



**Everyone's Smart
University**

Project Communications

Lecture 9

PMG 201

ALLOCATING RESOURCES TO THE PROJECT

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- **Expediting a Project**
- **Resource Loading**
- **Resource Leveling**
- **Allocating Scarce Resources to Projects**
- **Allocating Scarce Resources to Several Projects**
- **Goldratt's Critical Chain**

ALLOCATING RESOURCES TO THE PROJECT

- ❑ Projects compete with each other for the same resources in two different ways. First, consider a resource that is limited but is not consumed when used, the services of a specific technical specialist for instance. The problem here is which project gets to use the resource first and which must wait. Second, consider a resource that is limited and is consumed when used, a specific chemical reagent for instance.

ALLOCATING RESOURCES TO THE PROJECT

- In this case, the second project may have to wait until more of the reagent can be purchased and delivered. In both cases, the project that must wait may suffer a schedule delay that makes it late. Just as projects may compete for resources, different activities of the same project may compete. Two or more concurrent activities might require the same personnel, or equipment, or even work space. One activity will be given priority, and the other(s) must wait.**

1. Expediting a Project

- When task durations are estimated, an assumption is made that task resources are set at “normal” levels. This is the “standard practice” assumption. Traditionally, CPM project duration estimates also include a “crash” estimate together with estimates of the crash time and the resources required to shorten the duration of project activities. By selectively choosing which activities to crash and by how much, we can determine the minimum cost for all possible project completion times.

The Critical Path Method

- **In traditional PERT/CPM, the rules of “ standard practice ” apply and the normal task duration estimate is made with the normal or standard - practice resource usage. Then a second estimate, referred to as the crash duration, is made based on the resources required to expedite the task.**

Fast - Tracking a Project

- **In addition to crashing a project in order to expedite it, a project may also be fast - tracked . Used primarily in the construction industry, the term refers to an expediting technique in which the design and planning phases of a project are not actually completed before the building phase is started. Usually design and plan are finished before the building is started, so letting them overlap reduces project duration — if the fact that design and planning are incomplete does not result in a significant amount of rework and change orders during the building phase.**

2.Resource Loading

- **From the first day on the job, the PM is concerned with resource loading . Resource loading refers to the amounts of specific resources that are scheduled for use on specific activities or projects at specific times.**

Resource Loading con. ...

- ☐ **Resource loading is usually displayed as a list of the amounts of specific resources assigned for use on specific project activities at specific times, or as the level of a resource 's capacity required against the project calendar. To be useful for scheduling, the resource must have a calendar showing the resource 's availability.**

Resource Loading con. ...

- ❑ The calendar should include hours — and days — worked each week, any holidays on which the resource will not be available, and any other information affecting the availability of the resource. Resource cost per unit of usage should be included on the calendar, plus any additional cost for overtime or over use. Overscheduling a resource may cause serious problems for the PM.**

3.Resource Leveling

□ knows that there will be no problem raised by the apparent conflict in the allocation of the producer ' s time. The PM could have used one of the methods we noted in the discussion of resource loading to handle the matter, but elected not to take the time and effort. This, then, is another of the trade - offs the PM must make. Not every facet of a project requires equal managerial care. The PM must decide where to expend his or her managerial efforts — and then take responsibility for the decision.

Resource Leveling con.

- ☐ **When resources are added to a project, the PM may be asked to explain just how the project budget came to be underestimated. To answer such a question, the PM would be well advised to contact the administration of any large**

Resource Leveling con. ...

- ☐ A more or less steady state demand for human resources is highly desirable — if it is not seriously inconsistent with the technological demands of the project. The cost of adding, laying - off, or permanently releasing human beings is very high for both hourly and salaried personnel.
- ☐ If the parent organization is quite large and is operating many projects that have reasonably high commonality in their demand for certain skills, it is often possible to set up “ pools ” for such skills as machine operation, and similar types of workers. When pools are used to supply resources for projects, careful records must be kept to ensure fast determination of skill availability and that the proper charges are made to all projects.

Resource Leveling con. ...

- ❑ Most project management software will, when asked politely, level out the loads (usage) for individual resources and warn the PM when a resource is scheduled for greater - than - capacity workloads. Whenever possible, the leveling will utilize any available activity slack rather than extend the duration of the project. When a resource is assigned to an activity, it is assigned for 100 percent of its availability unless the PM specifies otherwise.**

Resource Leveling con. ...

- ☐ It is often necessary to have significant excess resource capacity on projects because of the uncertainty that exists in all projects. Dealing with this issue is a major reason for the installation of a competent risk management system.

Allocating Scarce Resources to Projects

- ✓ **Most solutions start with the PERT/CPM schedule. Given this initial solution, each activity is examined period by period and resource by resource. If the demand for a resource exceeds its supply, the software considers the tasks one by one and assigns resources to the tasks according to some priority rule chosen by the PM. Tasks that receive resources under this rule proceed as originally scheduled.**

Allocating Scarce Resources to Projects

- ✓ **Tasks that do not get resources are delayed until ongoing tasks are completed and the required resources are freed - up for use. If this increases the project duration, the change will be visible on the project ' s Gantt chart or network as it was when the videotape project client was not available while on vacation. No matter what priority rule is used, the project ' s technology always takes precedence.**

Some Comments about Constrained Resources

- **Every time a project falls behind schedule, the PM is apt to plead for more resources. In spite of the PM ' s complaints about the scarcity of resources, serious cases of resource scarcity rarely apply to resources in general, but rather to one or two very specific resources.**

Some Priority Rules

- **There are many possible rules for assigning preference to some activities over others when allocating scarce resources. Most popular project management software packages have a limited number of rules that can be automatically applied to level over allocated resources so many of the priority rules for assigning scarce resources to activities may have to be applied manually. Fortunately, as we will see, this is not as difficult as it might seem. Several of the most commonly used rules are as follows:**

Some Priority Rules cont. ...

- **As soon as possible** — This is the standard rule in scheduling. Activities are scheduled, and resources are made available with that in mind.

Some Priority Rules cont. ...

- **As late as possible** — With this rule, resources are made available so that activities start on their LSTs whenever possible without increasing the project's duration. This may seem irrational, but it preserves the firm's resources and delays cash outflows as long as possible.

Some Priority Rules cont. ...

- **Shortest task duration first** — Always consistent with technological precedence's, shorter tasks are given priority over longer tasks. This rule maximizes the number of tasks that can be completed by a system in a given time period.
- **Minimum slack first** — Tasks are supplied with resources in inverse order of their slacks. This rule usually minimizes the number of late activities.

Some Priority Rules cont. ...

- **Most critical followers** — The number of successors on the critical path(s) for each activity is counted. Activities with a higher number of critical successors take precedence. The rationale here is that such activities would cause the greatest damage to the desired project schedule if they are late.
- **Most successors** — The same as the previous rule except that all successors are counted. This rule has the same rationale as the preceding rule.

Some Priority Rules cont. ...

- **Most resources first** — With this rule, the greater the use of a specific resource on a task, the higher the task 's priority for the resource. This rule is based on the assumption that more important activities have a greater demand for scarce resources.

Allocating Scarce Resources to Projects

- **When a resource is over allocated, MSP can level resource usage by adopting a variety of priority rules, including available activity slack. If there is insufficient slack, other priority rules may be used to allocate the scarce resource. Most of the priority rules originated as job shop scheduling rules. The minimum slack rule usually works best. Only a few critical resources are actually scarce in the sense that project schedules must be adjusted to resource availability.**

5.Allocating Scarce Resources to Several Projects

- **When the problem of allocating scarce resources is extended to the case when several projects are being carried out concurrently, the size and complexity of the problem increase but the nature of the underlying problem remains the same. The projects might be independent or members of one large super project. In any case, there is a decided advantage if several projects are joined as a set.**

Criteria of Priority Rules

- **Whatever the priority rule, the PM faces the problem of choosing between the alternative outcomes that result from different priority rules, as well as different arrangements and durations of the pseudoactivities. There are many measurable criteria available to help us choose a priority rule. The most useful for projects are schedule slippage, resource utilization, and in - process inventory.**

Criteria of Priority Rules cont. ...

- **Schedule slippage simply measures the amount by which a project, or a set of projects, is delayed by application of a leveling rule (or by extending a pseudoactivity so that a project finishes later because it starts later).**

Criteria of Priority Rules cont. ...

- **As we noted above, the PM (and senior management) must trade off penalty costs or the possible displeasure of clients against the cost of adding resources, if that is possible, or by reducing the over allocation of Walts. Just as serious is the ripple effect that often occurs when a delay in one project causes a delay in others. Indeed, expediting one project typically causes disturbances in the schedules of others.**

The Basic Approach

- **It is now appropriate to stop for a moment and consider a matter. The basic approach taken here to solve project loading and leveling problems is borrowed from a manufacturing model that has widespread application and works equally well for projects. Our problem is that there exists a set of activities belonging to one or more projects all eager for processing by a limited set of facilities or other resources.**

The Basic Approach

- **Not all activities require the same subset of facilities or resources, and some activities are more in need of immediate attention than others. To make matters worse, some activities need more work than others, and some on being dealt with before some others.**

Resource Allocation and the Project Life Cycle

- **Whatever the scheduling rule, the scheduling method assigns scarce resources to activities on the basis of the degree to which the activity meets some priority conditions. Once the most urgent cases (as measured by the priority rule) have been given resources, the next most urgent cases receive their resources. The process continues until there are no more activities qualified under the rule.**

Resource Allocation and the Project Life Cycle con.

- **If all critical activities demanding scarce resources are supplied, but the remaining stock of scarce resources is depleted before all noncritical activities are resource loaded, the less urgent activities go unsupplied. When this happens, the less urgent activities become more urgent as period after period passes until they rise far enough up the priority rank list and receive their resources.**

Resource Allocation and the Project Life Cycle cont. ...

- **But what happens if the stock of scarce resources is depleted before all the critical activities receive resources? For example, when using the minimum slack rule, what happens if we run out of our scarce resource before we run out of critical (zero slack) activities?**

Allocating Scarce Resources to Several Projects

- **Allocating scarce resources among multiple projects is more complicated than the single project case, but is not different in its basic logic. The several projects are linked with pseudoactivities and treated as if they were the individual activities of a single project. Schedule slippage, resource utilization, and in - process inventory are measures of the goodness of any priority rule.**

Allocating Scarce Resources to Several Projects

- **Much of the allocation problem results because project facilities/resources have insufficient excess capacity to handle the uncertainties associated with projects. The shape of the project's life cycle helps determine whether or not resources can be borrowed from ongoing activities to supply stalled activities with critical resource needs.**

6. Goldratt's Critical Chain

- **Much research has been done on scheduling with constrained resources, and the findings verify what was expected — projects are completed faster when there are fewer of them struggling for attention from a limited set of facilities .**

Goldratt's Critical Chain

- To begin our discussion of Goldratt ' s approach, imagine for the moment that you are sitting in a room full of people with extensive experience as both project team members and project managers. Now imagine the responses you would hear if the group were asked the question: “ What things bugged you most about the projects you have been involved with? ” Typical of the responses that we have gotten to that question are:

Goldratt's Critical Chain cont. ...

- **Project due dates are too often unrealistic.**
- **There are too many changes made in the project ' s scope.**
- **Key resources and data are often unavailable when needed.**
- **The budget is frequently unrealistic and therefore often exceeded.**
- **It seems like my project is always in competition for resources with other projects.**

Goldratt's Critical Chain cont. ...

- **The critical chain concept identifies the facts that activity times are unknown and independent, that workers will inflate their time estimates to protect themselves, early completion tasks will not be reported, the work will expand to fill the time, tasks will not be started until the last minute, multitasking will be misapplied, resource demands will be uneven and result in task delays, and more projects and tasks will be undertaken to increase resource utilization.**