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Time Overrun and Cost Effectiveness in the Construction Industry

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ABSTRACT
The project management technique of planning and scheduling using tools and devices are helpful in comparing the project with stipulated cost, time and quality. Resource tracking, Minimize the uncertainty and Cost Effectiveness is focused in this project. The software tool used for planning and scheduling is Primavera project planner enterprise for construction. The study covers three case studies of the process of planning, scheduling the activities and monitoring. A general re sequencing model had been proposed to overcome the delay factor from the critical area, to minimize the delay of the construction and to reduce the time, cost and it also helpful to concentrate on the major areas in the project. Re sequencing model leads the management to cost savings and make entire project success. Resource planning is one aspect, which decides the systematic execution of the project at worksite. This study is to have hands- on experience in an ongoing project, and evaluation of schedule of equipment, staff, Labor and Materials. It helps to plan and evaluate the resources for the Construction of the building project. This study also compares the cost variation due to the delay of the project and re scheduling the project by crashing process.
KEYWORDS: Time Overrun, Cost Effectiveness, Construction Industry

I. INTRODUCTION

Project management is the art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of scope, cost, time and quality and participants satisfaction. The construction industry is usually very large, complex and different from other industries. The industry needs much investment and involves various types of participants

One of the most common activities in the management is planning. Creating the project plan is the first thing you should do when undertaking any kind of project. However, many people fail to realize the value of a plan in saving time, money, and many problems. The project management techniques of planning and scheduling are tools and devices, which are used to compute the project.

The completion of a construction project requires the judicious scheduling and allocation of available resources. Man power, money, equipment, and material are important project resources that require close management attention. The supply and availability of these resources close seldom be taken granted because of seasonal shortages, labor disputes, cash flow, equipment breakdowns, completing demands, delayed deliveries, and a host of associated uncertainties.

1.1 PROJECT PLANNING

Project planning is part of project management, which relates to the use of schedule such as Gantt charts to plan and subsequently report progress within the project environment. Initially, the project scope is defined and the appropriate methods for completing the project are determined. Project planning is the process of identifying all the activities to successfully complete the project. At this stage, the project plan may be optimized balance between resource usage and project duration to comply with the project objectives.

Project planning involves a series of steps that determine how to achieve a particular community or organizational goal or set of related goals. This goal can be identified in a community plan or a strategic plan. Project plans can also be based on community goals or action strategies developed through community meetings and gatherings, tribal council or board meetings, or other planning processes. The planning process should occur before you write your application and submit it for funding. Computer based integrated tool for the project management of building construction is developed and is very useful for the cost monitoring of the project through BOQ item wise and at the same time it will facilitate time monitoring in terms of activity wise. Planning decisions will influence:

- The overall strategy of how the work process is to be broken down for control.
- How the control is to be managed (staff resources)
- Design, and sub-contract packages, including what methods are to be used for design, procurement and executing the work
- The interface between the various participants, their work methods and safety
- Costs and quality issues
- Time to complete and sequencing including the zones of operation and their interfaces.

Project planning directly integrates with risk and opportunity management. The objective of maximizing the efficiency of the project strategy with respect to cost and time has to be balanced against the risks associated with new methods of working and the overall quality of the finished deliverables.

1.2 PROJECT SCHEDULING

Scheduling is the laying out of the project activities along a time sequence in which they are to be performed so as to assign the starting and finishes dates to various activities and to allocate resources to them. The schedule is the final product of scope, definition, budgeting, planning and forms the base against which all activities are measured. Project tracking and control cannot be accomplished without a good plan and schedule.

By preparing construction project scheduling in advance, you, the owner builder, are able to schedule subcontractors and materials deliveries so that the proper sub and the necessary materials arrive when they are needed, which in turn will allow you to save time, money, and hassle. Construction project scheduling could more aptly be called Construction Schedule Planning as this is where the plan is crafted. It simply shows the sequence of building activities (which activity follows which activity) and which ones can be going on at the same time.

1.3 DELAY OF PROJECT

In construction, delay could be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rent-able space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labor cost increases.

Completing projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources. These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. However, it is rarely happen that a project is completed within the specified time.

One of the most important problem in the construction industry is time and cost overruns. Time and cost overruns occur in every construction project and the magnitude of these delays and cost overruns varies considerably from project to project. So it is essential to define the actual causes of time and cost overruns in order to minimize and avoid the delays and increasing cost in any construction project. This chapter reviews literature concerning the major issues of time and cost overruns in order to recognize the related information regard those issues.

1.4 TIME OVERRUN

Time overruns is defined as the extension of time beyond planned completion dates traceable to the contractors. Delays are incidents that impact a project's progress and postpone project activities, delay causing incidents may include weather delays, unavailability of resources, design delays, etc. In general, project delays occur as a result of project activities that have both external and internal cause and effect relationship.

1.5 COST OVERRUN

Cost overrun is defined as excess of actual cost over budget. Cost overrun is also sometimes called "cost escalation," "cost increase," or "budget overrun." Cost overrun is defined as the change in contract amount divided by the original contract award amount .This calculation can be converted to a percentage for ease of comparison.

1.6 TYPES OF DELAYS

Owners and contractors have one common objective: To complete the project in Time and within Budget. It is failure of this objective of Time which leads to failure of Budget and ultimately gives rises to Disputes. "Time" is indicated invariably as of essence to the contract. There are circumstances compelling extension of time which is granted but time does mean money. It is when the question of money as compensation comes up, there come up several disputes.

II. NEED OF THE STUDY

Much of the project scheduling literature treats task durations as deterministic. In reality, however task durations are subject to considerable uncertainty and that uncertainty can be influenced by resources assigned.

Due to the complexity of projects, resource allocation and levelling are among the top challenges in project management. The purpose of this study is

to optimally allocate the resources among individual tasks for a construction project.

III. METHODOLOGY

The methodology adopted includes a practical real- time work made to explore the general system followed in the construction industry and also different. The purpose is to explore the real-time approaches for resource planning and tracking the project.

IV. CASE STUDY I

It is the second largest rolling machine foundation in Asia. It can Roll sheet thickness up to 220 mm. This site is located in Sohar Industrial Port Area, Sultanate of Oman. It is constructed inside the existing L & T Heavy Engineering work shop. The site is located near to the L&T Jetty here the water table is about -4.5 m level and have to excavate up to a depth of -9.50 m level. To control the water table during the construction time we installed deep well system. Six numbers of bore wells are installed for continuous dewatering. To protect the reinforcement from chloride attach epoxy coated reinforcements are used. Proper schedule have prepared to complete the project on time due to the complexity of the project.

4.1 CAUSES OF DELAY OF PROJECT

- Delay in installation of dewatering system.
- Confined Space for material handling.
- Unavailability of Epoxy coated reinforcement.
- Hot weather effect on construction activities
- Late procurement of materials.Changes in Drawings.
- Relocating existing utility services.
- Material Handling issues due to unavailability of overhead cranes.
- Conflict between contractor & client.
- Changes in material specification.
- Additional scope of works.
- Changes in drawings.
- Labor Strike.
- Delay due to Accident.
- Shortage of skilled labors.

4.2 METHODS ADOPTED TO OVERCOME DELAY

- Overtime Work.
- Implementing proper inventory control system.
- Proper planning & scheduling for the work.
- Reducing Delays on critical activities.
- ABI requested to provide additional storage space for handling the materials.
- Implementing quality management system for the work.
- Arranging Skilled labors.

V. STEPS IN PRIMEVERA

5.1 Enterprise Project Structure (EPS)

It is a hierarchal structure that company- wide projects and enables organizing and management of those projects

5.2 Work Break Structure (WBS)

A WBS is a hierarchal arrangement of the products and services produced during and by a project. The project is the highest level while an individual activity is the lowest level. Each project in the EPS has its own WBS.

5.3 Creating a Calendar

The calendar can create and assign it to each activity. These calendars define the available work hours in each calendar days. Also specify national holidays, organizations, project- specific work/ non-work days, and resource vocation days.

5.4 Adding Activity.

Activities are the fundamental work elements of a project. They are the lowest level of a work break down structure. (WBS), and as such, are the smallest subdivision of a project that directly concerns the project manager.

5.5 Assigning Relationship

A relationship defines how an activity relates to the start to finish of another activity or assignments. Add relationship between activities to create a path through the schedule from the first activity to the last activity.

5.6 Adding Resources.

Resources include the personnel and equipment that perform work on activities across all projects. Resources are generally reused between activities and /or projects.

VI. RESOURCE PLANNING

6.1 Planning Construction Labour

The project manpower planning primarily focuses on determining the size of the project workforce, its structuring into functional groups and worker's team and scheduling the manpower. To determine the number of workers needed to perform a given job in the specified time, data- wise forecasting of the workers requirements for accomplishing the project work, and finally, organizing the planned work.

6.2 Planning Construction Materials

The construction materials involves identifying the material required, estimated quantities defining specifications, forecasting requirements, locating sources for procurement, getting material samples approved and designing materials inventory and development the procurement plan to ensure a smooth

flow of materials till the connected construction works are completed at the project site.

6.3 **Planning Construction Equipment**

Construction equipment is indispensable in the execution of modern high cost, time – bound massive construction projects. It saves manpower, which is becoming ever more costly and demanding. It improves productivity and quality. Equipment planning for a project aims at identifying the construction tasks to be undertaken by mechanical equipment

VII. RESOURCE CALCULATIONS

7.1 Schedule of staff requirements

This schedule assists the head quarters resource department, regional and project team in mobilization in time, required staff fir the project and if necessary in planning new recruitment. It also forms the basis of action plan for demobilization. Here the schedule of Labor requirement for three case studies is tabulated.

7.2 Schedule of Requirements for Plant and Machinery

This schedule will help in mobilizing in time required plant and machinery from his own/hire as also in planning and procurement of new items. It will also the basis of the action plan for demobilizations. Here the schedule of plant & equipment requirement for three case studies is tabulated.

7.3 Schedule of Labour Requirements

This Schedule will help in stage wise mobilization of labour, particularly skilled workmen like Mason, Carpenter, Bar bender etc. and in ensuring that there are no abnormally high peaks or through in labour requirement resulting. The various labour required for the three case studies is tabulated.

7.4 Schedule of Material Requirement

This schedule will indicate approximately the total quantity of all essential materials (such as aggregates, cement, structural and reinforcement steel, formwork materials, timber etc) to be produced. Ensure sufficient lead-time for procurement of materials at best possible prices/ terms and avoid emergency purchases. Complete material requirements month wise for each items as per breakup of quantities. Here the schedule of material requirement for the three case studies is tabulated.

VIII. FACTORS AFFECTING PRODUCTIVITY

Productivity is a term that has a number of different meanings. Although it is most commonly associated with labour effectiveness in industry, in a broad sense productivity is the ratio of output to some or all of the resources used to produce the output. Productivity =output/input. Labour productivity may be defined as "output per unit of time" or "output per labour hour".

Labour productivity = units produced / hours of work.

Capital productivity = output / capital input

Material productivity = output / materials input.

The computation of production efficiency factors depends upon numerous variables, which affects productivity under actual job condition at the site. These variables vary from project to project and with place and time. Some of the typical factors affecting the productivity efficiency are given below.

8.1 Work Complexity

A simple, familiar work is easier to execute than unfamiliar, complex work.

8.2 Repetition of Work

While the first time execution of an unfamiliar works needs extra effort and results in low output, the skill acquired in the process, when utilized over a period of time to execute similar works, improves the productivity rate, especially when the crew of workers is the same.

8.3 Quality Control

Sensitive projects, like the construction of nuclear reactor calls for stringent quality control demands frequent inspections which involve elaborate documentation and are time consuming. They increase the non-productive time of the workers.

8.4 Equipment Intensive Tasks

The construction task that can be performed wholly or partly with equipment include excavating, handling, transporting, filling, compaction, grading ,hoisting, fabricating, pre-casting, erecting, plastering, finishing, paving, trenching, cable laying, pipe laying and so on.

The construction equipment executes work speedily. The equipment intensive tasks are less susceptible to productivity changes than the labour-intensive ones.

8.5 Supervision

A supervisor manages his assigned technical work as well as the workers under him. The accomplishment of task economically and on schedule mostly depends upon the competence of supervisor, which in turn, affects the workers' productivity. An efficient and effective supervisor can get a higher productivity from workers.

8.6 Climatic and Weather Conditions

Generally, under average weather conditions, with temperature varying from 40-70 degrees Fahrenheit and relative humidity of 60%, workers continue working at the same productivity level. But, extreme weather condition and seasonal changes, like extreme hot or cold climate, high humidity and strong winds and rains affect both productivity as well as the work performance.

8.7 Labour Availability

Labour productivity also depends upon the employment opportunities available in the market. If jobs are in plenty and labour is scarce, labour productivity tends to become less. During a slum in the construction market, labour is easily available while there is a dearth of jobs. In such situations, employers can afford to be selective, as hiring and firing of workers become easy. In a scarce job situation, the overall productivity improves, since the employers can then select suitable labour.

There is also a tendency among labour to move to high-value, large-sized projects, since they offer them longer service, better job opportunities and more stability.

8.8 Role Management

Project management has a key in planning and controlling productivity. It is responsible for specifying the weekly target of work to be accomplished by the workers as well as how the work is to be executed and using which resource. Productivity is bound to suffer if the management fails to fulfil its role and obligation effectively and fails to conduct pre-work preparation.

IX. RESULT

9.1 Schedule comparison for duration (case studies 1)

Planned duration is 169 days and Actual duration is 195 Days. Totally 26 days delayed from the planned schedule i.e. 15.38 %. The schedule comparison for duration for case study 1 as shown in Fig. 9.1

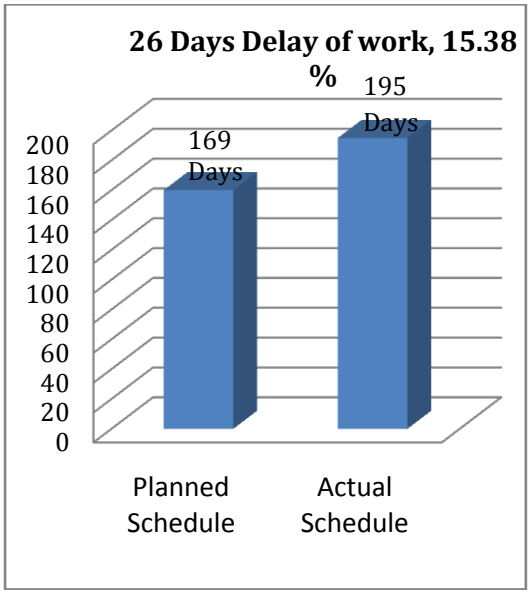

Fig. 9.1 Schedule Comparison for Duration (Case studies 1)

9.2 Schedule Comparison for Cost (Case studies 1)

Planned schedule cost is RO 150,901. During execution of the work, the cost is increased to RO 181,134 (19.37%). The schedule comparison for cost for case study 1 as shown in Fig 9.2

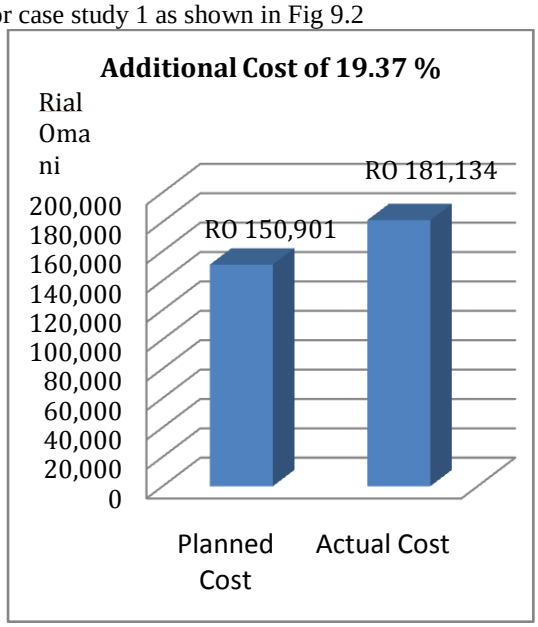

Fig.9.2 Schedule Comparison for Cost(Case studies 1)

X. CONCLUSIONS

- The Project Study was carried out to have an overall view of the case study of project and find out the deviation in scheduled against Planned Schedule.
- The Planning, Scheduling and Updating was done for the remaining activities using Primavera P6 software.

- For the purpose of planning, the project were split up in to Macro level (i.e) work break down structure and Micro level, in this the activities were prepared under WBS and also defined a separate project calendar for this case study.
- The Predecessors and Successors were also defined for each activity.
- The Duration of the activities were calculated by considering the available limited of resources and quantity of work to be done, the quantum of work for each month was prepared with the help of Bill of Quantities (BOQ).
- After Creating the activities the resources were loaded and reduced the peak hour allocation of resources by smoothening i.e., called resource leveling.
- This Project helped me to have a comprehensive study about the project planning and resource planning for various construction activities to use the software Primavera P6.

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