SMARTWORKS

Using CPA and PERT to plan your projects

How does one typically go about planning a project ?

Project planning is one of the first major activities a project manager needs to undertake once a project is approved. T
a crucial role through out the project and it makes sense for project managers to arrive at realistic plan for a proje
Hence this activity demands great attention from the project manager.

Project planning involves drawing the activity (task) plan, resource plan, and schedule within the constraints of a give
this phase, a project manager views the project in terms of a Gantt chart, PERT or network diagram and ensures tha
very good chance of achieving the scope within the given schedule with the resources allocated. Also the manager
work (work break down structure) into smaller tasks to achieve better control.

What does Work breakdown structure really mean?

Every project has well defined objectives in terms of schedule, scope and resources. It could be something like "Bui
aircraft the world has ever seen and deliver to our customer by January 1, 2006 at a unit cost of 100 million USD.
pretty broad and it is not possible for one person to achieve this. It perhaps needs thousands of people possessing va
accomplish the task.

So the scope is broken down further into easily manageable chunks of activities, which can be monitored. This
breakdown structure (WBS). WBS is a hierarchic breakdown of a project or major activity into successive levels, in whi
finer breakdown of the preceding level. A WBS of a project looks a lot like the 'contents' page of a document t
document split into sections, chapters and pages. The items within a specific level of WBS are numbered consecutive
4). Each item at the next level is numbered as a subset of its parent item (e.g., 1.1, 1.1.1, 1.2.3.4). There is no
number of levels a task is broken down into.

For instance for the scope of building an air craft could be broken down as follows:

1. Build the Aircraft (An Aircraft making company such as Boeing / Airbus)
.....
1.n build the avionics (Perhaps out sourced to Major Aircraft contractor)
....
1.n.n Build navigation computer for aircraft guidance (may be by a subcontractor)
....
1.n.n.n Build GPS-WAAS receiver as per DO178b specification
....
1.n.n.n.n Build RF receiver to receive WAAS signals (bought out)

In a good WBS structure, the tasks are broken down into finer activities, the duration of which do not exceed 2 to 3
project is broken down into fine granular activities, task dependencies are also identified. Not all of the activities in
executed in parallel. Some of the activities cannot be started if other tasks are not completed. Such tasks are called
Dependency may be introduced either because of the intrinsic nature of the activity or due to resource constraints or c

What exactly does one mean by Critical Path Analysis (CPA) ?

In the late 1950s, the Critical Path Method (CPM) was developed at Dupont for managing projects. The main focu
Analysis (CPA) is to plan projects so they are completed on time within budget constraints.
CPA uses a deterministic model, i.e. the duration of the activities and the cost are known with certainty. (While any
manager may not agree with the deterministic nature of the tasks in a project, that is the way CPA functions.)

The stepwise CPA approach to project planning is as follows:

1. Split the project into subprojects and further split the subprojects into activities or tasks.
2. Identify the duration taken to complete a task.
3. Identify the resources needed to complete a task.
4. Identify how this task depends on other tasks.
5. Once the tasks, their dependencies on other tasks and the duration is identified, the following parameters for every arrived at:

The earliest start time for the task (EST). Starting from the earliest (starting) task in the project, the EST of the task predecessor task plus the previous task duration. This needs to be calculated for all tasks in a project. The EST deterr possible time to start a task in a project.

The latest start time for the task (LST). Starting with the last task in the project, the LST of the preceding task is th minus its duration. This is again calculated for each task in a project. The LST determines the latest time by which the started in order to complete with in the project deadline.

The difference between these two parameters is the float (or slack) for a given task. If a task float is zero then it dc flexibility to start later than its earliest start time. Such a task is called a critical task. A sequence of critical tasks in a critical path in a project. Other tasks in the project can be delayed or take longer without affecting the duratio (providing they remain within the float). If a task exceeds the float then it becomes a critical task..

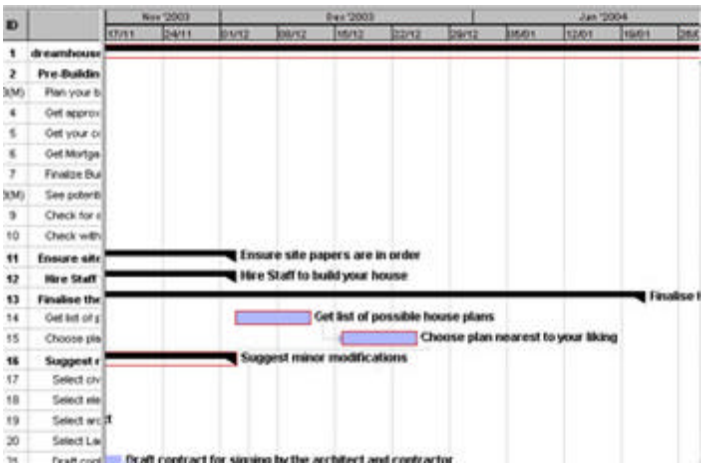


Fig1.1: Gannt Chart Showing Critical Path of the Project

What is PERT?

Around the same time the Critical Path Analysis (CPA) was used in Du Pont for project management, the US Navy ha Program Evaluation and Review Technique (PERT) to plan and control projects. Both PERT and CPA are much similar essential differences too.

In CPA a project manager gives a fixed duration for each task in a project. PERT has a probabilistic approach that allo time estimates for the duration of each activity.

The stepwise PERT approach for project management is as follows:

1. Split the project into sub projects and further divide the sub projects in to activities or tasks.
2. Identify the resources needed to accomplish a task.

3. Identify how this task depends on other tasks.
4. Identify the duration a given task would take. This is where PERT differs from the CPA. As most practicing projec have overshot budget and time would testify, it is difficult to come up with an absolute value for the duration of a task the PERT approach uses three estimates for the duration of a task.

PERT duration estimates:

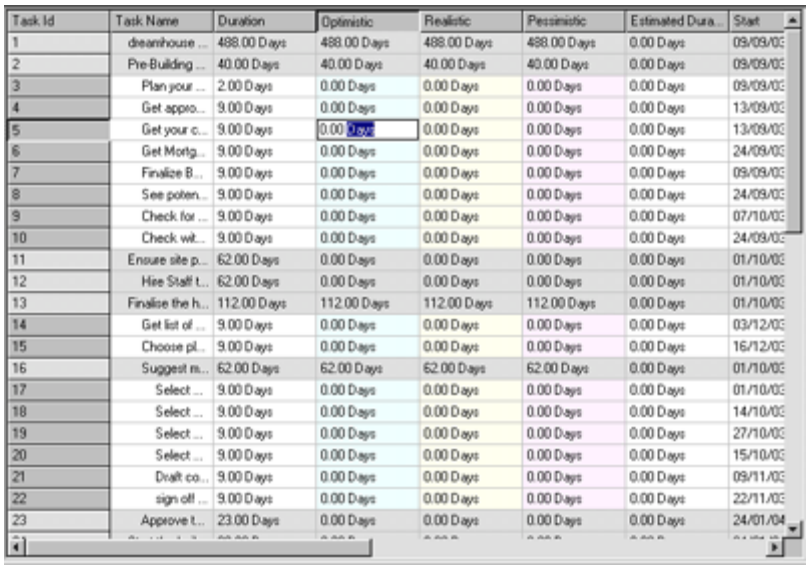
Optimistic duration (Od): This is the time a task would take if no unexpected risks happen during the executio everything goes perfectly smooth. (This is what an inexperienced manager believes!)

Most likely duration (Md): Most realistic time estimate to complete the task. This includes estimating and planning r that are likely to be put into use during task execution. Seasoned managers have an uncanny way of estimating very c time using historical data from prior estimation errors.

Pessimistic duration (Pd): Duration a task would take if everything goes wrong. It assumes all possible risks hap project.

The Expected duration (Ed) for the task is calculated by applying the below-mentioned formula:
Ed = (Od+ 4Md + Pd)/6. It is also possible that each organization could come up with their own formula based on pri projects handled by them.

Smartworks Project Planner allows the project manager to come up with the formula to be used for calculating the e While the default formula would remain as Ed = (Od+ 4Md + Pd)/6. The manager can modify it to suit his/her past instance it might be possible for the manager to give additional weight to the pessimistic duration as shown in the follo



Task Id	Task Name	Duration	Optimistic	Realistic	Pessimistic	Estimated Dura...	Start
1	dreamhouse ...	488.00 Days	488.00 Days	488.00 Days	488.00 Days	0.00 Days	09/09/03
2	Pre-Building ...	40.00 Days	40.00 Days	40.00 Days	40.00 Days	0.00 Days	09/09/03
3	Plan your ...	2.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	09/09/03
4	Get appro...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	13/09/03
5	Get your c...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	13/09/03
6	Get Mortg...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	24/09/03
7	Finalize B...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	09/09/03
8	See poten...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	24/09/03
9	Check for ...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	07/10/03
10	Check wit...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	24/09/03
11	Ensure site p...	62.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	01/10/03
12	Hire Staff t...	62.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	01/10/03
13	Finalise the h...	112.00 Days	112.00 Days	112.00 Days	112.00 Days	0.00 Days	01/10/03
14	Get list of ...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	03/12/03
15	Choose pl...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	16/12/03
16	Suggest m...	62.00 Days	62.00 Days	62.00 Days	62.00 Days	0.00 Days	01/10/03
17	Select ...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	01/10/03
18	Select ...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	14/10/03
19	Select ...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	27/10/03
20	Select ...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	15/10/03
21	Draft co...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	09/11/03
22	sign off ...	9.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	22/11/03
23	Approve t...	23.00 Days	0.00 Days	0.00 Days	0.00 Days	0.00 Days	24/01/04

Fig1.3 : Project planner bit map of the dialog box where project manager can enter the weights for the optimistic/ pessimistic duration

Once the weights are entered, the project manager can individually start giving the various estimates for all the tas This could be mostly done in consultation with a team where it is likely for the manager to get multiple inputs for the t

5. Once the tasks, their dependencies on other tasks and the duration are identified, EST and LST for each of the

arrived at.

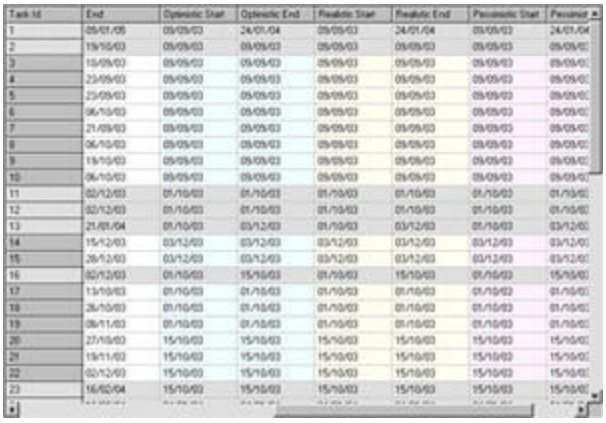


Fig1.3 : Pert analysis view where in the Ed for all tasks are calculated

6. Next, the variances for all the tasks, which are in the critical path, need to be arrived at. The variances of each of th computed by applying a formula based on the weights used to arrive at the Expected duration for the task. Typically t be (Pd - Od)/6. The project variance is the sum of the variances of each of the tasks on the critical path. The square (sigma) would give the project standard deviation.

7. With these data, it becomes possible to compute the likelihood of a project being completed on a given due date. T = (Date for which probability of completion is needed - Expected date of completion) / Project standard deviation).

With the PERT approach,

1. Given a due date, one can find out the probability of a project getting completed within the due date.
2. One can arrive at a due date for a given probability.