Why control budget?

- Identify the cash flow; income and expenses at any given time.
- It is a critical factor for the success of the company.
- Identify activities which consume more than the estimated cost. This helps to determine causes of success or failure of the project.
- Establish a benchmark for future estimation purposes.

Project Control and Monitoring

Field reports are sent daily from Site Superintendents to the Project Manager, Scheduling Engineer and Cost Controller to highlight the daily progress and any problems that were faced or expected to be faced in the near future, which might affect the project's progress or cost.

The Scheduling Engineer inputs the daily progress and compares it to planned progress. Further, he identifies any deviation from schedule and verifies that the Critical Path has not shifted. A report containing the analysis of the daily progress, a list of critical activities in progress, and a list of activities expected to be completed or started in the coming seven days is then printed and distributed to the Construction Manager, Site Superintendents, Cost Controller and Material Engineer.

A construction progress meeting is held on weekly basis among the parties involved in the project (i.e. Contractor's Construction Manager, Scheduler, Project Management Team, and Client). In this meeting, a weekly progress report is distributed by the Scheduling Engineer and reviewed by all parties. This report highlights the progress achieved during the past week, the planned activities for the coming week, and the cumulative progress up-to-date. Special emphasis is put on the critical activities in progress and those which are expected to start in the coming week. (See attached sample)

In this meeting, the contractor's performance and trouble spots hindering the project's progress are reviewed. Then, a joint action plan is established to tackle and eliminate trouble spots and to maintain or accelerate the completion date of the project.

The Scheduling Engineer is also responsible for producing a less detailed progress report intended for updating the upper management of both the contractor and the client about the progress of the project. (See attached sample)

The cost engineer utilizes the daily/weekly/monthly progress report to calculate the actual cost for each activity. He produces a report containing the actual vs. planned cost and the current project's productivity indexes and sends it to the Construction Manager and the Project Control Manager. The productivity indexes are then compiled and archived in the company database for future estimating purposes.

Why monitor?

- To compare planned vs. actual man-hours and manpower histogram.
- To provide actual project progress to concerned parties.
- To identify efficiency and productivity.
- To determine actual cost information reports to higher management.
- To submit accurate invoices and track payments.

Subcontracting Control

Subcontracting is an evident part of any construction project. However, it may lead to unexpected delays which might shift the critical path. Therefore, Saudi Saipem has developed a long-term partnership (TQM Technique) relationship with local contractors to assist in completing projects. Saudi Saipem utilizes those contractors to perform pre-specified activities such as paving and concrete work. Saipem requires all of its subcontractors to apply the previously mentioned project control techniques and it closely monitor their control systems and progress.

Why control subcontractors?

- To ensure that the subcontractor will finish his activities as per schedule.
- To control the quality of subcontractor's performed work.
- To control the cost and invoices paid to the subcontractor.
- To fulfill the client's requirements (e.g. quality, schedule).

Effectiveness of Saipem Project Management Techniques

The success of any construction contractor depends mainly on its ability to plan, schedule, and control the projects on hand. This study shows that Saipem is implementing a project control system which routinely collects and records the information from the start of the project. At each reporting period the actual status is compared to the planned status so that the necessary corrective actions can be taken. As the information is accumulated, a trend analysis is performed to identify any deviations from the plan and to make forecasts of future budgets and schedules. A trend analysis allows the evaluation of productivity and variances in cost and schedule.

A formal process for measuring progress in the field is used to determine the amount of work in place, which is expressed as a percentage. The percent complete on an activity is determined by units completed or by an incremental milestone. The earned value approach is then utilized to determine the overall percent complete. This will drag the management's attention on potential cost and schedule trouble spots in-time for corrective action to be taken. Also, those processes are providing an analysis of the project and its week links that could lead to failure and build a set of success indicators that indicate risky situations.

Saipem is involving cost and schedule personnel, subcontractors, and suppliers early in the project, together with getting input of all team members enhances effective cost and schedule control. This early involvement of project players eliminates any ambiguities or misunderstandings related to scope, budget, and schedule.

Experience with Saipem and analysis of their Project Management Techniques (based on interview made with contractor's personnel) proved that their system is very effective in controlling the complex nature of construction projects.

Conclusion

Saipem is a very well establish international construction contractor who has implemented state of the art project management techniques. All the projects completed for Saudi Aramco throughout the past twelve years were within schedule.

Review of the scheduling technique used by Saipem showed that they have a strong system in-place. It is capable of breaking any project into small manageable activities, scheduling those activities in a logical order, and monitoring and controlling the actual progress of those activities.

APPENDIX