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ACTIVITY NETWORKS

The Activity Network

Activity Networks, or PERT Charts, have become established as one of the most popular planning techniques. PERT is an acronym for Program Evaluation Review Technique, and this technique has its origins in the 1960's Polaris nuclear deterrent program. However, the activity networks diagrams have since been applied to activity planning for a wide range of projects. The approach is very scalable, enabling it to be applied effectively to the planning of activities spanning even a very short time frame. The activity network is a diagram that represents the activities required and their inter-dependencies, their start and finish dates and the time necessary for their completion. The resources required for each activity are also included on the diagram. Activity Networks are made up of a series of activity boxes, each of which depicts a discrete activity or task. Each activity box may contain up to 7 items of information. The top line of the activity networks box reflects the earliest point at which the activity could start and finish. The center-line should contain descriptive information about the activity and the bottom line should be used to reflect the latest start and finish times.

Float & Critical Path

Once the resources required to complete each activity have been identified and the activity network updated to reflect these, then the start and finish dates can be added. With the shape and size of the planned area of work now visible, the total cost of the resources can be calculated. There will always be a critical path running through any project, from the first activity to the last. The critical path is defined as that series of activities that have zero float. The concept of float is central to critical path analysis, as it represents the ability to schedule an activity, or sequence of activities, within a flexible time slot rather than having to perform it immediately. This enables the more efficient management of resources across all of the activities in the network.

Calculating Float

Reading through activity networks from left to right gives the total duration of the planned work. Reading back through the network, subtracting each duration shows those activities that have any spare time. This spare time, known as float, is a very useful concept in relation to resource scheduling and smoothing. Float identifies parcels of time that can be used to introduce flexibility into the planned work, enabling the more efficient use of the available resources.

Resource Definitions

Resources can be broadly divided into consumables and non-consumables. A consumable resource is consumed as it goes into a task, for example, when money is spent on paying contractors it cannot be used again. Non-consumable resources can be used over and over again. Manpower and equipment are obvious examples of non-consumable resources.

It is often helpful to consider resource definitions, in order to define the capabilities, cost and productivity of different worker groups. This classification is normally conducted with reference to the skill profiles of staff. It is important to define the effort that each group can produce per unit of time in order to accurately match the task needs with the allocated resources. The various resource definitions may be supported by estimates of the quantity of each resource that will be available. This information is called a resource availability profile and these are often shown as graphs of the level of availability against time.

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Resource Each Task

Initially, each task should be dealt with in isolation - it would be premature to attempt to optimize the overall efficiency of matching tasks to resources. At this early stage the allocation of resources to tasks should be carried out on a 'best estimate' of how to address the workload requirements. Three techniques can then be applied to optimize the efficient use of resources:

Resource Aggregation

Resource aggregation involves compiling a day-by-day total of demand for each type of resource and representing this information in a histogram. The comparison of the daily demand for each resource type against the resource availability profile should highlight any problem areas. For example, a shortfall in the availability of a particular resource type at any point in time.

Resource Levelling

Following resource aggregation, resource levelling should be carried out to ensure that there is never a demand for more resources than have been specified as being available. This typically involves the delaying of certain tasks - in expectation of the release of the resources being used. Resource levelling aims to keep all resource demands within the resource availability profiles. However if this has implications - such as the extension of the end-date of the project then these profiles may require adjustment, for example, by the securing of further resources of a given type.

Resource Smoothing

Resource smoothing is intended to smooth out the demand for each resource. The effect is to reduce the size of the peaks and troughs on the resource histogram - or as a more practical interpretation to improve the efficiency of resource utilization. Resource smoothing can be facilitated by a variety of different techniques. For example; by adjusting the timing of activities within their float, by moving allocated resources between activities. There are also more radical approaches, for example hiring in of contract staff or the pre-construction of certain outputs. Following detailed resource planning, which should result in the optimum scheduling of all resources, this information needs to be converted into costs. All non-human elements are included at this point, for example machine time, equipment purchase, equipment hire and consumables. The resulting table provides totals that should be compared to the figures in any overall plans or estimates. If the constraints, or tolerances, of these plans have been exceeded then re-planning or reference to a higher authority, may be necessary.

Gantt Charts

The activity network is an excellent start point for the production of a bar chart or Gantt chart, which can be used to highlight the start and finish dates for the major activities. Gantt Chart are the preferred information media of senior managers, who usually find that the information portrayed in activity networks is too detailed. Gantt charts are simple to understand and easy to change, however they only provide a vague description of a complex area of work and lack quite a lot of important detail. Modern software planning packages are able to present planning data in a wide variety of formats including numerical sequence, alphabetical and date order.

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Gantt Chart Limitations

The Gantt chart has three important limitations: Firstly, the sequencing and inter-relationships between the activities are not shown, therefore they do not represent a network of the activities. If one activity is accelerated or delayed it will be difficult to see the effect that this may have on associated activities. Secondly, the Gantt chart cannot show the results of either an early or a late start in the activities. It does not reflect true project status because elements behind schedule do not mean that the project is behind schedule. Finally the Gantt chart does not show the uncertainty involved in performing the activity, therefore questions concerning the minimum or maximum duration of the activity are not represented. A refinement is the logical bar-chart, which shows the logical relationships between the activities. Whilst this technique is useful, be aware that on larger projects the volume of activities may result in a cluttered presentation. Many variations of Gantt chart can be used to represent a broad spectrum of project information and in spite of its limitations the Gantt chart remains the preferred presentation format when summarizing planning information for senior management.

Histogram Representation

When planning it is important to calculate how many resources a specific activity will require. There is also a need to establish the overall resource requirements of the project, for any given period, possibly including the resources needed on a daily basis. The type of diagram that facilitates this is called a histogram and is another widely used project planning aid. Histograms enable this information to be portrayed clearly. They can be derived from the Gantt chart representing the period in question. The only additional information that may be required is the type of specialist resource required for each activity.

Pie Charts

The pie chart is another useful method of presenting summarized planning information. The resulting diagram, which exploits a color or shading key, is easy to generate and understand. The major drawback with pie chart presentations is that they do not permit comparisons as readily as bar-charts, where estimated and actual figures can be represented as two colors within the same bar.

This tutorial is an excerpt from the GetAhead in Time Management course

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