Module: Business Processes
Unit: Good Practice in the Project Cycle
Lesson: Activity in the Project Cycle 1

Activity in the Project Cycle 1

Introduction

Project Initiation is the formal process of committing an organisation to begin a project.

An important activity in project initiation is the selection of the project manager (PM). The key output from this phase is the scope statement.

Selection of the Project Manager

Selecting the project manager is one of the critical decisions concerning the project. In lesson three of this unit we will look at the qualities, skills and competences of a good project manager.

Project Charter

Once an organisation has made a decision to undertake a project, a Project Charter must be drawn up to formally recognise the existence of the project.

top tips

A PM must not commence work on a project, until a Project Charter has been drawn up. It is the Project Charter that formally recognises the existence of the project and empowers the project manager to use organisational resources to kick-off the project.

A Project Charter is also sometimes referred to as a Project Definition Document, and is usually issued by a manager outside of the project (independent of the project).

The Project Charter addresses:

Project Intent

The Charter must be a clear statement on the boundaries of project scope at a high level.

Product description

A summary description of the output of the project (product or service or combination)

Business Need

The reason the project is being undertaken.

Preliminary delineation of roles & responsibilities

May at this stage identify the project manager and key project staff. The earlier the project manager is appointed the better.

Reference of authority for the future of the project

It must identify who will be the authority for decisions on the future of the project. Depending on the size of the project and the organisation it may be the project sponsor or project manager, where

the project sponsor will tend to be a senior manager who has initiated or has a strong commitment to the project.

Project Structure

Whatever the organisational context, a project has its own structure e.g. with the PM reporting to a project steering group and project teams reporting to the PM. The precise project structure, in terms of the particular teams, and number of teams, will depend on the characteristics of the project. Smaller projects and projects carried out within a functional setting will probably not have a separate project administrator and the project manager will address administrative tasks, while larger ones will typically need one.

Next we describe the role of the various parties in the project structure.

Project Steering Committee/Group: A group consisting of the project sponsor, other stakeholders and authorities with relevant knowledge about the project, and frequently customers. The Project Steering Committee provides direction to the project. The Chairperson of the Steering Group is usually the Project Sponsor (or a senior member of the Sponsor group).

Project SponsorAn individual or group within the performing organisation that is providing financial resources for the project. The Project sponsor has the authority to approve the project (and future project decisions) on behalf of the performing organisation.

Project Manager (PM) For purposes of the project, the PM reports to the Project Steering Committee.

Project teams Projects today frequently operate within matrix organisations. The project's multi-disciplinary team members are drawn from various line or functional divisions in the organisation. Team members will therefore have a reporting line to their own line/functional divisions, but on all project activities they report to the PM. Project team members must therefore adapt to a two-boss situation.

A further issue to highlight in the project structure is the Project Office, an important administrative function for the project. On large projects the project office function is crucial, and is usually managed by a Project Administrator reporting to the project manager. But even on small projects there are benefits in establishing a formal project office for the management of all documentation, even if this is managed by the project manager. The project office itself is likely to be an electronic repository of all project information.

Clearly the PM is a key person on the project. The PM should be identified as early as possible after project approval and formally engaged with the project charter. The project charter gives the PM authority to start off the project by establishing the project structure and then assembling the project team.

Forming the Project Team

The PM should define the key roles and optimal team structure early. The precise structure would depend on the particular project and its work undertaking. Every project will have certain roles that are more critical than others. People assigned to critical roles should report directly to the PM. Key resources should be assigned early as they will be involved in detailed requirements definition.

It is also important that the PM considers the Project Office requirements and where appropriate identifies a project administrator. This seemingly unimportant and unglamorous support function is more critical that it might appear at first sight. It should be considered for projects with team sizes in excess of 6.

top tips

During the Initiation phase, the PM should:

- Define the key roles
- Define the project team structure
- Assign individuals to critical roles
- Define the project office requirement

During project initiation only the core team is put together. To resource the project fully, the PM will need a forecast of resources needed over the entire project cycle. This is derived from the Work Breakdown Structure; an output from planning. (We will discuss the Work Breakdown Structure later in this unit .) At this stage (initiation phase) the PM will not know the precise resources required.

High-performance Project Teams

The likelihood of a project's success is enhanced by the PM forming a high-performance team. This does not happen by chance. It has to be planned and then nurtured. When selecting the team members it is important to correctly establish the mix of skills required, and validate the required skills and resources (with customers, PMs of similar projects etc). Organisation of the team is also vital.

Open communication is another vital ingredient for successful project teams. This should be facilitated and encouraged by the PM and will take the form of both formal and informal communication.

Last, but not least, teams should be inspired. The PM plays an important role in setting the vision and motivating the team throughout the project. Team bonding activities also have a role to play, as do rewards/celebrations for achieving project team goals. For a project to be successful, team performance is much more important than individual performance. This should be recognised and rewarded. Team members should be proud to be part of a 'winning' team.

You should now look at the brief article on high performing teams at:

http://www.psychologytoday.com /.../10-rules-high-performing- teams

Project Charter

High performance teams often commit to a Team Charter.

The Project Team Charter is different from the Project Charter. A Project Charter is a must. A Project Team Charter is highly recommended. It engenders commitment and ownership of the project as it sets out performance objectives, roles and responsibilities of the team and its rules of engagement. It is a statement that is mutually agreed upon and should have the signature of each team member.

Performance objectives

Performance objectives set out what the project will do and deliver (in broad terms), as well as referencing the time-lines and budget. Identifying the schedule and cost constraints raises the visibility of these critical constraints to every team member.

Roles and responsibilities

The organisational chart together with the roles and responsibilities of each team member should be identified. This way there is no ambiguity or misunderstanding on who does what.

Rules of engagement

Rules of engagement set out the ground rules for the operation of the team. They set out the expectations of team members in the way they wish to work together, such as punctuality, respect, commitment, openness, acceptable behaviour etc. It can also address meeting protocols (for example, that an agenda be distributed beforehand) etc.

Customer Requirements and Scope

A key activity during the Project Initiation phase is collating and analysing customer requirements and then establishing the broad scope of the project.

Customer requirements arise from:

- Wants
- Needs
- Wish-lists ('nice to have' features)

During the initiation phase, the PM, together with any team members in place, will work with customers and sponsors to establish a Requirements Baseline (or statement), which will identify:

- Inclusions: which requirements will be addressed in the project
- Exclusions: which requirements will not be addressed in the project

Scope Statement

The Scope Statement is the key output from the project initiation phase. It serves as a documented basis for confirming a common understanding of the project.

The Scope Statement is generally developed at the same time as establishing the Requirements

Baseline. It is wider in scope and pitched at a higher level addressing project/business justification, project objectives, project products and project deliverables.

http://www.dummies.com/.../wha t-to-include-in-a-project-scop e-statement.html gives you a good outline of the contents of a scope statement.

A well-written scope statement is crucial to a project manager's ability to make intelligent decisions during the life cycle of a project. As a project manager, the more information you can gather in the early stages of a project, the more adaptable you can be if you should have to deal with obstacles that might appear during the project.

You create a project scope statement to establish a solid agreement between the project team and the customer by clarifying, identifying, and relating the work of the project to the business owner's objectives. The two parties reach an agreement by explaining the need or issue to be resolved by the project, what the product or deliverables will include, and what potential costs, gains, and success measures are involved.

Writing a successful scope statement means that you include directly, or by reference, other documents, including your:

- Project justification
- Project product
- Project deliverables
- Project objectives

NOTE You should have the scope statement reviewed and approved by the both the project sponsor and the customer. You should not include any confidential information. For example, remove the budgeted costs from your supplier in the customer's version of the scope statement.

To write a scope statement, include the following:

1. The project justification information

The project justification describes a problem to be resolved, an opportunity to be exploited, or a benefit to be obtained. You always derive the project justification from the strategic objectives of the parent organisation. The following are examples of project justification:

- Market demand
- Business need
- Customer request
- Technological advance
- Legal requirement

The project justification needs to be clear and precise, and you should include both qualitative and

quantitative measures. After the project is started, its justification becomes the basis for evaluating future trade-offs and a powerful source of motivation for your stakeholders (as the project is seen as benefiting the business).

2. Identify the project product

The project product is a summary of the product description and includes:

- Work required to resolve the problem and achieve the benefits.
- Work that falls outside the project scope.
- Interactions with other projects.

It is crucial that you identify work that might fall outside the project scope as well as how the project work might interact with other projects. Identifying the exclusions is important because it enables you to set expectations with your customer and project team.

NOTE If you clearly identify exclusions at the beginning of a project, future projects are more easily identified.

3. Identify the project deliverables

List the summary-level sub-products of the project for which full and satisfactory delivery would mark the completion of the project.

Rather than breaking the work of the project into a list of low-level deliverables and details, identify high-level deliverables so that project reviewers can readily focus on the business problems that the project is trying to resolve.

4. Identify the project objectives

Include cost, schedule, and quality measures. Project objectives should have an attribute (for example, cost), a yardstick (for example, U.S. dollars), and an absolute or relative value (for example, less than 1.5 million).

The project objectives must:

- Address all the work within the scope of the project.
- Not address work outside the scope of the project.

A comprehensive scope statement is a key document that binds you, your project team, the project sponsor, and the customer. It is an agreement that defines the work of the project and the customer's business objectives. A comprehensive scope statement can help you identify changes in scope after the project has started and help you plan for any modifications or adjustments that might be needed during the life cycle of the project.

Planning

Planning is the second stage of the simple project cycle that we are using to structure the first two lessons of this unit. To gain an overview of issues relevant to project planning you should now read chapters three and four of the module textbook. Lewis (2007)

The Work Breakdown Structure (WBS)

As you will have seen from Lewis (2007) the WBS is a element in project planning. It can be visualised as the collection of building blocks, defining the entire scope of the project. It is the framework on which the project is built.

The starting point of the WBS is the Requirements Baseline or the scope definition document. From this a hierarchical structure (or Family Tree Picture) is established. First, the key high level activities are identified, and these are then progressively broken down into sub-activities at the next level down. This process of decomposition is then repeated. The total number of levels on the WBS would depend on the complexity of the project. The lowest level of the WBS is known as the work package. Each work package will result in a deliverable.

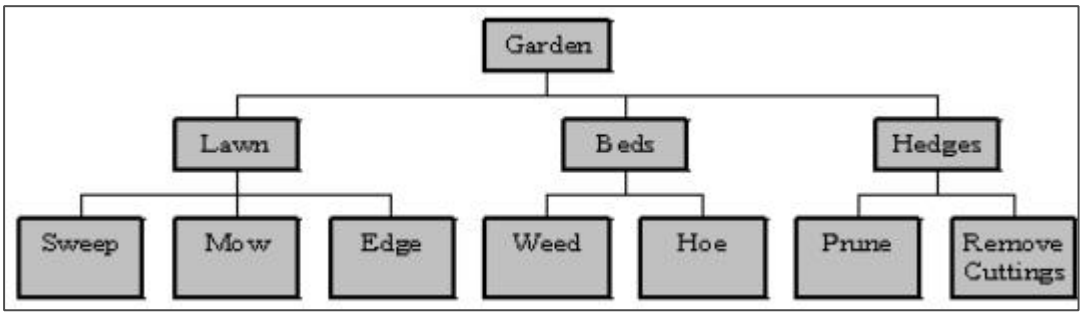

Figure 4.01 - Example WBS

The example WBS is a simple one; depicting the activities associated with gardening. It is not intended to show the full scope of gardening! At the highest level, gardening consists of carrying out work on the (i) lawn, (ii) beds and (iii) hedges. Each element is drawn as a box with a title. Every box is a summary of the boxes in the levels below it. A general rule-of-thumb for the level you breakdown the WBS to, is that work packages should require no more than 80 hours for completion.

top tips

The WBS is a deliverable-oriented decomposition of the project. It needs to be detailed enough to provide meaningful identification of all project tasks that must be accomplished for project completion.

Developing the WBS is a project team activity, and the PM should involve the team members. In this way not only is there more team focus on project objectives, but also greater commitment and 'buy-in' from the team.

top tips

The WBS is a key project management tool, and is vital for successfully integrating and controlling a project. A WBS defines all of the work that must be carried out on the project.

The WBS is used throughout the project in planning and budgeting, funding, estimating, scheduling, performance management and testing.

my learning space activity

What are the benefits of using a WBS? Can you list them?

feedback

Here are some of the benefits you are likely to have identified:

- A clear and unambiguous statement of precisely of what needs to be done on the project
- Forces detailed planning and documentation
- Deliverable oriented - focuses objectives on project deliverables throughout project execution
- Builds the project team in compiling the WBS
- Clarifies responsibilities
- Identifies specific work packages for estimating and assigning work
- Serves as a tool for the allocation of project budget across the various activities.

In addition Brad Egeland posts about the benefits and downsides of WBS below, which we have downloaded and reproduced from http://pmtips.net/benefits-wor k-breakdown-structure/ (last accessed 9th April 2013) (Permission to reproduce pending)

The WBS provides the project manager and team with the necessary framework of tasks going forward to create detailed cost estimates and also to provide major input to project task scheduling at the most detailed and accurate level possible. By going through the WBS motions, the project manager and team will have a pretty good idea whether or not they have captured all the necessary tasks, based on the project requirements, that are going to need to happen to get the job done.

Four key benefits to developing a WBS are:

#1 - WBS forces the team to create detailed steps

The WBS forces the project manager, team members, and customers to delineate the steps required to build and deliver the product or service. The exercise alone encourages a dialogue that will help clarify ambiguities, bring out assumptions, narrow the scope of the project, and raise critical issues early on.

#2 - WBS lays the groundwork for schedule and budget

It lays the groundwork for developing an effective schedule and good budget plans. A well-defined WBS enables resources to be allocated to specific tasks, helps in generating a meaningful schedule, and makes calculating a reliable budget easier.

#3 - WBS creates accountability

The level of detail in a WBS makes it easier to hold people accountable for completing their tasks. With a defined WBS, people cannot hide under the "cover of broadness." A well-defined task can be assigned to a specific individual, who is then responsible for its completion.

#4 - WBS creation breeds commitment

The process of developing and completing a WBS breeds excitement and commitment. Although the project manager will often develop the high-level WBS, he will seek the participation of his core team to flesh out the extreme detail of the WBS. This participation will spark involvement in the

project.

The downsides (sort of)

Of course, developing a WBS is not easy. It can be a painstaking process. And it can take quite a bit of time. A large WBS (one that identifies several thousand activities) can take many, many hours to develop. For another, it requires effort. There is a knowledge transfer and exercise of brainpower. The larger the scope of the project, the larger the WBS will be. More people must provide input and then approve the portion they are responsible to perform. Finally, the WBS requires continual refinement. The first iteration is rarely right and as the project changes, so does the WBS.

Even after considering the downsides, the overall advantages still outweigh the known challenges. A good WBS makes planning and executing a project easier and lays the groundwork for the schedule, the tracking, the budgeting, and all the accountability throughout the rest of the engagement.

Resourcing the WBS

Resource planning involves determining what resources and what quantity is required for each WBS item.

What types of resources should you plan for?

Resourcing is not just human resourcing. Resourcing must include facilities (where will the project be carried out? What accommodation needs are there?), equipment (computer hardware, machinery), software requirements, travel requirements, materials (capital and consumables) etc.

When considering the people aspects of resourcing, the most appropriate human resources should be assigned to the task at hand. A WBS item 'develop software' will need a resource with appropriate software development skills in the language, operating system, methodology, testing philosophy etc. A gas boiler task will require an appropriately registered gas engineer; developing building plans will require a qualified architect and so on. In some cases, for highly specialised tasks, a consultant may be engaged for a short duration. At this stage individual people are not assigned, but general human resource profiles drawn up, and the resource profile should be appropriate to the task.

The quantity of the resources available is also important to determine at this stage. Two skilled people working together may be able to complete a task in half the time that it takes one person.

Clearly resourcing is a key input to cost estimating which we will be considering later.

To gain further information and a fresh perspective on the WBS read chapter 5 of Lewis (2007)

The Schedule Baseline

Scheduling falls under the umbrella of time management in project management. The schedule is a vital tool used by the PM to track progress and status.

think about it

What is a Schedule? Can you define it?

feedback

A schedule consists of planned dates for carrying out project activities and meeting project milestones.

Let us look again at the planning overview chart.

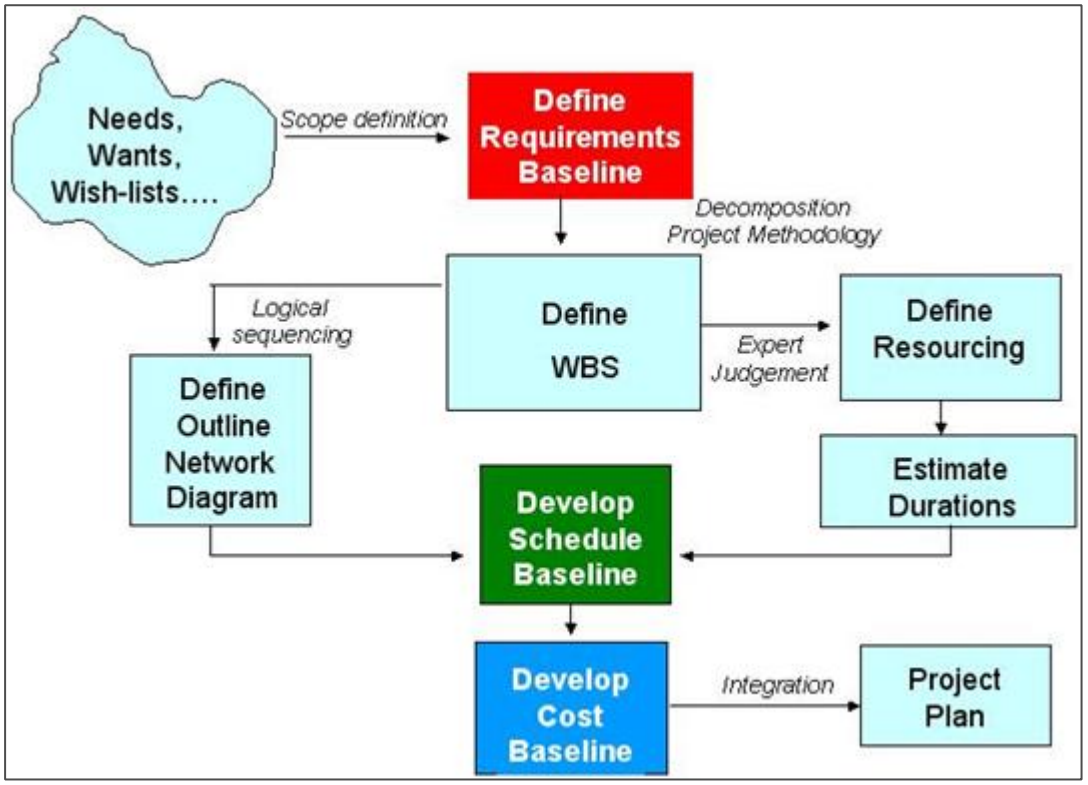

Figure 4.02 - Project planning activities

The Flowchart shows how the schedule baseline is developed from the Outline Network Diagram and the Duration Estimates.

Outline Network Diagram The outline network diagram is the logical sequencing of activities on the WBS. The development of the network diagram should be a project team activity led by the PM.

Duration estimates Developing the schedule will also require activity durations, which also can be based on the WBS. Again it is vital that you engage your project team - the team member most experienced/familiar with the activity should be used to provide the estimate. The resource profile that will be used will also heavily influence the durations. An experienced, senior engineer will be able to design a solution much more quickly than an inexperienced engineer. Getting the estimates right is obviously very important, not just for schedule development but also in estimating costs.

think about it

How are schedules used by team members and the Project Manager during project execution?

feedback

Schedules will be used constantly by team members to assess whether they will meet (or indeed beat!) their objectives for the tasks apportioned to them; specifically in terms of time-lines. Team members should be clear that if any deviations (from the schedule baseline) are expected, they should highlight it to the PM immediately.

Thus schedules are used by PMs to track project progress and status, and are a useful means of assessing if a possible change could affect the time-lines, in particular, the schedule baseline.

Creating a Network Diagram

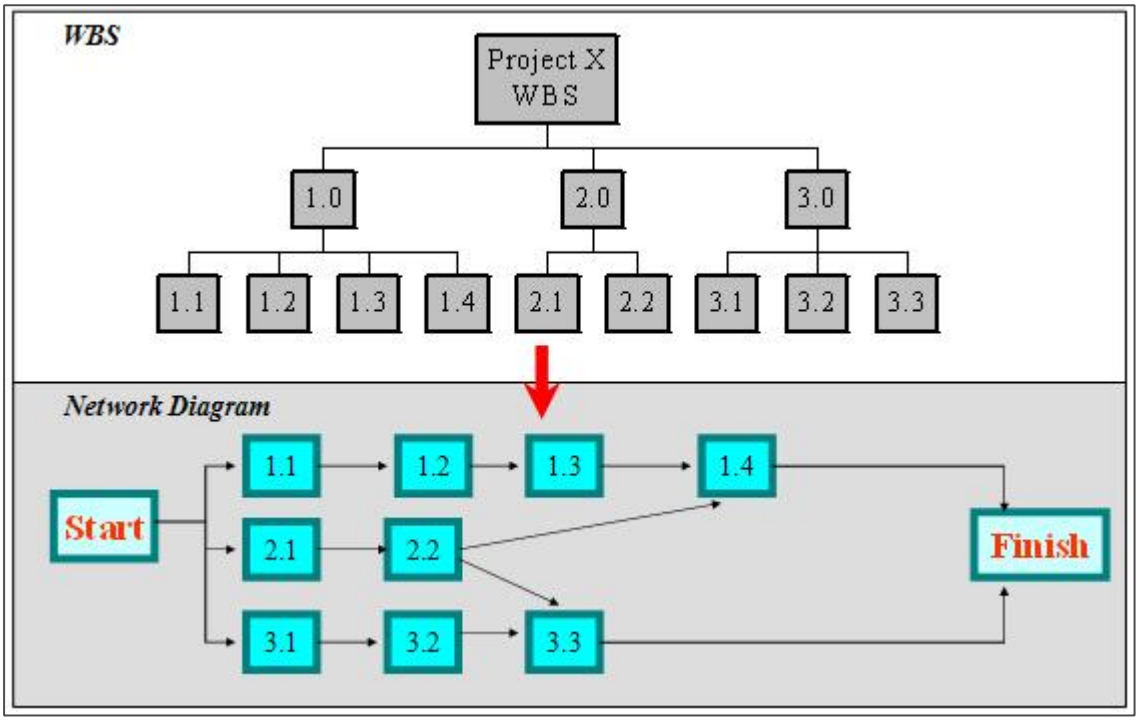

Figure 4.03 - From WBS to Network Diagram

With the input of the Project Team, the WBS is used to develop an outline network diagram illustrating the logical sequencing of activities and dependencies.

Once the network diagram has been established and durations established for each activity, a project schedule can be developed. Methods such as precedence diagramming are used in developing network diagrams, which we examine later in this lesson.

Precedence Diagramming (PDM)

There are a number of mathematical analysis techniques for developing network diagrams with timings. The most commonly used technique today is the Precedence Diagramming Method (PDM)

that was developed at Stanford University in the early 1960s.

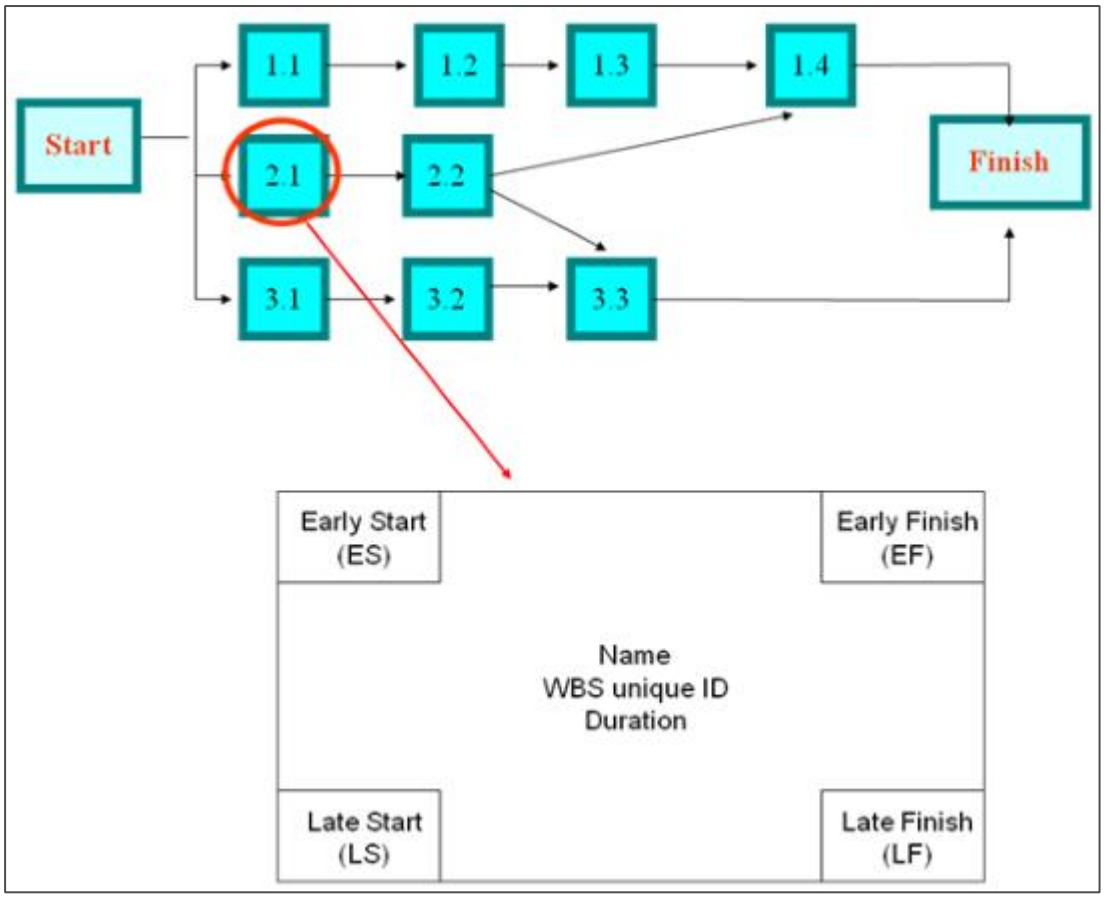

Figure 4.04 - The Starting Point for PDM; the Outline Network Diagram

Precedence Diagramming starts off with the outline network diagram. The outline network diagram defines the logical sequencing of the project activities as derived from the WBS, but has no information about work package duration. In Precedence Diagramming, this is built into the boxes using the notation shown on the expanded box.

Firstly each box must have a name and in some cases a reference number linking the activity back to the WBS ID. The estimated duration is then shown below these.

The 4 corners of the box denote earliest start (ES), earliest finish (EF), latest start (LS) and latest finish (LF).

ES: earliest possible time at which an activity can start.

EF: earliest possible time at which an activity can finish.

LS: latest possible time at which an activity may begin without delaying a successor activity.

LF: latest possible time at which an activity may be completed without delaying a successor activity.

top tips

Rules in PDM:

- Activities (shown as boxes) are drawn from left-to-right.
- There is a starting point and ending point.
- Activities are linked by precedence relationships.
- There are predecessor(s) for each activity.
- There is a successor for each activity.

Here are key concepts in PDM:

Critical Path

- represents the shortest amount of time in which the project can be completed

Float (or slack)

- float is the amount of time an activity can be delayed without delaying the earliest start of its follow-on activities . It is calculated as:

float = LF - EF

or

float = LS - ES

If float > 0; time is available

If float = 0; activity is critical

If float < 0; activity is behind

Coffee and biscuits "mini project" - Part 1

This is the first part of a series of activities for a "mini project" that will take you through:

- Part 1: development of outline network diagram
- Part 2: forward pass
- Part 3: backward pass
- Part 4: calculation of critical path

The "mini project"....

You have been asked to organise coffee and biscuits for a mid-morning break at a business meeting.

You may assume that the WBS has been developed and contains the following activities (durations shown in parentheses):

- Boil Water (10 minutes).
- Put coffee in percolator (2 minutes).
- Pour water into percolator and brew coffee (10 minutes).
- Open packets of biscuits (4 minutes).
- Arrange biscuits on plates (6 minutes).
- Arrange mugs, milk jug and sugar on tray (6 minutes).
- Put out the coffee & biscuits in meeting room (4 minutes).

As the project is a "mini-project" with just a few activities, no unique ID is shown for the above. The name uniquely identifies the activity.

- Part 1: Develop the Outline Network Diagram (using the summary WBS presented above).

Step 1: Generate the outline network diagram showing the logical sequencing (working from left to right).

Step 2: Ensure each activity box has a name and duration.

feedback

Using the summary WBS and logical sequencing the Outline Network Diagram should look like this:

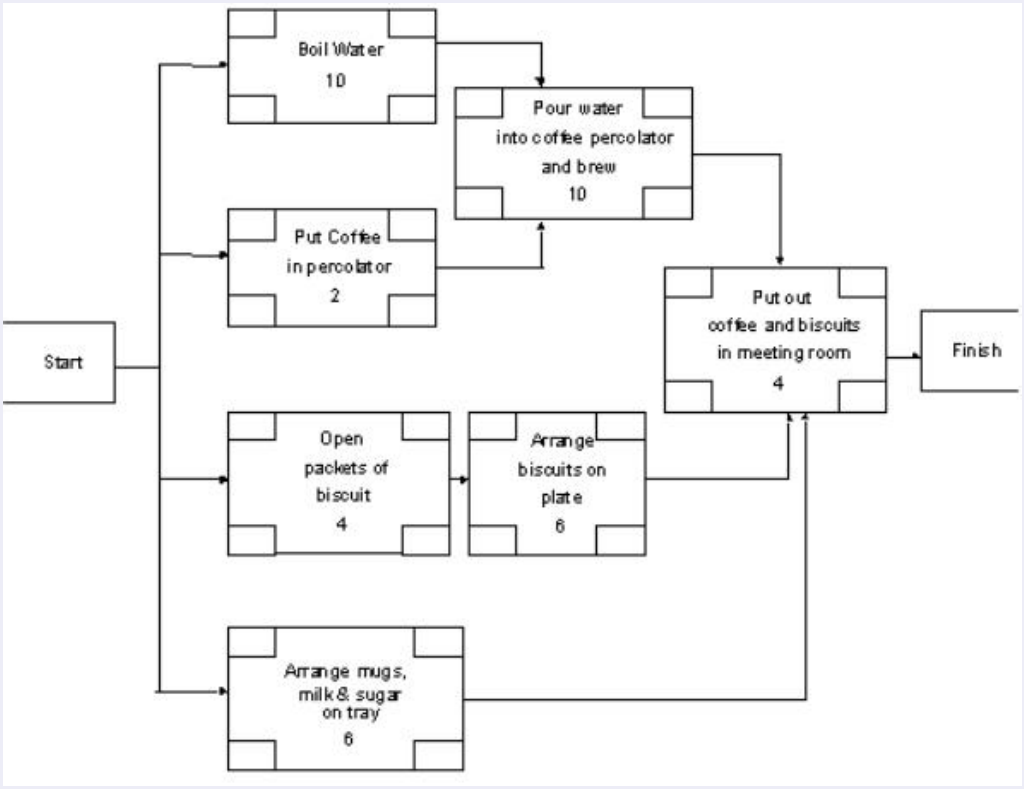

Figure 4.05 - Outline Network Diagram for mini Project

The critical path is an important concept in scheduling and project management. The critical path represents the shortest time in which the project can be completed. This is the vital piece of information that management and customers want to know. It is therefore important that the PM gets it right. Note that it is possible to have more than one critical path (two or more paths that have the same total time and represent the shortest time in which the project can be completed).

Calculating the Critical Path

The critical path is computed by carrying out a forward pass and then a backward pass through the network.

The forward pass is carried out by working through the network from left to right and establishes ES & EF for all activities.

The backward pass is carried out by working through the network from right to left and establishes LF & LS for all activities.

my learning space activity

Now carry out a forward pass for the outline diagram you produced following the steps below -

Step 3: Use project start date as the earliest possible start (ES) for first activity; then work out its earliest possible finish(EF) by adding the duration to the earliest start; put ES at the top left hand corner, duration in the middle at the top and EF at the top right hand corner. (See figure 4.08 below for more detail on that.)

Step 4: For the next activity that follows on the earliest start time is assumed to be the same as the latest finish of the previous activity.

Step 5: Again work out this second activity's earliest finish by adding the duration to the earliest start; put ES at the top left hand corner, duration in the middle at the top and EF at the top right hand corner.

Step 6: Repeat steps above working through network diagram from left to right; for the final activity in the network assume EF of that activity is the end point of the project.

Note:

1. When an activity has more than one predecessor, use the highest EF of predecessors as the ES for the successor.

feedback

See figure 4.06 below for the completed forward pass.

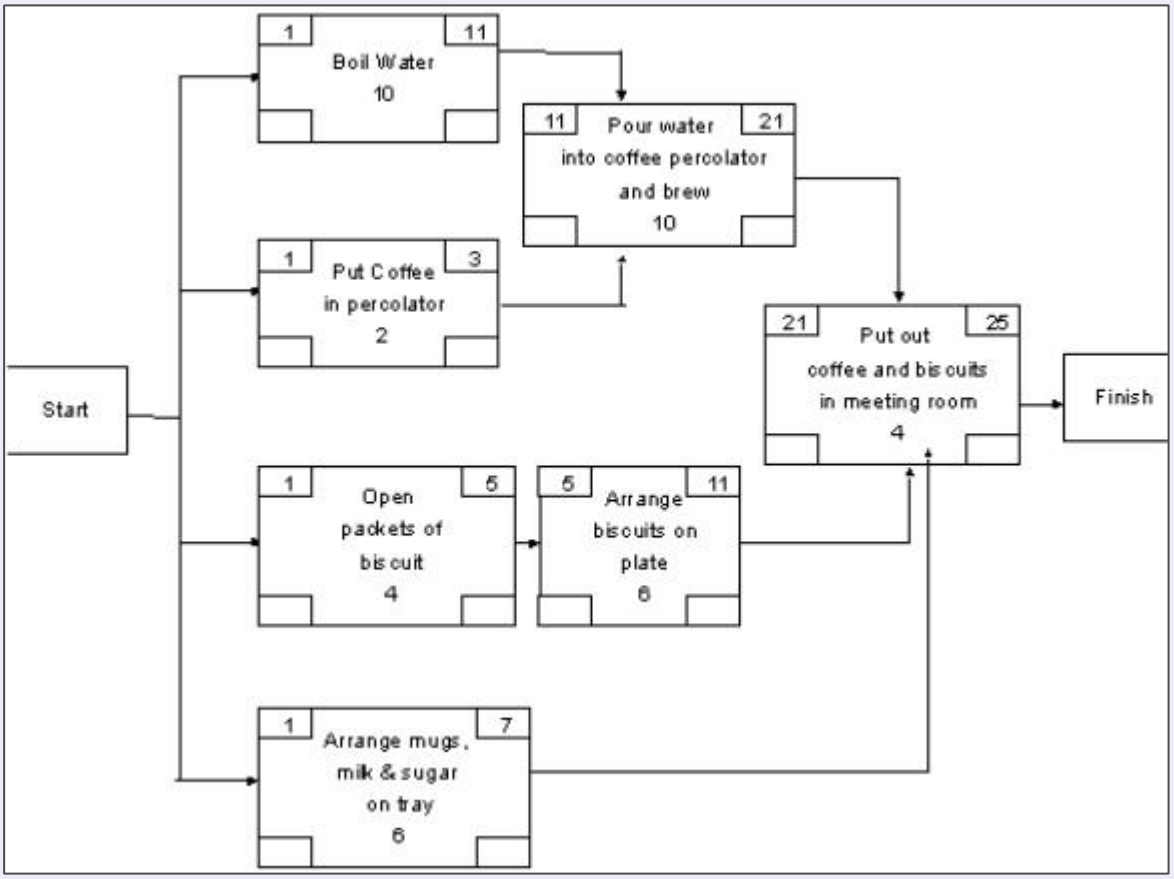

Figure 4.06 - Outline Network Diagram with forward pass complete.

my learning space activity

Now carry out a backward pass for the outline diagram you produced following the steps below -

Step 7. As we say above, assume the EF of the last activity is the final point of the project; that means that the EF is the same as the latest finish (LF). Put the latest finish in the bottom right hand corner of the final activity box.

Step 8.Work out the latest start time (LS) of the final activity by deducting duration from the latest finish (LF) time.

Step 9. Work out the float for the last activity; that is the difference between the corresponding earliest and latest times (i.e. latest start minus earliest start or latest finish minus earliest finish; as you can see from figure 4.9 float for the final activity is zero.

Step 4.On the backward pass the latest start time of one activity is the same as the latest finish time of the previous one; on that basis you can repeat the actions at steps 2 and 3 above for earlier activities working through them right to left one at a time.

Note:

1. When a predecessor has multiple successors, select the lowest LS as the LF of the predecessor

feedback

As you work back you will find some activities e.g. that of arranging biscuits on a plate ,where there is a gap between the earliest possible and latest times/dates. This gap represents the float available for the activity and as you can see details of that are inserted near the corresponding boxes in figure 4.07 below:

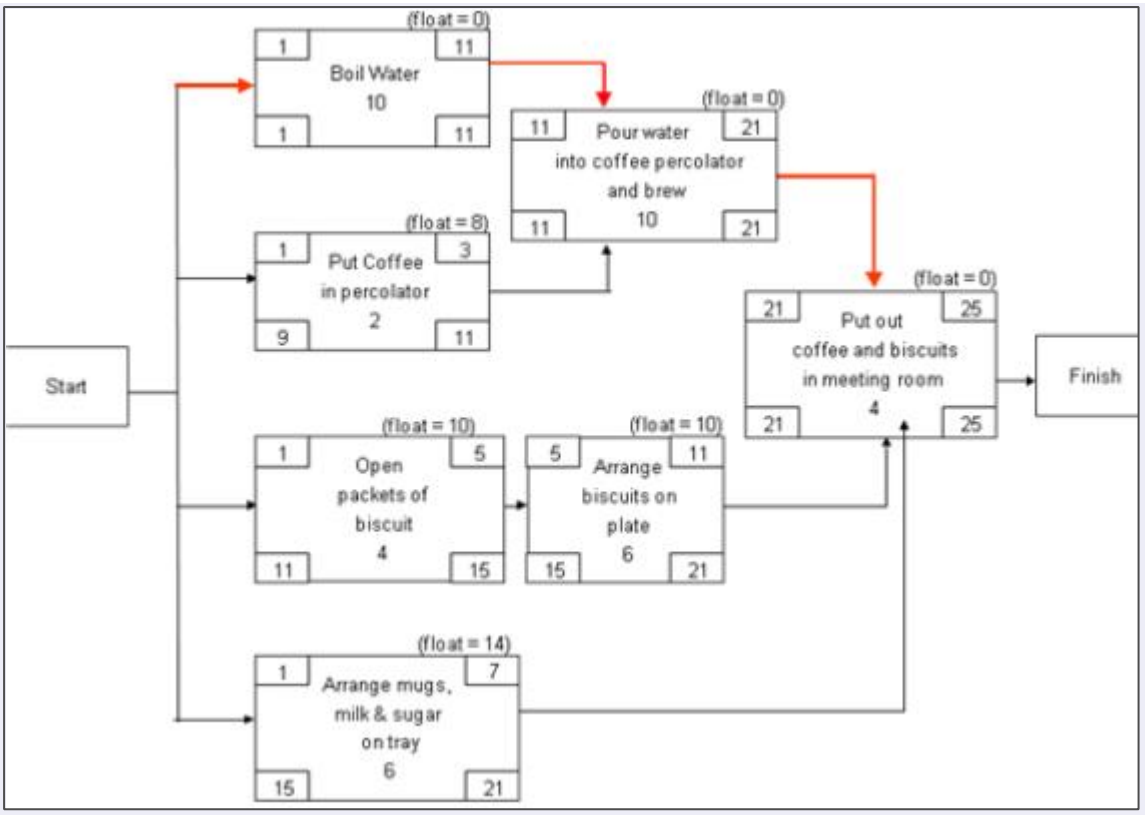

Figure 4.07 - Outline Network Diagram with forward and backward passes complete.

my learning space activity

For the final part of the series of activities for the "mini project" determine the critical path.

feedback

To determine the critical path you need to compute float first.

Float = LF - EF

or

Float = LS - ES

The computed float is shown above each activity box in parentheses.

The critical path is easily identified as the path that contains all the activities with zero floats.

The critical path is shown in red lines connecting 'Boil water' - 'Pour water into coffee percolator' - 'Put out coffee and biscuits'. Each of these activities has zero float.

Project Views
Schedules can be viewed in a number of ways. Three of the principal views are precedence diagrams, Gantt charts and milestone charts. Precedence diagram is another term for the sort of network diagram we examined above. We reproduce below a brief discussion of the advantages and disadvantages of network or critical path diagrams.

Advantages and Disadvantages of Critical Path Method
Even the most advanced and well thought of process or product has its fair share of pros and cons. The critical path method is no exception. In this article, we will discuss the advantages and disadvantages of critical path method.

The critical path method helps you identify the most important activities that can impact the project schedule. As such, this method is useful in creating project schedules and managing high-risk activities on the critical path. Even the most well thought through process will inevitably have some disadvantages - critical path method is no exception! Let us explore the pros and cons of critical path method.

Pros of the Critical Path Method
There many pros of using the critical path method during project planning and execution. The critical path method:

1. Makes dependencies visible between the project activities; this is done by **c**onstructing project network diagrams or precedence diagrams
2. Organises large and complex projects, hence allowing a more systematic approach to project planning and scheduling, project execution, and risk management.
3. Enables the calculation of the float (slack) of each activit**y**. The float tells you exactly how long an activity can come in late without it impacting the project schedule.
4. Encourages the Project Manager to reduce the project duration by optimising the critical path and using compression techniques as applicable.
5. Increases visibility of impact of schedule revisions, which are usually necessary when major milestones have been missed or when the risk of missing a major milestone looms large.
6. Enables the Project Manager to optimise efficiency by allocating resources appropriately, consequently the overall cost can be reduced.
7. Provides opportunities to respond to the negative risk going over-schedule by identifying the activities that are most critical.

For large and complex projects, it is best to use specialised software. This software generates data, such as activity float, automatically for you. Next, let us take a look at some Critical Path Method disadvantages.

Cons of Critical Path Method

There are not many disadvantages to Critical Path Method. Mentioned below are the cons of the Critical Path Method.

1. For large and complex projects, there will be thousands of activities and dependency relationships**.** Without software it can be mighty difficult managing this. To make matters worse, if the plan changes during project execution then the precedence diagram will have to be redrawn. Fortunately, we do have relatively cheap software that can handle this with ease.

2. One of the advantages of drawing a project precedence diagram is that you can print and stick

2. in the project area. The precedence diagram enables the team to stay focused on project activities. Project team members are always cognisant of the critical path since it is visible every day. However, for large projects with thousands of activities, it may be difficult to print the project network diagram. You would most definitely need a plotter.

3. The Critical Path Method does not account for resource and resource allocation.

The above article was written by Rupen Sharma, PMP and edited by Ronda Bowen and it was accessed at http://www.brighthubpm.com/... /(last accessed10th April 2013) (Permission to reproduce pending)

Milestone Chart

A Milestone Chart is a Project Control Chart that graphically depicts key events along a timescale, usually with triangles representing each event. It can depict a single event or a culmination of events. It can mark specific points in the project where checks can be made to see if the project is on time and where it should be. The best place to locate milestones is at the completion of a major activity. (

The Gantt chart is often combined with a milestone chart. Below we reproduce an article on Gantt charts with permission from The Research Whisperer website at http://theresearchwhisperer.wordpress.com/2011/09/13/gantt-c hart/ (Permission to reproduce pending)

Gantt Charts

Planning and Scheduling More Complex Projects

Gantt Charts (also known as Gantt Diagrams) are useful tools for analyzing and planning more complex projects. They:

1. Help you to plan out the tasks that need to be completed.
2. Give you a basis for scheduling when these tasks will be carried out.
3. Allow you to plan the allocation of resources needed to complete the project.
4. Help you to work out the critical path for a project where you must complete it by a particular date.

When a project is under way, Gantt Charts help you to monitor whether the project is on schedule. If it is not, it allows you to pinpoint the remedial action necessary to put it back on schedule.

Sequential and Parallel Activities

An essential concept behind project planning (and Critical Path Analysis) is that some activities are dependent on other activities being completed first. As a shallow example, it is not a good idea to start building a bridge before you have designed it!

These dependent activities need to be completed in a sequence, with each stage being more-or-less completed before the next activity can begin. We can call dependent activities "sequential" or "linear."

Other activities are "parallel" tasks. These do not have to be done in sequence, but may sometimes need other tasks to be finished first.

Drawing a Gantt Chart

To draw up a Gantt Chart, follow these steps:

Step 1 - List all Activities in the Plan

For each task, show the earliest start date, estimated length of time it will take, and whether it is parallel or sequential. Also show which other stages they depend on.

You will end up with a task list like the one in figure 4.09. This example shows the task list for a custom-written computer project.

Task	Earliest start	Length	Type	Dependent on...
A. High level analysis	Week 0	1 week	Sequential	
B. Selection of hardware platform	Week 1	1 day	Sequential	A
C. Installation and commissioning of hardware	Week 1.2	2 weeks	Parallel	B
D. Detailed analysis of core modules	Week 1	2 weeks	Sequential	A
E. Detailed analysis of supporting modules	Week 3	2 weeks	Sequential	D
F. Programming of core modules	Week 3	3 weeks	Sequential	D
G. Programming of supporting modules	Week 5	3 weeks	Sequential	E
H. Quality assurance of core modules	Week 5	1 week	Sequential	F
I. Quality assurance of supporting modules	Week 8	1 week	Sequential	G
J. Core module training	Week 6	1 day	Parallel	C,H
K. Development and QA of accounting reporting	Week 5	1 week	Parallel	E
L. Development and QA of management reporting	Week 5	1 week	Parallel	E
M. Development of Management Information System	Week 6	1 week	Sequential	L
N. Detailed training	Week 9	1 week	Sequential	I, J, K, M

Figure 4.08 - Table of data for Gantt Chart construction.

Step 2 - Set up Your Gantt Chart

Head up graph paper with the days or weeks through to task completion.

Step 3 - Plot the Tasks onto the Graph Paper

Next draw up a rough draft of the Gantt Chart. Plot each task on the graph paper, showing it starting on the earliest possible date. Draw it as a bar, with the length of the bar being the length of the task.

Above the task bars, mark the time taken to complete them.

Schedule them in such a way that sequential actions are carried out in the required sequence. Ensure that dependent activities do not start until the activities they depend on have been completed.

This will produce an untidy diagram like the one below:

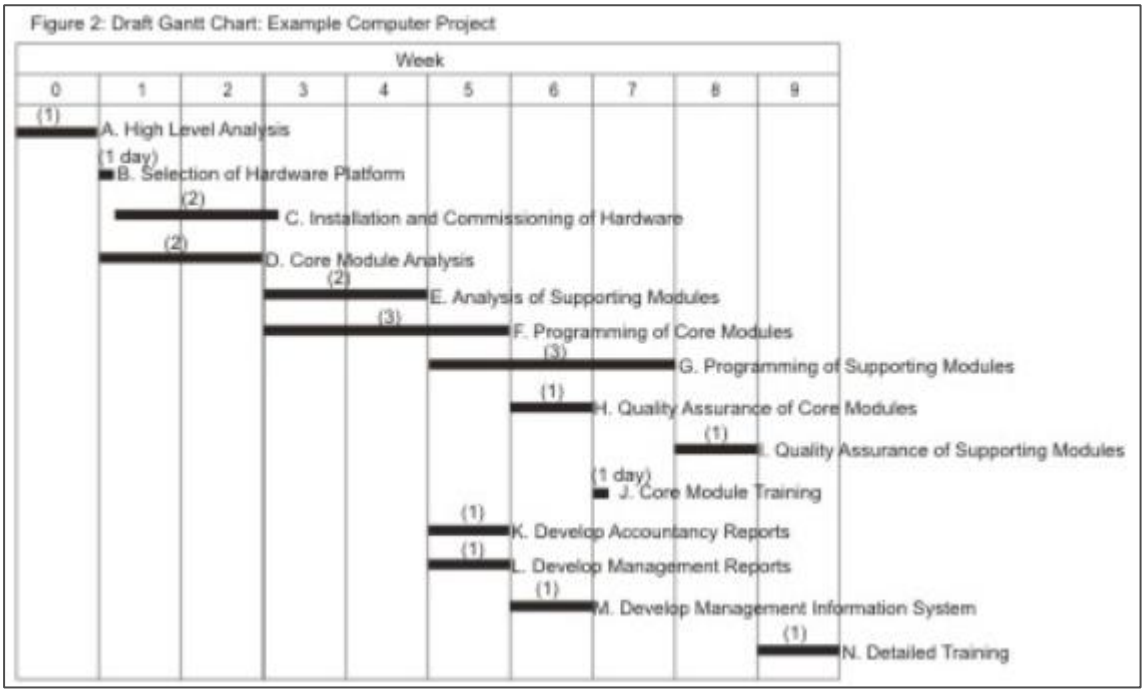

Figure 4.09 - Rough draft of the Gantt Chart

Step 4 - Presenting the Analysis

The last stage in this process is to prepare a final version of the Gantt Chart. This shows how the sets of sequential activities link together, and identifies the critical path activities. At this stage you also need to check the resourcing of the various activities. While scheduling, ensure that you make best use of the resources you have available and do not over-commit resource.

You can also use colour to represent the different resource types that you need to use such as programmers or analysts.

A redrawn version of the example project is shown below:

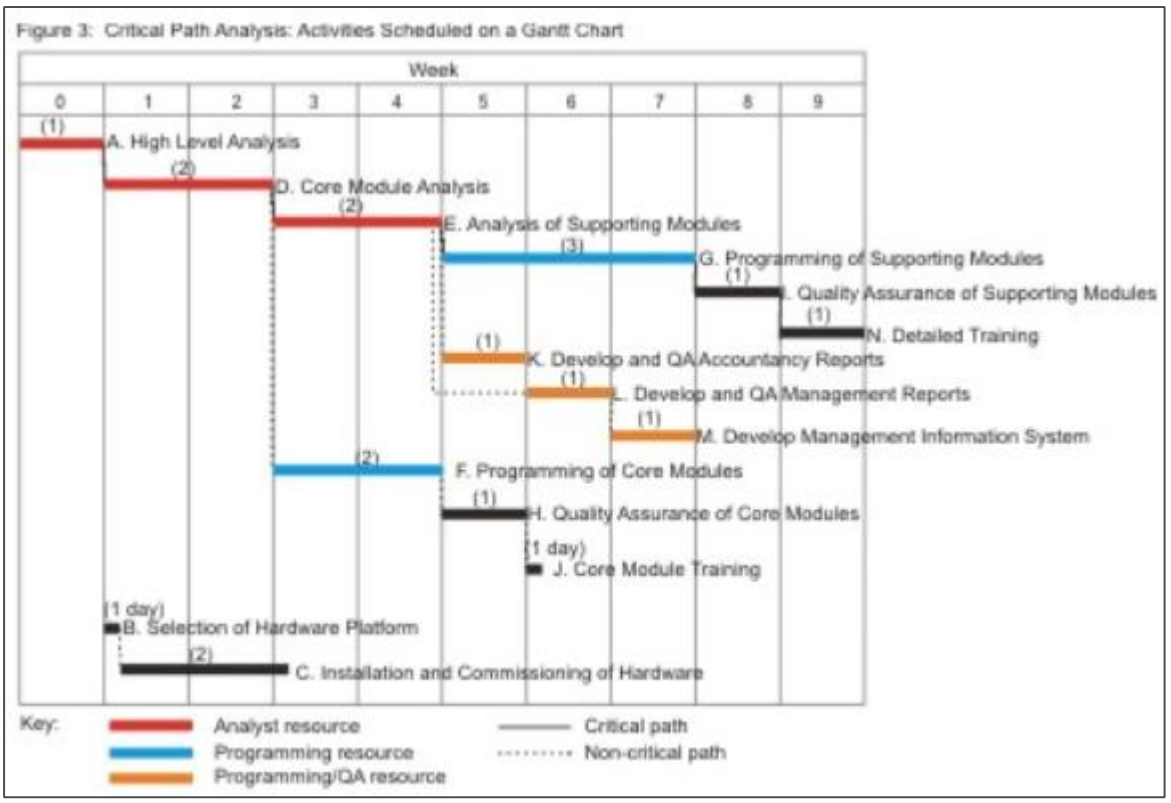

Figure 4.10 - Final Gantt Chart

By drawing this example Gantt Chart, you can see that:

1. If all goes well, the project can be completed in 10 weeks.

2. If you want to complete the task as rapidly as possible, you need:

3. One analyst for the first five weeks. (Note that we had to change the scope of activity F so that we could finish this task in two weeks, rather than three. This was because we wanted to complete the project in 10 weeks, and we could not commit resources to activities F and G at the same time.

4. One programmer for five weeks starting week 4.

5. One programmer/QA expert for three weeks starting week six. (Note that activities L and M have been moved back a week. This does not affect the critical path, but it does mean that a single programming/QA resource can carry out all three of activities K, L and M.)

6. Analysis, development, and testing of supporting modules are essential activities that must be completed on time.

Hardware installation and commissioning is not time-critical as long as it is completed before the Core Module Training starts.

While this section describes how to draw a Gantt Chart manually, in practice project managers use software tools like Microsoft Project to create Gantt Charts. Not only do these ease the drawing of Gantt Charts, they also make modification of plans easier and provide facilities for monitoring progress against plans, as well as generating resource histograms.

Key Points

Gantt charts are useful tools for planning and scheduling projects. They allow you to assess how long a project should take, determine the resources needed, and lay out the order in which tasks need to be carried out. They are useful in managing the dependencies between tasks.

When a project is under way, Gantt charts are useful for monitoring its progress. You can immediately see what should have been achieved at a point in time, and can therefore take remedial action to bring the project back on course. This can be essential for the successful and profitable implementation of the project.

It is interesting, as we can see from the above, that Gantt charts can also be used to identify a critical path in a project.

Cost Planning

Cost planning refers to the processes undertaken to estimate the project cost and then to ensure that the project is completed within the approved budget.

Cost planning consists of two processes:

- Cost estimating
- Cost budgeting

Cost Estimating

Cost estimating is the process of estimating the approximate cost of all the resources required to complete the project. Resources can be human resources but also machinery, computer hardware, software, office space, sub-contracting costs, travel and subsistence costs etc. A first pass at cost estimating may be carried out during the project initiation phase, to give the organisation an idea of how to price the project. It should, however, be noted that pricing is a business decision and cost estimates is just one input to the process. The price will generally be higher than the cost estimate to allow for overheads, contingency, margin of error and profit margins. Other strategic considerations also enter into the pricing decision process.

There are a number of techniques used in cost estimating. One is bottom-up estimating; that is to cost the individual work items (from the WBS) to obtain a total cost. Another technique is top-down estimating. This technique is often carried out when costing is conducted during the project initiation phase. It is estimating on the basis of the actual costs of a similar project conducted by the organisation.

Cost Budgeting

During the planning stage the PM will also allocate the overall project budget across the various work items to establish the cost baseline. This is called cost budgeting. Cost budgeting is usually carried out at one or two levels above the lowest level in the WBS tree structure and is referred to as a cost account. The budget assigned to the cost account represents a cost baseline and is used for measuring project cost performance.

Once the WBS has been established, you can allocate the project budget to work items. The WBS identifies activities that require resources and hence expenditure.

An example of a project to gather and validate customer requirements using a product proto-type is used below to illustrate how a cost spreadsheet can be developed for cost budgeting.

Cost categories	*Activity/type*	*Planned costs*		
		Month 1	Month 2	Month 3
Requirements				
	Organise project kick-off meeting	£2,000		
	Gather preliminary user requirements	£3,000		
	Analyse user requirements	£2,000	£7,500	
	Setup customer meeting to agree/prioritise requirements	£2,500		
	Prepare final User Requirements Document			£2,000
	Obtain customer signoff on User Requirements			£1,000
		£9,500	**£7,500**	**£3,000**
Prototype				
	Design prototype		£3,000	
	Build prototype		£2,000	£4,000
	Test prototype			£3,000
			£5,000	**£7,000**
Customer validation				
	Organise customer event to validate requirements		£500	£3,000
	Demo prototype			£1,000
	Capture feedback			£1,000
			£500	**£5,000**
Operational costs				
	Project Management	**£2,000**	**£2,000**	**£2,000**
Direct costs				
	Facilities	£1,000		£1,000
	Travel & subsistence	£500	£500	£500
	Materials	£200	£100	
	Computer hardware & software	£2,700		
		£4,400	**£600**	**£1,500**
Total project costs		**£15,900**	**£15,600**	**£18,500**

Figure 4.11 - Example Cost Spreadsheet

The first 3 cost categories represent major activities (Initial Gathering of Customer Requirements, Production of Prototype, Validation of Whether Prototype meets Requirements.) The spreadsheet shows the human resource costs associated with them. Then there is the operational cost of project management, followed by direct project costs such as purchase of hardware/software, hire of facilities (e.g. hotel) for customer meetings etc.

Note how costs are apportioned per time-period (in this case month). This would be carried out using the project schedule.

This kind of cost spreadsheet enables you to generate a project cost baseline, which is usually displayed as an S-curve.

The S curve shows planned or budgeted cost against time. It represents the cost baseline. At any time on the project, the baseline gives you a value of the budgeted cost. If you have spent too much or too little (particularly the former), then there is potentially a problem. We will look at this again in the context of project monitoring and see how it is used to monitor project progress (e.g. using earned value analysis).

You should now read chapters 6 and 7 of Lewis (2007)

my learning space activity

Review Activity

This review activity builds on the "mini project" - coffee and biscuits for a mid-morning break.

In earlier My Learning Space Activities you created a network diagram and determined the critical path for organising coffee and biscuits for a mid-morning break at a business meeting. The WBS elements were:

- Boil Water (10 minutes).
- Put coffee in percolator (2 minutes).
- Pour water into percolator and brew coffee (10 minutes).
- Open packets of biscuits (4 minutes).
- Arrange biscuits on plates (6 minutes).
- Arrange mugs, milk jug and sugar on tray (6 minutes).
- Put out the coffee and biscuits in meeting room (4 minutes).

The meeting organisers have now requested that tea also be served at the break. The additional WBS items are:

- Warm teapot by rinsing in hot water (2 minutes)
- Place teabags in teapot (2 minutes)
- Pour water into teapot and brew (10 minutes)
- All other activities and durations remain the same, except that one item has been re-named 'Put out coffee, tea and biscuits in meeting room'. Its duration is still 4 minutes.
- Extend the network for the new requirement
- Determine the critical path
- Use project scheduling software (e.g. MS project, ABT Workbench) to prepare a Gantt chart

feedback

The extension of the network is shown to encompass the tea-making activities:

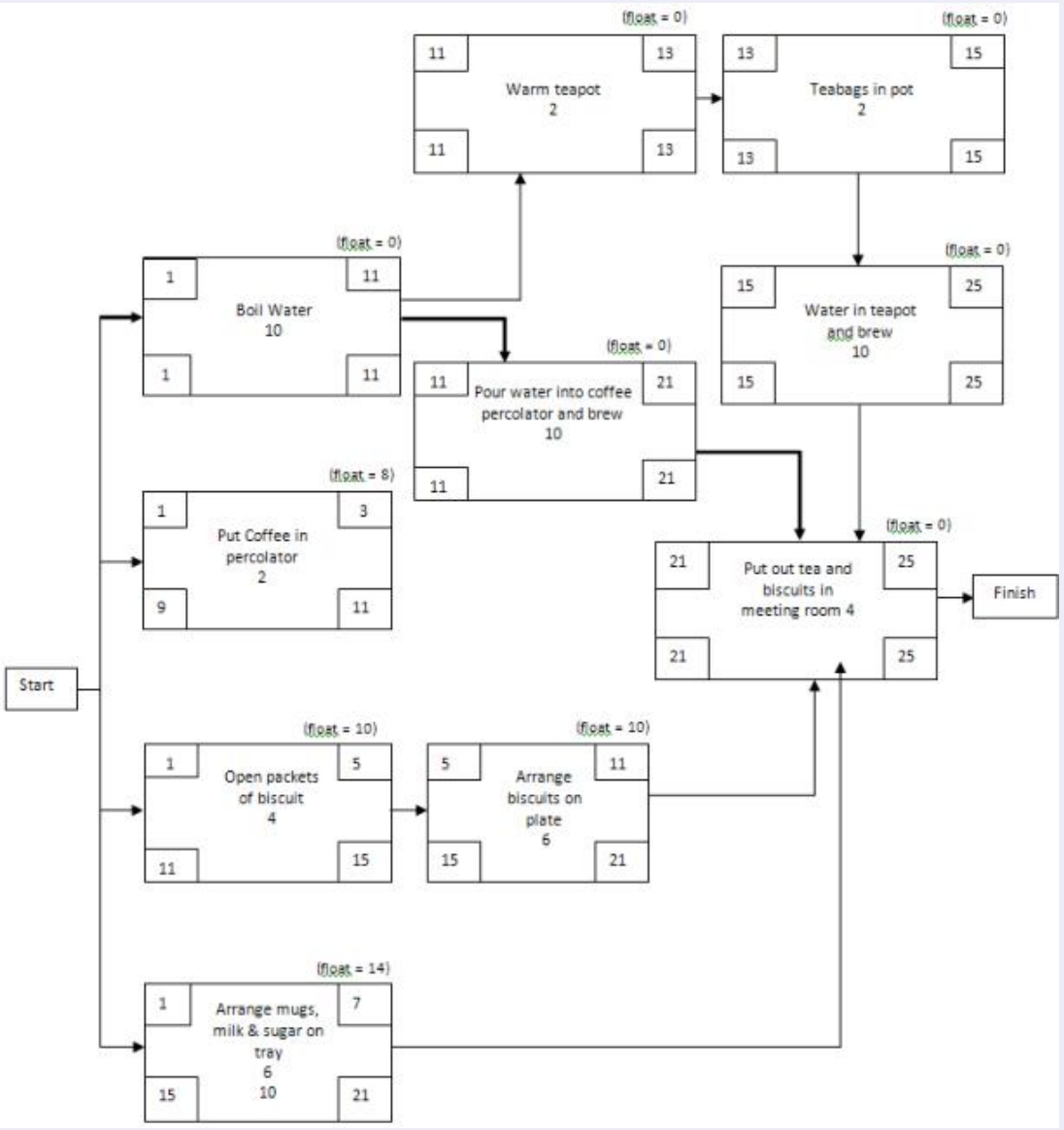

Figure 4.12 - Extension of network for mini project

Note the critical path (displayed in red) has changed to the following path:

'Boil Water' - 'Warm teapot by rinsing in hot water' - 'Place teabags in teapot' - 'Pour water into teapot and brew' - 'Put out coffee, tea and biscuits in meeting room'.

The tea making activities are now on the critical path.

Knowledge Checks

Which of these statements are true?

- The requirements baseline defines what is included and what is excluded
- The requirements baseline is not a baseline until it is approved by the project steering committee
- The WBS is a deliverable oriented decomposition of the project
- The WBS identifies who will undertake each task and in what time-scales
- Project scope is measured against requirements
- Project scope is measured against the plan
- Product scope is measured against the requirements
- Work not in the WBS is outside project scope

● Submit

Please choose which of the answers above are correct.
When you are happy with your choices press the submit button.

In the context of projects, which of these statements on cost estimating and pricing are True?

- Cost estimating and pricing are one and the same thing
- Cost estimating is ascertaining the budget assigned to the project by senior management
- Pricing is the price the customer is willing to pay for the project
- Cost estimating is determining how much it will cost the organisation to carry out the project
- Pricing is a business decision
- Pricing concerns how much the organisation will charge to an external client for performing the project
- Pricing is a key project management task conducted at the end of planning

● Submit

Please choose which of the answers above are correct.
When you are happy with your choices press the submit button.

Knowledge Checks - Solutions

Which of these statements are true?

- The requirements baseline defines what is included and what is excluded 
- The requirements baseline is not a baseline until it is approved by the project steering committee 
- The WBS is a deliverable oriented decomposition of the project 
- The WBS identifies who will undertake each task and in what time-scales 
- Project scope is measured against requirements 
- Project scope is measured against the plan 
- Product scope is measured against the requirements 
- Work not in the WBS is outside project scope 

● Submit

Please choose which of the answers above are correct.
When you are happy with your choices press the submit button.

In the context of projects, which of these statements on cost estimating and pricing are True?

- Cost estimating and pricing are one and the same thing 
- Cost estimating is ascertaining the budget assigned to the project by senior management 
- Pricing is the price the customer is willing to pay for the project 
- Cost estimating is determining how much it will cost the organisation to carry out the project 
- Pricing is a business decision 
- Pricing concerns how much the organisation will charge to an external client for performing the project 
- Pricing is a key project management task conducted at the end of planning 

● Submit

Please choose which of the answers above are correct.
When you are happy with your choices press the submit button.