Planning, Scheduling and Resource Management for Residential real estate project in Ahmedabad by using Microsoft Project

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Abstract **- Project management is a process of planning organizing and managing activities and resources to accomplish a defined objective within constraints on time resource or cost. It is very common to see project failing to achieve its mission within specified time and cost. The factors contributing to overrun are inadequate project formation, poor planning for implementation and lack project management during project execution but the main cause of failure can be attributed to cost estimation failure and management failure. Project controlling uses the data from monitor activity to bring actual performance to planned performance.**

Keywords **– project management, planning, organizing, controlling**

I. INTRODUCTION

Construction is one of the biggest industries in the world today and it employs individuals from various disciplines and backgrounds. Depending on the size of the project, whether it be an office building or a skyscraper; thousands of people may be involved, which obviously requires a quite a bit of planning.

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 participation satisfaction.

The basic ingredients for a project management framework may be represented schematically in Figure 1.

A working knowledge of general management and familiarity with the special knowledge domain related to the project are indispensable.

Supporting disciplines such as computer science and decision science may also play an important role.

Modern management practices and various special knowledge domains have absorbed various techniques which were once identified only with the supporting disciplines.

Similarly, many operations research techniques such as linear programming and network analysis are now widely used in many knowledge or application domains.

A project is a finite endeavor (having specific start and completion dates) undertaken to create a unique product or service which brings about beneficial change or added value. This finite characteristic of project stand in sharp contrast to processes, or operations, which are permanent or semi-permanent functional work to repetitively produce the same product or service. In practice, the management of these two systems is often found to be quite different and as such requires the development of distinct technical skills and the adoption of separate management philosophy, which is the subject of this article.

The primary challenge of project management is to achieve all of the project goals and objectives while honoring the project constraints. Typical constraints are scope, time and budget. The secondary – and more ambitious – challenge is to optimize the allocation and integration of inputs necessary to meet pre-defined objectives. A project is a carefully defined set of activities that use resources (money, people, material, energy, space, provisions, communications, motivation, etc.) to achieve the project goals and objectives.

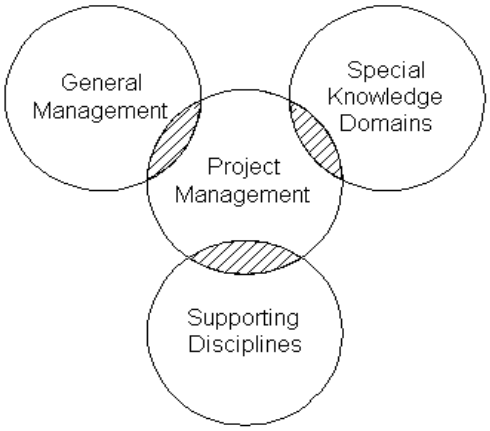

Figure 1 Basic Ingredients in Project Management

II. MICROSOFT PROJECT

Microsoft Project is a software application sold by Microsoft that provides project management tools to manage projects. The program, which has many different versions, allows users to:

- Understand and control project schedules and finances.
- Communicate and present project information.
- Organize work and people to make sure that projects are completed on schedule.

Advantages of Using Microsoft Project

- Familiar and intuitive.
- Save time and effort.
- Flexible and powerful.
- Control and deliver.
- Evaluate possibilities.
- Collaborate with others.

III. INTEGRATED PROJECT MANAGEMENT

The prime objective of an Integrated Project Management and Control System (IPMCS) is to ensure the completion of projects within the stipulated cost and time and of requisite quality.

The present day large projects involve:

- Very high capital
- Sophisticated technology
- Long time spans
- Thousands of activities
- Complex sequence events

The managements of these projects require management of various functions and areas like:

- Financial resources
- Human resources
- Engineering
- Contracts & materials
- Environment
- Construction

According to Hai (1996) each of the discipline mentioned above may have independent detailed project management system to achieve their functional objectives. These functional objectives may not be totally in line with the overall objective of commissioning projects on time, within the estimated cost and quality standard will be an impossible task. Implementation of a project is a joint venture of the owner, the government agencies/financing institutions and hundreds of vendors in India and abroad, whose efforts have to be integrated in a controlled and logical sequence for successful and timely completion of the project.

IV. CONSTRUCTION PLANNING

Construction planning is a fundamental and challenging activity in the management and execution of construction of construction projects. It involves the choice of technology, the definition of works tasks, and the estimation of any interactions among the different work tasks. A good construction plan is basis for developing the budget and the schedule foe work. Developing the construction plan is a critical task in the management of construction, even if the plan is not written or otherwise formally recorded. In addition to these technical aspects of construction planning, it may also be necessary to make organizational decisions about the relationships between project participants and even which organization to include in a project. For example the extent to which sub-contractors will be used on a project is often determined during construction planning. Comprehensive Construction Management practices with latest tools & techniques available can be of great help in reducing

cost, eliminate wastage, and manage finances and family to increase profitability of the project. Housing construction projects involves number of equipment, fluctuating labour requirement s, various materials and complex cash needs. This scenario again becomes more complex due to dynamic nature of housing projects which makes all parameters changing time to time with changing internal-external environment. There is intense need to work out integrated program which connects planning, scheduling and other changing external parameters with resource management. This will help in not only forecasting the needs but also to control the project in the favor of developer's aims of time, cost and quality.

Construction planning involves:

- Basic Concepts in the Development of Construction Plans
- Choice of Technology and Construction Method
- Defining Work Tasks
- Defining Precedence Relationships Among Activities
- Estimating Activity Durations
- Estimating Resource Requirement for Work Activities

V. SCHEDULING

Preparation of schedule for a project gives a definite idea about the project time, budget, resource needs for the projects. It helps in providing a reference against which the progress of the project can be tracked. Following are the steps involved in scheduling of projects:

Defining work Tasks

At the same time that the choice of technology and general method are considered, a parallel step in the planning process is to define the various work tasks that must be accomplished. These work tasks represent the necessary framework to permit scheduling of construction activities, along with estimating the resources required by the individual work tasks and any necessary precedence or required sequence among the tasks. The terms work 'tasks' or 'activities' are often used interchangeably in construction plans to reefer to specific, defined items of work. In job shop or manufacturing terminology, a project would be called a 'job' and an activity called an 'operation', but the sense of the terms is equivalent. The scheduling problem is to determine an appropriate set of activity start time, resource allocation and completion times that will result in completion of the project in a timely and efficient fashion. Construction planning is the necessary fore-runner to scheduling. In this planning, defining work tasks, technology and construction method.

Defining Precedence Relationships among Activities

Once work activities have been defined, the relationships among the activities can be specified. Precedence relations between activities signify that the activities must take place in a particular sequence. Numerous natural sequences exist for construction activities due to requirements for structural integrity, regulations, and other technical requirements. For example, design drawings cannot be checked before they are drawn. Diagrammatically, precedence relationships can be illustrated by a network or graph.

More complicated precedence relationships can also be specified. For example, one activity might not be able to start for several days after the completion of another activity. As a common example, concrete might have to cure for several days before formwork is removed. This restriction on the removal of forms activity is called a lag between the completion of one activity and the start of another activity. Many computer based scheduling programs permit the use of a variety of precedence relationships.

VI. WORK PACKAGE SCHEDULING

A work package is a sub-element of a construction project on which both cost and time data are collected for project status reporting. All work packages combined constitute a project's work breakdown structure.

Choo, Ballard and Zabelle (1999) state that work packaging is a planning process that requires detailed understanding of the scope of the work and constraining factors. In order to systematically track constraint that may prevent the successful execution of work packages, each work package's scope needs to be defined clearly. A work package defines a definite amount of similar work to be done often in a well-defined area, using specific design information, material, labour, and equipment, and with prerequisite work completed. Grouping similar work allows a continuous flow of resources to be archived by moving crews from one area to the next.

This systematic approach helps the user create quality work plans and learn from understanding reasons for failure. A work package has constraints that must be satisfied in order for it likely to be carried out successfully and without interruptions. Information regarding these constraints is equally important as the early and late start and finish date, as well as the cost of an activity. Since constraints are specific to each work package, they should be tracked as a part of the work package information. These constraints are categorized in 5 types as constraints on contract, engineering, material, labour, equipment and prerequisite work.

Table. Summary of Construction Schedule model

(1)	Traditional CPM (2)	Time/cost tradeoff (3)	Limited resource allocation (4)	Unlimited resource leveling (5)
Objective	Feasibility project deration	Minimum project cost	Minimum project duration	Minimum variation of resource profile
Cost	Not considered	Considered	Not considered	Not considered

Resource information	Not considered	Not considered	considered	Not considered

Source: Choo Ballard and Zabelle (1999)

VII. RESOURCES

Resources are classified mainly in following categories-

1. Non-storable or renewable resource – The resources which remain unused in some period cannot be carried over to augment the availability in later periods. For these resources the constraints on availability are concerned with total usage at any period of project deration. Resources like manpower, machines, equipment's etc. fall in this category.

2. Storable resources – The resources which can be stored for a period and can be used later on when need arise are called storable resources. When there is constraint on availability of resources for which total consumption during the entire project is of concern, such resources are termed as non-renewable resources. However for some resources there are constraints over the entire project duration. Such resource are termed as doubly constrained resources.

Resource Requirements for Work Activities

In addition to precedence relationships and time durations, resources requirements are usually estimated for each activity. Since the work activities defined for a project are comprehensive the total resources required for the project are the sum of the resources required for the various activities. By making resource during the course of the project can be identified. Potential bottlenecks can thus be identified, and schedule, resource allocation or technology change made to avoid problems.

Many formal scheduling procedures can incorporate constraints imposed by the availability of particular resource. For example, the unavailability of a specific piece of equipment or crew may prohibit activities from being undertaken at a particular time. Another type of resources is space. A planner typically wills schedule only one activity in the same location at the same time. While activities requiring the same space may have no necessary technical precedence, simultaneous work might not be possible. Computational procedures for these various the estimation of required resources.

The initial problem in estimating resource requirements id to decide the extent and number of resources that might be defined. At a very aggregate level, resources categories might be limited to the amount of labour (measured in man-hours or in dollars), the amount of materials required for an activity, and the total cost of the activity. At this aggregate level, the resource estimates may be useful for purpose of project monitoring and cash flow planning. For example, actual expenditures on an activity can be compared with the estimated required resources to reveal any problems that are problems that are being encountered during the course of a project.

Resource levelling

In project management, resource leveling is defined by A Guide to the Project Management Body of Knowledge (PMBOK Guide) as "A technique in which start and finish dates are adjusted based on resource constraints with the goal of balancing demand for resources with the available supply.

When performing project planning activities, the manager will attempt to schedule certain tasks simultaneously. When more resources such as machines or people are needed than are available, or perhaps a specific person is needed in both tasks, the tasks will have to be rescheduled concurrently or even sequentially to manage the constraint. Project planning resource leveling is the process of resolving these conflicts. It can also be used to balance the workload of primary resources over the course of the project[s], usually at the expense of one of the traditional triple constraints (time, cost, scope).

When using specially designed project software, leveling typically means resolving conflicts or over allocations in the project plan by allowing the software to calculate delays and update tasks automatically. Project management software leveling requires delaying tasks until resources are available. In more complex environments, resources could be allocated across multiple, concurrent projects thus requiring the process of resource leveling to be performed at company level.

In either definition, leveling could result in a later project finish date if the tasks affected are in the critical path.

Resource leveling is also useful in the world of maintenance management. Many organizations have maintenance backlogs. These backlogs consist of work orders. In a "planned state" these work orders have estimates such as 2 electricians for 8 hours. These work orders have other attributes such as report date, priority, asset operational requirements, and safety concerns. These same organizations have a need to create weekly schedules. Resource-leveling can take the "work demand" and balance it against the resource pool availability for the given week. The goal is to create this weekly schedule in advance of performing the work. Without resource-leveling the organization (planner, scheduler, and supervisor) is most likely performing subjective selection.

For the most part, when it comes to maintenance scheduling, there is less, if any, task interdependence, and therefore less need to calculate critical path and total float.

VIII. RESEARCH GAP

Faniren, O., Love, P., Li, H. "Optimal allocation of construction planning resources" Journal of Construction engineering and management, (Sep-Oct 1999)

The research work demonstrates that investing in construction planning activities beyond an optimum point increases the probability of poor project cost performance, although further research work needs to be done to determine globally guaranteed values of optimum planning inputs for different categories of construction projects.

Hai, M., "Integrated project management" NICMAR journal, Vol-2, No. 1/4 (Jan-Dec 1996)

This research work gives impetus to use of integrated project management and control system and its implementation across various discipline and interface with various agencies is traced but the whole approach is restricted to preplanned and anticipated situation but not for the dynamic site situations.

Choo, H. Tommeleim, D. Ballard, G. & Zabelle, T. "Work plan: Constraint – Based database for work package scheduling" Journal of Construction engineering and Management, (May – June 1999)

The work plan guides the user step by step through the process of spelling out work packages, identifying constraints, checking constraints satisfactions, releasing packages, and allocating resources; weekly review collects the progress data and reason for plan failure although it ignores interdependency of work packages. This will ignore the snowball effect caused due to failure in any precedent work package.

Pena-Mora, F., & Park, n. "Dynamic planning for fast-tracking building construction project" Journal of Construction engineering and Management, (Nov-Dec 2001)

The research shows feedback processes for developing dynamic planning methodology which aims at improving the planning and management of fast tracking by providing overlapping strategies, workforce control policies, and schedule adjustments that will minimize the negative impact of fast-tracking.

Hegzy, T., Shabeeb, A. & Cheema, T. "Algorithm for scheduling with multi skilled constraint resources" Journal of Construction engineering and Management, (Nov-Dec 2000)

The proposed approach gives benefit of its ability to utilize the under allocation of one resource to resolve an over allocation of another, thus saving project time and cost but it has not considered the use of priority factors if more than one resource can be the substitute.

Also, cost comparison of such alternatives is not considered.

Hegzy, T., & Wassef, N. "Cost optimization in project with repetitive non serial activities" Journal of construction engineering and Management, (May-June 2001)

The study presented focuses on cost optimization without any scope of dynamic input from volatile external conditions of the construction project.

Kang, L. Lee, B. & Park, c. "Optimal schedule planning form multiple repetitive construction process" Journal of construction engineering and Management, ((Sep-Oct 2001)

The study shows various scheduling methods and models for repetitive construction projects although there is vast scope to effectively use such scheduling techniques with cost optimization to suit the project characteristic of cost constraint for EWS housing.

Hegzy, T., "Optimization of resource allocation and levelling using genetic algorithms" Journal of Construction engineering and Management, (May-June 1999)

The resource output is software based solution for resource allocation focusing on its optimizing regardless of continuity of resource engagement. There is scope to develop methodology to consider this continuity which forms the critical criteria for repetitive construction project.

Rayes, K., & Moselhi, O. "Optimizing resource utilization for repetitive construction projects" Journal of construction engineering and Management, (Jan-Feb 2001)

The paper presents an automated and practical optimization model which utilizes dynamic programming formulation and incorporates scheduling algorithm and an interruption algorithm so as to automate the generation of interruption during scheduling. There is vast scope to incorporate use of alternate construction technology and its implication on planning, scheduling and resource management of multiple repetitive construction projects.

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