Kampala International University Uganda

MASTER IN BUSINESS ADMINISTRATION

MODULE

PROJECT PLANNING AND MANAGEMENT

By

UNIT 1

Introduction to Project Management and Project Integration Management

1. Project Definition

A project is defined by the Project Management Institute (PMI) TM, as a "temporary endeavour undertaken to create a unique product or service."1 In lay person terms a project is a grouping of tasks with a specified start and end date, a specific and defined objective, a budget and resources assigned to the effort. A project is a one time event that creates or manages change. Either you are implementing something new such as a new program, a new system or you are enhancing existing programs or systems. Repetitive tasks or performing the same task again and again are not by definition projects.

What is Project Management?

Project Management has been called an accidental profession. In many organizations in the past project managers typically stumbled or fell into project management responsibilities. The world has since changed and project management is now recognized globally as a formal discipline, with international standards and guidelines and a growing knowledge base of best practices.

Project management is the application of skills and knowledge and the use of tools and techniques applied to activities in a project to complete the project as defined in the scope.

Project management is not only the use of a scheduling tool such as Microsoft Project, Scheduler Plus, etc. Many organisations still do not understand that the ability to use a scheduling tool is not enough to successfully manage a project. The use of a tool is only one part of the equation. Project management requires a high level of skill in both the people and technical side of the discipline for successful projects to result.

If we consider that the tasks in a project are completed by people, this then sheds an entirely different light to the concept of project

management and should make it clear that for successful project management the right combination of skills can impact on success and project outcomes.

The world is changing very rapidly with added complexities, increased expectations and constant change. Project Management is an effective process for organizations to address business needs to get products and services to market more quickly and preferably before the competition!

1.2 International Standards and Guidelines

Project Management is a formal discipline with international standards and guidelines developed by the Project Management Institute (PMI). A significant body of knowledge has been accumulated specifically over the past *5* years relating to effective project management practices, tools, techniques and processes across industries. PMITM is recognized as the international body providing guidance and direction for the discipline.

PMITM has developed the "Project Management Body of Knowledge" or PMBOKTM" documenting the essential knowledge areas and processes required to effectively manage projects. There are nine "body" of knowledge areas within the standards and guidelines.

- **Integration Management** — processes to ensure that the elements of the project are effectively coordinated. Integration management involves making decisions a throughout the project in terms of objectives and alternative approaches to meet or Project in terms of objectives and alternative approaches to meet or exceed stakeholder expectations.
- **Scope Management** - processes to ensure that all the work required to complete the project is defined. Defining what is or is not in scope.
- **Time Management** — all processes required to ensure that the project completes on time (defined schedule).

- **Cost Management** — all processes required to ensure the project is completed within the budget approved for the project.
- **Quality Management** — processes to ensure that the project delivers the need for which it was undertaken. Includes all quality processes such as quality policy, objectives, and responsibility and implements these through quality planning, quality assurance, quality control and quality improvement.
- **Risk Management** — all processes involved in identifying, assessing/analysing, responding and controlling project risk.
- **Human Resource Management** — all processes required to make the most effective use of people resources in a project, including sponsor, stakeholders, partners, team etc.
- **Communications Management** — all processes to ensure timely and appropriate distribution of project information, includes providing links between key people in the project, generating, collecting, disseminating, storing and archival of project information.
- **Procurement Management** — processes to acquire goods and services for the project outside of the organization.

Unit 2

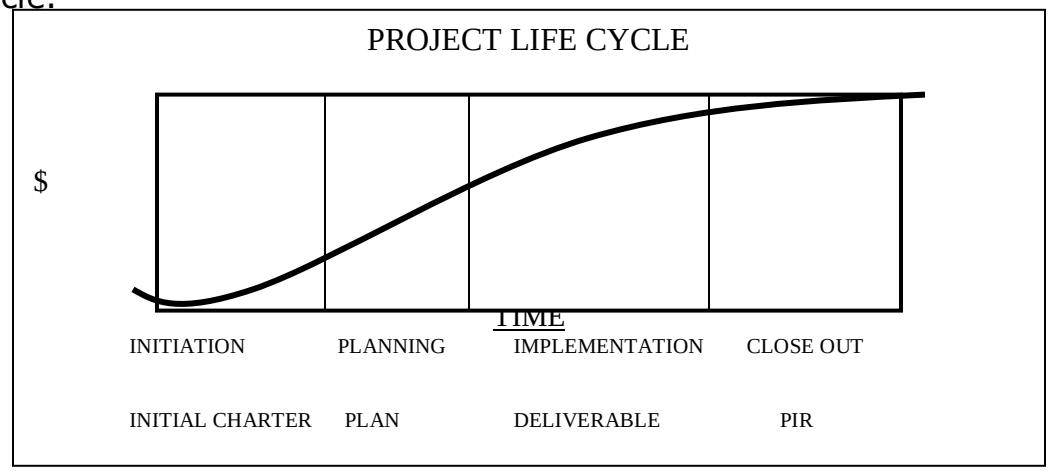
Project Management Processes

Project Management processes define, organize and complete the work defined for the project. There are five project management process areas that apply to most projects and are defined in the PMBOK:

- **Initiating Processes** — authorizing the project or phase.
- **Planning Processes** — defining the project objectives and selecting the most appropriate approach for the project to attain the objectives.
- **Executing Processes** — managing the resources required to carry out the project as defined in the plan.
- **Controlling Processes** — ensuring that project objectives are met as defined by monitoring, measuring progress against plan, identifying variance from plan and taking corrective action.
- **Closing Processes** — formalising acceptance of a phase and or the project and closing all associated activities.

Project management is integrative and to effectively manage a project, a project manager uses all of the body of knowledge areas and all of the processes throughout the life cycle of a project.

The following diagram is a sample of a standard four phase project life cycle.



2.1 Project vs. Product Life Cycles

Those of you involved in information technology fields have likely heard of the systems development life cycle (SDLC) — a framework for describing the phases involved in developing and maintaining IT systems. This is an example of a product life cycle.

The project life cycle applies to all projects (regardless of product produced) whereas a product life cycle varies depending on the nature of the product. Many products (such as large IT systems) are actually developed through a series of several different projects.

Large projects are seldom given full funding and approval from the beginning. Usually a project has to successfully pass through each of the project phases before continuing to next. The practice of 'progressive resource commitment' also means you only get the money for the next phase after the prior phase has been completed and there is an opportunity for management review to evaluate progress, probability of success and continued alignment with organisational strategy. These management points are often called **phase exits, kill points** or **stage gates.**

2.2 What is the Value of Project Management?

Project Management increases the probability of project success. Project Management is change facilitation, and used effectively with appropriate processes, tools, techniques and skills will:

- Support the Business
- Get the product or service to market effectively, efficiently and to quality standards.
- Provide common approach to project management
- Improve service

Project management is the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project.

Unit 3

How Project Management Relates to Other Disciplines

Project management overlaps with general management knowledge and practice, as well as with the project's application areas, knowledge, and practice. Project managers focus on integrating all the pieces required for project completion. General managers or operational managers tend to focus on a particular discipline or functional area. In this respect, project management tends to be a cross-functional role, often involving people from various business areas and divisions.

While project management requires some fundamental understanding of the knowledge area of the project itself, the project manager does not have to be an expert in that field. You don't need to be a certified carpenter, plumber, and electrician in to manage the construction of your house, but you do need to have a least a fundamental understanding of each trade or discipline.

3.1 The Project Management Profession.

The Project Management Institute (PMI) provides certification as a project management professional (PMP). The requirements include verification of from 4500 to 7500 hours of project management experience (depending on education level), adherence to a Code of Ethics, and obtaining a score of 70% or higher on a 200-question multiple choice as certification exam. For further information see the PMI Internet website at http://www.PMI.org.

There are also numerous other sources of information on the project management profession. Here are some other websites you may wish to check out:

www.gantthead.com

http://www.proiectmanagement.com/rnain.htrn

3.2 Understanding Organizations.

Ask any experienced project manager what the most important part of project management is and what is likely to give them the most difficulty, and the answer invariably is 'people'. That's because managing projects is really about getting people to work together cooperatively. So understanding organisational dynamics and politics is often key to project success. Organisations can be viewed as having four different frames:

- **Structural** (this is the formal or rational view like you see in an org chart)
- **Human Resource** (this focuses on balancing the needs of the organisation and the needs of its people)
- **Political** (who really has the power, influence and control over resources — often different than what the org chart would lead you to believe!)
- **Symbolic** (this relates to organisational culture and the meaning attributed to certain symbols, events, or processes)

3.3 The Importance of Project Stakeholders

Project stakeholders are the people involved in or affected by project activities.

Internal Stakeholders:

- Project sponsor
- Project team
- Support staff
- Internal customers
- Senior Management
- Functional Managers
- Other Project Managers

Compete for resources

External Stakeholders

- External customers
- Competitors
- Suppliers

- Others affected by the project, but not directly involved (e.g., government, concerned citizens, etc.)

A project manager I once met said there are three important questions to ask at the beginning of any project regarding stakeholders and decision-making:

1. How do we know when we've won?
2. How do we know when we are done?
3. Who gets to decide 1. and 2.?

3.4 Stakeholder Analysis

Project Identifies key stakeholders and information about them such as:

- organization or affiliation
    - project role
    - unique facts
    - level of interest
    - level of influence
    - suggestions for managing the relationship with this stakeholder

3.5 Project Management Skill Set

Some research has indicated that the following fifteen functions are essential for effective project management:

- Define project scope
- Identify stakeholders, decision-makers and escalation procedures
- Develop detailed task lists (work breakdown structures)
- Estimate time requirements
- Develop initial project management flow chart
- Identify required resources and budget
- Evaluate project requirements
- Identify and evaluate risks
- Prepare contingency plans
- Identify interdependencies
- Identify and track critical milestones
- Participate in project phase review
- Secure needed resources
- Manage the change control process
- Report project status

A March 1998 study of 100 practicing project managers found the following to be necessary critical characteristics of an effective project manager:

- Lead by example
- Are visionaries
- Are technically competent
- Are decisive
- Are good communicators
- Are good motivators
- Stand up to upper management when necessary
- Support team members
- Encourage new ideas

Unit 4

Project Integration Management

Many people confuse integration management with systems integration. The definition of project integration management is *"the processes involved in coordinating all of the other project management knowledge areas throughout a project's life cycle."*

To be an effective project manager, you must focus on performing integration management or making sure all the pieces come together at the right times to ensure project success. It is especially difficult for people with technical backgrounds to delegate many technical tasks, so that they can focus on integration management and the "big picture" view of the project. The three key components of project integration management are:

- Project Plan Development (creating the Project Plan)
- Project Plan Execution (carrying out the Project Plan), and
- Change Control (coordinating changes across the entire project).

Integration Management is about integrating the work of the entire project team by focusing on high quality communication and relationship building. Thus project integration management includes what is known as Interface Management or *identifying and managing the points of interaction between the various project players and elements.*

4.1 The Project Plan

The project plan is the core high-level document that guides a project's execution and control. Project plans:

- Document assumptions, definitions and decisions
- Facilitate stakeholder communication
- Define content, extent and timing of key management reviews
- Provide a baseline for project control and measuring progress
- Define a size appropriate to the scope of the project

The basic outline of a project plan is as follows:

Introduction or Project Overview

- Project name
- Project description
- Project sponsor
- Project manager
- Key team members
- Summary of key Deliverables
- List of reference documents or materials
- Glossary of definitions and acronyms

4.2 Project Organization

- Organisation charts
- Company or institution organisation chart
- Project organisation chart (lines of authority, responsibilities and communication)
- Project responsibilities
- Diagram, flow chart or timeline of major steps

4.3. Project Management and Technical Processes

Management objectives, priorities, assumptions & constraints

Project controls

How is progress monitored?

What is the Change Control process?

Who has authority to make what types of decisions?

Risk management how is risk identified, managed and controlled?

Project staffing — how many and what type of people are required and when?

Technical processes — (e.g., Systems Development Life Cycle (SDLC) and CASE (Computer Aided Software Engineering) tool selection.

Project documentation requirements

Project Deliverables and Work Breakdown Structure

Major Work packages

Key deliverables
Required specifications (hardware, software, construction specifications, codes, regulations etc.)

Project Schedule

- Summary schedule (key deliverables and their planned completion dates) Detailed schedule including dependencies (Network Diagram for illustration) Schedule assumptions and constraints

Project Budget

- Summary budget
- Detailed Budget
- Fixed and variable costs
- Projected benefits
- Assumptions

Unit 5

Project Plan Execution

Project integration management considers project planning and execution as inseparable activities. The purpose of the project plan is to guide execution. However, project plans are often changed during the course of execution as additional knowledge and information is gained through experience. Project managers rely on the expertise of team members in each knowledge area to help guide and build the plan. Project managers need good leadership, communication and political skills to execute project plans.

A key function of the project manager is to make sure the right resources are available in the things right quantities at the right time to get the job done. This includes making sure that team members have the necessary knowledge and skills. In the many projects, labour shortages often mean having to provide staff training. Also, making sure that there are back-up resources in case a key team player becomes ill or is 'lured away' also becomes a critical element of risk management on IT projects.

5.1 Project Execution Tools and Techniques

Some of the specialised tools and techniques used by project managers for project plan execution include:

5.2 Project Management Software

Project management software has become a standard 'tool of the trade'. Microsoft Project, is the most widely used project management software tools in the world. Primavera Project Planner, Scheduler Plus, Open Plan are examples of other scheduling tools available on the market. For a list of other software products and resources check out the following website: http://www.infogoal.com/pmc/pmcswr.htm

Project management software assists in creating detailed work breakdown structures, assigning resources, scheduling, budgeting and monitoring progress. It automates the production of GANTT and

Network Diagrams and can include hyperlinks to other project documents.

5.3 Status Review Meetings

Regularly scheduled status review meetings are a standard project management tool for:

- exchanging project information
- monitoring progress
- maintaining motivation
- managing risk
- identifying issues
- stakeholder communication

5.4 Work Authorisation Systems

Work authorisation systems are a formalised process used on large projects to authorise work to begin on a particular activity or work package. They are designed to ensure that the right le in the things are done by the right people at the right time, They can be manual or automated.

5.5 Overall Change Control

Overall change control includes identifying, evaluating and managing project changes. Remember the triple constraint triangle of project management (quality, time and cost) and how we said you cannot change one parameter without impacting at least one of the other constraints? Without proper change control, a project can easily drift into 'scope creep' and severe cost and/or time over-runs.

The three objectives of overall change control are:

1. Making sure the changes are useful and beneficial (this usually involves making trade-offs)
2. Determining if and when a change has occurred (and making sure senior management stays informed so there are no surprises)

3. Managing actual changes as they occur.

Key tools in overall change control are the project plan, status or performance reports and change requests. Project plans need to be updated as changes are made during execution. Status reports provide a mechanism to alert the project manager and other team members of issues that could cause problems. Change requests must be formal and written. Significant changes should be written, and be reviewed through a formal change control process implemented for analysing and authorising project changes.

Unit 6

Change Control System

A change control system is a formal, documented process that describes when and how official project documents (especially the project plan) may be changed. It describes who is authorised to make changes, the procedures to be followed and the tracking system that will be used. A change control system often includes the following elements:

1. A **change control board** (CCB) or Steering Committee — a group of people specifically responsible for reviewing and authorising or rejecting project changes. They provide guidelines for change requests, evaluate these requests and manage their implementation.
2. **Configuration Management** - a process that ensures that the descriptions of the project's products and deliverables are complete and correct.
3. **Change Communication Plan** — policies and procedures for identifying and reporting change requirements and communicating change decisions. This is to ensure that the entire project team remains up to date with the project details.

6.1 Suggestions for Managing Change Control

- Understand that constant communication and negotiation is a normal part of the process
- Plan for change
- Establish formal change control systems and procedures
- Use configuration management
- Define procedures for quick decisions on small-scale changes
- Use status reports to identify and manage change
- Use project management and other tools and processes to help manage and communicate changes.

6.2 The Need for Senior Management Buy-In

Senior management commitment and support is one of the critical success factors for project management. The main reasons cited for this are as follows:

- To ensure the project has adequate resources
- To ensure approval for unique or unanticipated project needs
- To ensure cooperation of other managers and staff
- To help deal with political issues
- To provide coaching and mentoring on leadership issues

Some organisations will create a special project management office or centre of excellence as a special support block for project activity.

Scope and Time Management

Overview

This block examines two core of the project management functions — scope and time management. Project Scope Management includes the processes involved in defining and controlling what is or is not included in a project, It ensures making sure that all project stakeholders have the same understanding of what the deliverables are and how and when they will be delivered. Project Time Management involves the processes required to ensure timely completion of a project. These include: activity definition, activity sequencitig, activity duration estimating, schedule development and schedule control.

At the end of this Block, you will be given an assignment, which is a multiple choice test. This test provides a confirmation of understanding of the general concepts of project management including the integration, scope and time management bodies of knowledge as defined in the Block notes and based on the international standards and guidelines defined in the PMBOK (Project Management Body of Knowledge).

Block Notes

Project Planning

We are going to take a quick look at the elements of project planning, starting with the project life cycle and then examine the importance of detailed planning to the overall success of the project.

Without a clear definition of the project, it's impossible to discern what should be delivered as a result. If requirements are not clear, your project will be impossible to control, and it or will become unmanageable. We will review the fundamentals of planning and then move on to the importance of developing a comprehensive work breakdown structure.

Today's organizations are running at a fast pace. More so than ever, organizations are faced with increasing global competition and as such, want products and services delivered yesterday! Organizations are struggling with multiple projects, tight deadlines and fewer skilled resources available to manage these projects. Project managers are struggling with the concepts of best practices and the reality of life in a corporation. Often insufficient time is provided for planning the project appropriately and as a result projects consistently fail to produce the expected results, have cost or time overruns, or just plain fail. In such cases, the project manager can usually look back on his or her experiences and see what went wrong, vowing never to make the same mistake again. Sometimes, however, the cycle continues.

Whether you manage a small, medium or large size project, effective planning of the project is the single most critical step to success. Too many project managers either neglect or spend too little time and effort planning. The tendency is to rush to implementation before a clear picture is developed. The project definition must be clear and understood by the stakeholders and the team. Often the directive from the project sponsor is "Just do it" or "W6 need this in place by next week", "we don't have the luxury to spend time planning, we need to do the project", not allowing the time up front to conduct proper

planning activities. Failure to plan, however, usually results in failure to survive.

Without a clearly defined scope, the project has no sustainable basis for success. Building a detailed project plan forces the team and the stakeholders to realistically assess the proposed project. What will the outcome be when the project is finished? What will you have? — product, service? What will the product/service look like? What are the must have, nice to have features of the product/service? What is the current situation? What is the desired outcome? What are the obstacles keeping you from closing the gap? Who are the primary and secondary stakeholders? What is the problem/change? What are the assumptions/constraints and objectives of the project?

The planning stage of the project includes setting broad-based goals and designing strategies and action plans to reach these goals.

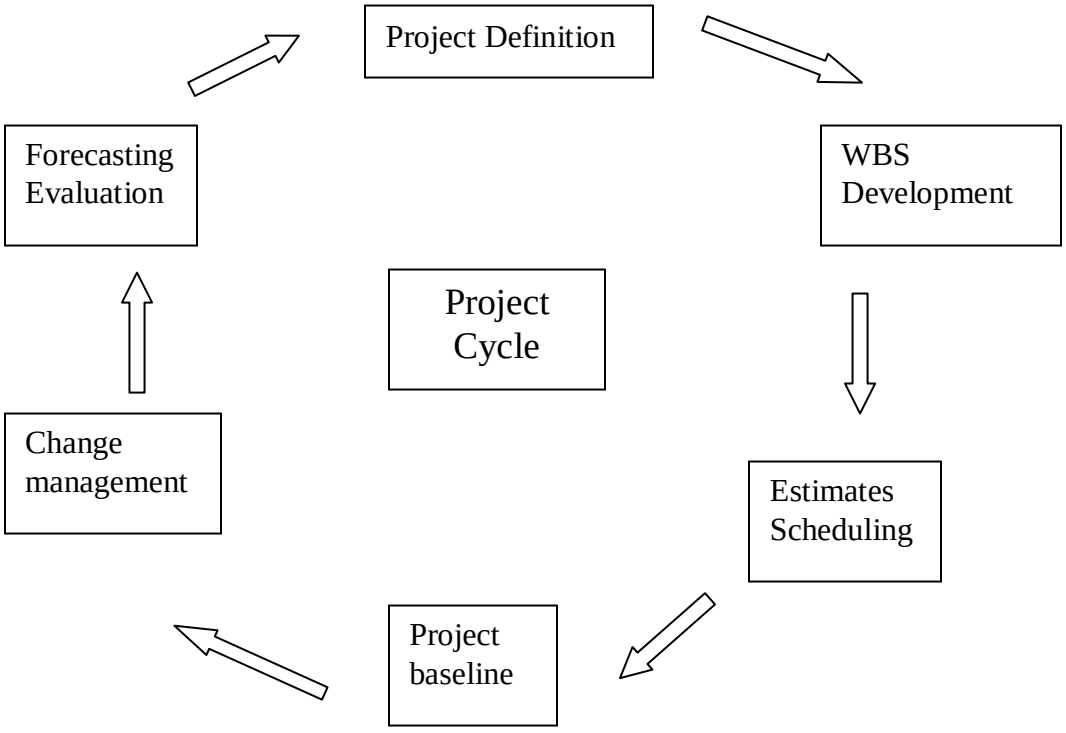
Project planning is a dynamic, "cyclical" process that continues throughout the project life cycle. Planning must take place to deal with problems, change or risks as they occur in the project. Planning begins with the identified and agreed to requirements in mind. It is critical to the success of the project to understand your destination when you start. You will know where you are going and you will have developed plans to arrive at the goal and complete the project successfully. Project managers must learn how to develop a project strategy and plan regarding how to implement that plan. Your organization, team and stakeholders *depend* on it.

Project planning is a cycle that is repeated on an on-going basis. For the duration of the project, it is never a finished process. Why? Because resources change or move, factors in the organisation may change causing project objectives to change, unknown risks can occur, and! it or technology may change, requiring project managers to continually monitor and manage on this process through out the life of the project.

The following diagram illustrates the "Project Life Cycle" and the cyclical nature of planning re faced activities.

Diagram used with permission Enterprise Project Management Ltd.

The Project Cycle



6.3 Project Definition.

Determining clear and agreed to requirements is a fundamental concept in project management. Requirements must be explicit and detailed in a fashion allowing scope to be determined and stakeholders to have a clear understanding about what the project will accomplish. This is the key input into scope definition. Stakeholder issues can affect the potential success or failure of a project. As such it is important that as part of the project can definition a stakeholder identification and analysis is conducted and the right stakeholders are brought into the project as early as possible. By doing this you are establishing support for the project early on in the process and will be able to leverage that support going forward to achieve success.

Key inputs to Project Definition:

- Clearly defined requirements
- Defined mission and objectives of the project
- Defined and agreed to statement of work

The statement of work or scope statement must clearly state the project objectives and should follow the SMART concept:

- Specific.
- Measurable
- Agreed to by the team and stakeholders
- Realistic within the specific environment
- Time constrained

Acceptance criteria and project success must be agreed to up front with the stakeholders and sponsor, and all deliverables must be specific and objective.

Outputs of Project Definition:

- Project Charter
- Stakeholder identification and assessment
- Risk identification, assessment and response
- Quality Plan
- Communications Plan
- Work Breakdown Structure

6.4 Triple Constraints

The concept of Triple Constraints is critical in project management overall and to defining individual projects. Managing a project using the triple constraints allows the project manager to direct the progress of the plan for those components affecting 1.schedule, 2.cost and 3.quality within the defined scope of the project. Increased cost will affect time, increased or changed scope affects cost and time, and increased time will affect scope and cost. The bottom line is - if you don't meet the triple constraints, the project will not complete within the defined scope.

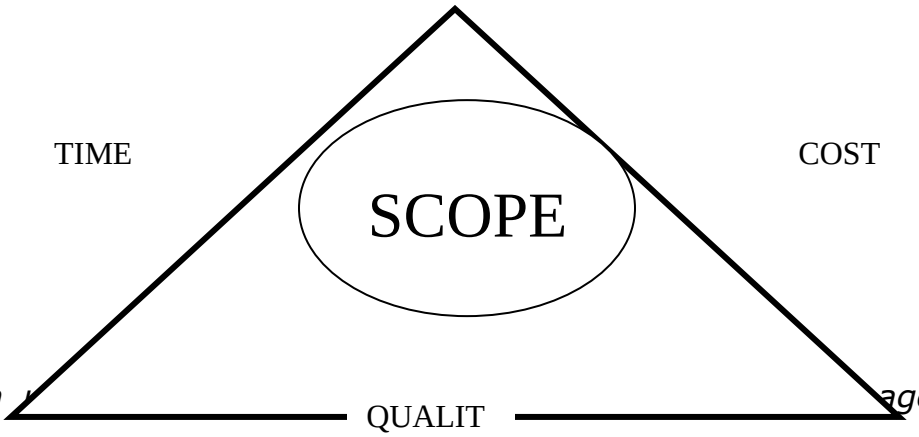


Diagram agement Lid.

The triple constraints are the indicators used to measure the success of the project. In most organisations, it is often difficult, if not impossible, to create clear metrics for the success or failure of projects. Often, success or failure is determined by the public relations capabilities of the project manager. When defining the project, it is imperative to establish the scope of the project in terms of time, cost and quality, within the context of the agreed to deliverables. In order to define the full scope of the project a Work Breakdown Structure is required. Whatever is "not" defined in the Work Breakdown Structure at the end of planning is "out of scope" for the project. Therefore, as a project manager you need to work with the right team members and stakeholders to develop a thorough structure.

6.5 Scope Management

Project Scope Management can be defined as ***"the processes involved in defining and controlling what is or is not included in a project."*** It entails making sure that all project stakeholders have the same understanding of what the deliverables are and how and when they will be delivered.

The five key processes involved in scope management include:

1. **Initiation** — beginning a project or continuing to the next phase. Usually involves the creation of a project charter.
2. **Scope Planning** — Involves establishing decision-making criteria (a. How do we know when we're done? b. How do we know when we've won? c. Who gets to decide a & b?) Deliverables include scope statement and scope management plan.
3. Scope Definition — Creating a Work Breakdown Structure (WBS) — to break major deliverables down into smaller, more manageable components)
4. **Scope Verification** — Formal acceptance of scope definition by key stakeholders
5. **Scope Change Control** — controlling 'scope creep'

6.6 Project Selection

Projects should support the strategic direction of the organisation and be managed to ensure tangible benefits to the organisation. The organisation's strategic plan should guide the project selection process. We will discuss this in some detail in the final block of this course.

6.7 The Analytical Approach

There are a number of rational analytical models that can be used in project selection.

1. **Need, Funding and Will (NFW) Model**

(a) Do people agree that the project needs to be done?

(b) Is the organisation prepared to allocate sufficient funds for the project?

(c) Is there a strong will to make the project sucóeed (especially CEO and senior management support)?

2. Categorisation Approach

a) Problems, Opportunities and Directives (POD)

b) Windows of Opportunity - categorisation based on estimated project time or completion dates.

c) Overall Priority - High, Medium or Low?

4. Financial Models

a. Net Present Value (NPV)

- Provides a way of comparing projects of different duration, cost and expected benefit
- All projected future costs and returns are 'discounted' or brought back to a present value. (This is based on the time value of money that says a dollar earned or spent today is worth more than a dollar 5 years from now.) The present values will depend on the time period and discount or interest rate applied. For example, the net present of $50 earned 5 years from now is $31 using a 10% discount rate. Another way to think of this is if I gave you $31 today and you put it in a savings account that paid 10% compound annual interest, in five years from now the value of that account would be $50.

- The NPV approach involves the following steps:
    1. Estimate and itemize each cash infl6w and outflow for the project and when it is expected to occur.
    2. Determine the appropriate discount rate.
    3. Discount each cash inflow and outflow to the present time period.
    4. Add together all the discounted inflows and outflows. (MS Excel has a built in NPV function)

For two or more projects, the project with the highest NPV has the highest present financial value.

b. Return on Investment (ROI)

- ROI also uses discounting
- ROI = Income/Investment
- ROI NPV/Discounted Cost or
- ROI = (Total discounted benefits - total discounted costs)/discounted costs

Many organizations have a **Required Rate of Return** or a minimal acceptable ROI

c. Payback period

- The amount of time it takes before discounted benefits exceeds discounted costs
- When does NPV become positive?
- How soon does the investment start paying off?
- How long will it take to recoup the dollars invested in a project?

d. Weighted Scoring Model

- Identify selection criteria (time, priority, estimated payback, etc)
- Assign a weight to each criterion
- Assign scores to each criterion for each project
- Calculate weighted score for each project by multiplying weight by score and summing for each project
- Project with highest weighted score wins

Criteria (A)	**Weight (B)**	**Project 1 Score (C)**	**Project 1 Weighted Score (B)X(C)**	**Project 2 Score (E)**	**Project 2 Weighted Score (BXE)**
Boss likes it	40%	40	16	60	24
Will make a lot of money	30%	50	15	30	9
We can do it fast	20%	*25*	*5*	*25*	*5*
Uses lots of	10%	20	2	15	1.5

nifty new technology					
Total			**38**		**39.5**

According to the above system, Project 2 wins because it has the highest weighted score, even though it is expected to make less money. This example also illustrates another point. Project selection is not always made on the basis of rational analysis. Organisational politics can have a strong influence on project selection. This is especially true within a government bureaucracy where both small and large 'P' politics can have a large influence on the decision-making process.

6.8 Project Charters

The key document that often defines project initiation is the project charter. A **Project** Charter is a ***document thatformally recognises the existence of a project and provides direction on the project's objectives and management.*** Once the project charter is signed by the project sponsor, it provides authorisation for the project manager to start planning.

The charter is often used to let key members of the organisation know about the existence of the project, and to authorise its implementation. Key project stakeholders should sign the charter.

At a minimum a project charter should contain:

- Title and date of authorization
- Name of project manager and contact info
- Statement of project Scope
- Summary of approach
    - Roles and responsibilities matrix
    - Sign-off page for key stakeholders

Sample Project Charter Table of Contents

- Project Name
- Project Objectives

- Project Purpose
- Scope (In and Out of Scope)
- Key Deliverables
- High Level Schedule (Plan)
- Key Stakeholders (internal and external)
- Cross Organisation Team Members
- Risk Management
- Links to Other Projects
- Constraints & Assumptions
- Completion Criteria
- Approval

3. Scope Planning

Scope planning involves developing documents to clarify project scope and the basis for project decisions including criteria for phase sign-off. (How do we know when we're done?) The key output is a scope statement.

The **scope statement**, or statement of work, is the key document used to enunciate and confirm the scope of the project. It should include the following:

- Project justification (What is the business need? Why are we doing this project?)
- Project products (Key products & Services — e.g., minimum hardware and software requirements)
- Summary of project deliverables
- Scope management plan (cost, time and quality measures of success and clearly articulates both what the project will deliver and what it will not deliver).
- Sometimes called a Statement of Work
- Scope Definition — The Work Breakdown Structure

The next step in scope management is scope definition — or breaking the work down into manageable pieces. Good scope definition:

- helps improve the accuracy of time, cost and resource estimates

- defines a baseline for performance measurement and project control
- assists in communicating work responsibilities

A work breakdown structure (WBS) is defined as: **"a *deliverables-oriented depiction of the work involved in a project that defines the total scope of the project.'***
In simple terms, it's a detailed listing of what is required to deliver the product/service of the project.

It is the "heart" or foundation of project management that provides the basis for planning and development for the project.

3.1 The Work Breakdown Structure (WBS)

A key strategy of effective planning is to "break" the project down into manageable components of work that can be individually planned, estimated and managed. The process of "breaking" the work down is called the "Work Breakdown Structure". The work breakdown structure is a tool that displays in detail, the project statement of work to aid in understanding and communication of the project scope. The WBS is created from the earliest stages of project definition.

Without the WBS, there is no schedule or cost control in modern project management. The work breakdown structure is a powerful tool for expressing the scope or extent of a project in simple terms. It represents the project in terms of the hierarchy of deliverables it will produce. The WBS starts with a single box at the top, which represents the entire project. The project is then broken down into lower levels such as a phase, and then is further detailed into activity, task and step. The WBS supports the principle of management by objectives/deliverables by providing a map of what is to be produced in the project. (See and Sample WBS diagram below).

The WBS is the input into activity definition. Once it is determined what to build the next level of detail takes us to specifying how it can be built by developing the activities, tasks and steps to the bottom level of the WBS. Again, this is an important aspect to the

development of the WBS. We want to take the project down to a level where the project manager can effectively manage the project!

The WBS must not only cover the "product" of the project, but also the elements related to any5 initiating, planning, implementing, and completing activities of the project. The content should be as explicit as possible.

The WBS should answer the following questions 1) Does the detail in the WBS reflect the entire project? 2) Are the work packages SMART? 3) Have the tasks been defined clearly?

WBS Rules

- Begin with the scope statement
- Task descriptions developed using a verb and a noun
- Develop WBS to lowest level of control required to effectively manage a project (Work Package — guideline 80 hours of effort)
- Each work package is developed to accomplish a discrete and separate element of work
- Allow assignment to a single organisational unit for exclusive responsibility.
- Organise the WBS by Task:
    - Phase
    - Activity
    - Task
    - Step

  OR
- Organize the WBS by Deliverables:
    - Hardware
    - Software
    - Network

Many project managers today use a combination of deliverables orientation and task orientation, which involve starting the WBS with specific deliverables (what) at the high level and then breaking the tasks out (how) to create the deliverable to the detailed level.

The following diagram describes a typical task oriented and phased, high-level WBS structure. The box at the top represents the entire project and is referred to as WBS level I. The lower levels which describe the components of the project increasing in detail represent level 2, level 3 and so on. The WBS level is important as it allows reporting of cost estimates at various levels that are often required in the organisation. Project managers typically need to understand and manage all levels of the project. To better facilitate this responsibility for a phase could be allocated to a sub-project leader at a level 2 and team leaders at the level 3.

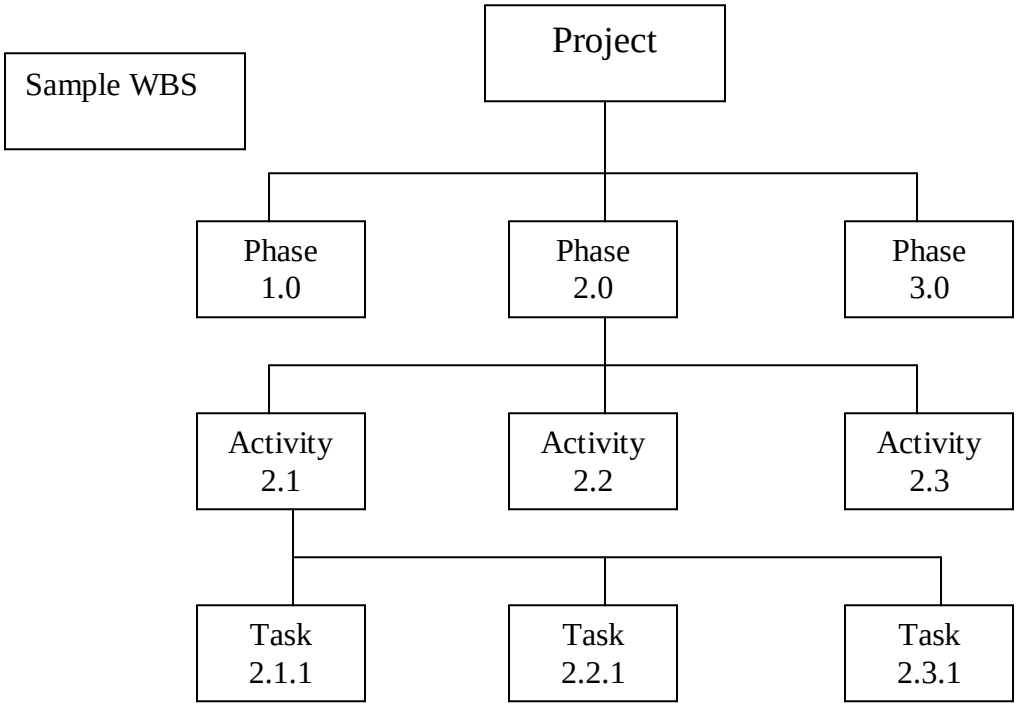


Diagram used with permission Enterprise Project Management Ltd

The WBS partitions project deliverables into smaller components and provides a mechanism for collecting and organizing costs and provides for performance measurement and control.

It provides a simple outline of what is to be produced by the project. The WBS does not deal with time! It is the input into schedule development.

There are four basic approaches to creating work breakdown structures:

1. **Using Guidelines** — Many organisations, especially government organisations, will provide strict guidelines for developing a WBS. This enables them to compare costs estimates for various phases or levels of a contract between competing bidders or against their own estimates.
2. **The Analogy Approach** — This is basically using a WBS developed for another project as a template. Some organisations, particularly those that have a project office, often have a library of documentation from other projects including Work Breakdown Structures.
3. **The Top-Down Approach** — This conventional method of creating a WBS from scratch involves starting with the largest project items and then breaking them down in sub-tasks. This works well for a project manager who already has a good grasp of the technical details of a project, or who has managed a similar project before.
4. **The Bottom-Up Approach** — As the name suggests, this method involves listing all the detailed tasks first and then grouping or arranging them into higher level categories. This approach is often used on entirely new systems or approaches to jobs. While it is quite time-consuming it also helps in developing project teams and fostering stakeholder buy-in.

Work breakdown structures can be presented in many ways. A common form and the one

used in project management software, such as MS Project, is a tabular form like this:

		Task Name	**Duration**
1		1. Start Project	0 days
2		• **2. Initiating tasks**	**11 days**
3		2.1 Initial Meeting with project sponsor	1 day
4		2.2 Research Similar projects	5 days
5		2.3 Draft Project requirements	3 days
6		2.4 Review with sponsor and other stakeholders	1 day
7		2.5 Develop project charter	1 day
8		2.6 Charter signed	0 days
9		• **3 Planning tasks**	**11 days**
10		3.1 Develop WBS	5 days
11		3.2 Estimate Durations	5 days
12		3.3 Assign resources	4 days
13		3.4 Determine task relationships	2 days
14		3.5 Enter cost information	3 days
15		3.6 Review Gantt and PERT chart information	1 day
16		3.7 Review plan with stakeholders	1 day
17		• **4 Executing tasks**	**69 days**
18		4.1 Analysis tasks	20 days
19		4.2 Design tasks	34 days
20		4.3 Implementation tasks	20 days

A work package is a deliverable or product at the lowest level of the WBS. In the above illustration, *3.5* Enter cost information would be an example of a work package for this particular WBS.

To create a work breakdown structure you need to understand the project and its scope as well as the needs and knowledge of the stakeholders. The entire project team should be involved in creating

and reviewing the WBS. The principle is 'the people who do the work should help plan the work!

Scope Change Control

At the beginning of this block we introduced the term 'scope creep'. This does not refer to a peeping torn with a telescope. Rather this is a phenomenon that often occurs in projects as a result of the best of intentions. It is the tendency for project scope to get larger and larger. As project manager you want to ensure client satisfaction and benefit realisation. It starts with the client coming back to you after the project scope has been agreed to and saying, "I know this wasn't part of the original project, but if we just did this one more thing, it would be that much better." That one more thing, of itself, may not add that much to the overall project time or cost. But that process repeated often enough can result in significant cost and time over-runs.

Two methods of controlling scope creep are scope verification and scope change control.

Scope verification involves documenting the project's processes and products and getting the key stakeholders to sign off on them. In a project, this is usually accomplished through what are known as a Business Requirements Document and a Technical Specifications Document. **Scope Change Control** usually entails a formalised process for changing project scope wherein the implications in terms of time and cost are clearly stated. Again, key stakeholders are required to sign-off on accepted changes to the scope of the project. The best preventative measure for project scope change is doing a thorough job of requirements and specifications in the first place.

According to the Standish Group, the top three reasons for project problems are

1. Lack of stakeholder input
2. Incomplete requirements and specifications
3. Changing requirements and specifications

Suggestions for Enhancing User Involvement

The following are suggestions for improving user input:

- Ensure all projects have a client project sponsor.
- Make all documentation readily available.
- Include stakeholders on the project team.
- Hold tegu1ar meetings with stakeholders.
- Get stakeholders to sign-off on key deliverables.
- Deliver something to stakeholders and sponsors on a regular basis.
- Co-locate stakeholders with project team if possible

Suggestions for Reducing Incomplete and Changing Requirements

- Develop and follow a requirements management process.
- Use techniques such as prototyping, JAD (Joint Application Design) sessions to gain a thorough understanding of user requirements. JAD was developed by IBM Canada as a short and iterative process to work with stakeholders to define and agree upon requirements in a structure process.
- Put all requirements in writing. Keep them current & readily available.
- Provide adequate testing throughout the project life cycle.
- Create a formalised change control system, and require stakeholder sign-off.
- Stick to the completion date (Remember the triple constraint triangle — if the time and can’t change, very little can change in terms of cost and quality!)

Unit 7

Project Time Management

Overall, schedule issues are one of the primary sources of conflict over the life of a project. Scope and cost can be estimated and debated. The schedule, once set, tends to be the least flexible and the most easily measured and evaluated of the three project constraints.

Definition: **Project Time Management** involves ***the processes required to ensure timely completion of a project***. These include:

- **Activity Definition** — identifiing the activity or task that must be performed to produce the project deliverables. (A task is an element of work that has an expected duration, cost & resource requirements.)
- **Activity Sequencing** — identifying and documenting the relationships between project activities (particularly the order of execution).
- **Activity Duration Estimating** —approximating the amount of time or number of work periods needed to complete each activity or task
- **Schedule Development** — analyzing activity sequences, duration estimates and resource requirements to create a workable schedule.
- **Schedule Control** — controlling and managing changes to the project schedule

Activity definition usually entails developing a more detailed work breakdown structure. (In, my view, the more detailed the better.) The project team should review this revised WBS before moving to the next step — activity sequencing. Part of activity definition includes documenting detailed product descriptions, assumptions and constraints.

Activity sequencing looks at dependencies and relationships — does one activity need to precede another or can they be done in parallel? Three main types of dependencies:

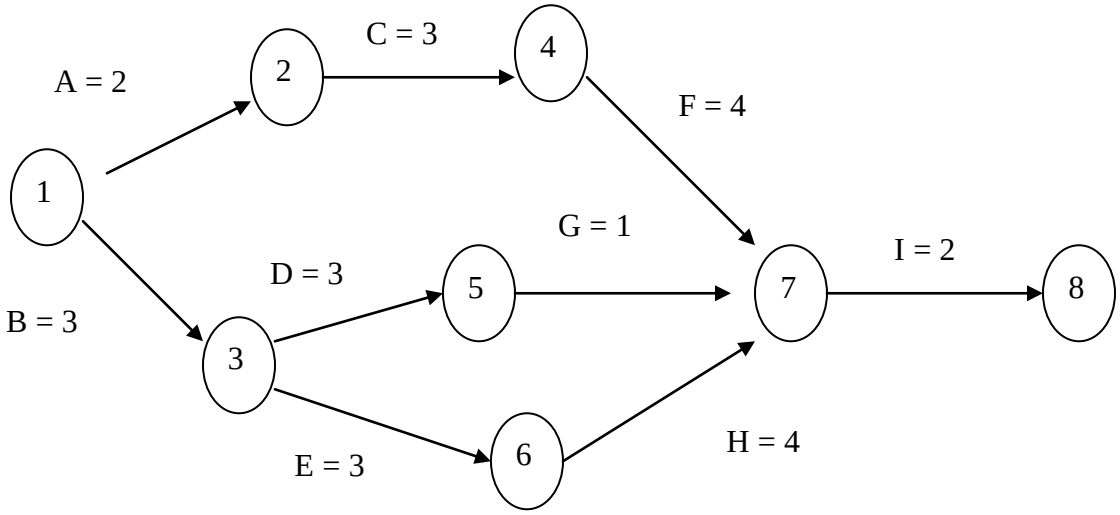
- Mandatory — 'hard logic' — one task cannot start until a previous task is complete (e.g., can't test until you build).
- Discretionary — 'soft logic' - defined by project team (e.g., no detailed design until analysis is signed off)
- External — dependent on non-project activity (e.g., software install project can't start until hardware is delivered)

7.1 Schedule Development Tools

The key project management tools used to develop accurate and effective schedules include Network Diagrams, GANTT charts and Critical Path analysis.

Network Diagrams

A project network diagram *is a schematic display of the logical relationships among project activities or the sequencing of project activities.* It is the preferred technique for showing activity sequencing.



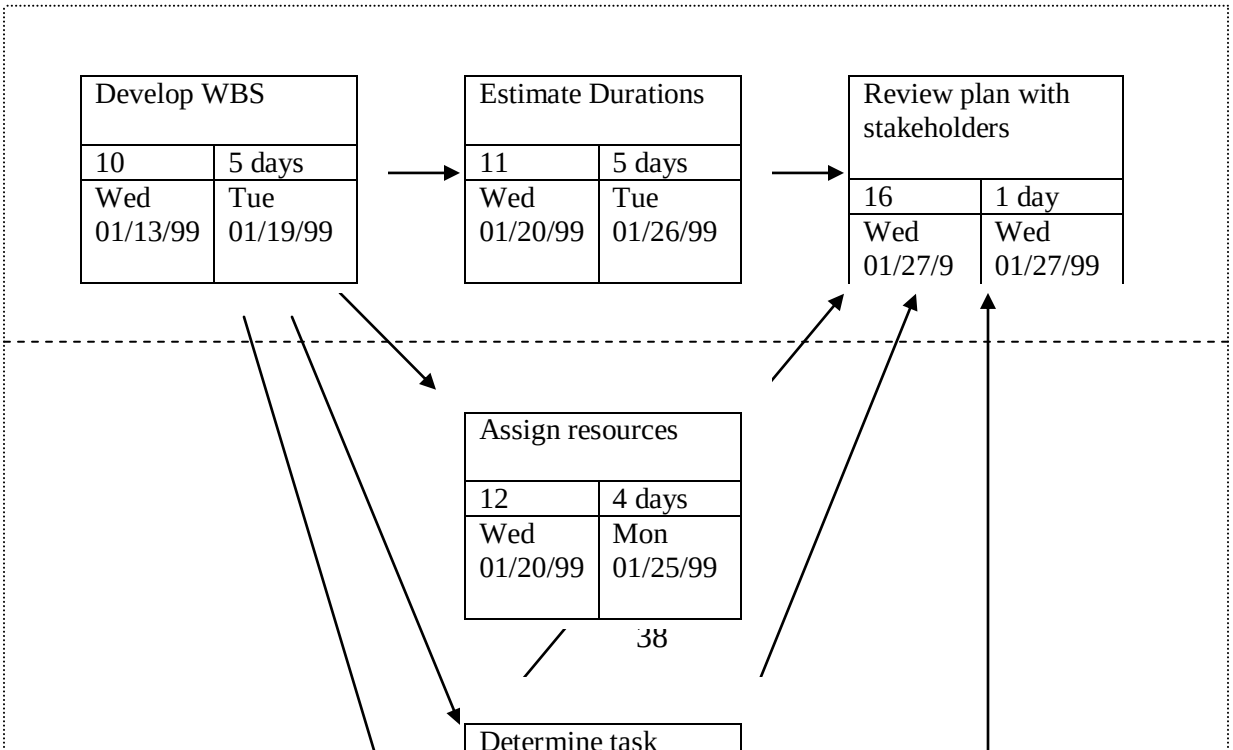
In the above network diagram the letters represent activities or tasks. The arrows show the sequencing, and the values associated with the letters (e.g. D= 3) represent the units of time (days, weeks, etc.) associated with that task or activity. The example diagram uses the Activity on Arrow (AOA) or Arrow Diagramming Method (ADM), in

which activities are represented by arrows and are connected at points called nodes to illustrate activity sequencing. The total estimated duration of this sample project is the sum of all the numbers associated with arrows—or *25* days.

Another way of drawing a network diagram is by the precedence diagramming method (PDM) a network diagramming technique in which boxes represent activities. The diagram below is an extract of a much larger project network diagram. Activities are placed inside the boxes, which represent the nodes in this diagram. Arrows are used to show relationships (There are a lot of arrows in this example that don't seem to go anywhere because it's part of a larger project). One of the key advantages of network diagrams over Activity on Arrow diagrams is the elimination of dummy activities — activities with no duration and resources sometimes needed in AOA diagrams to show relationships between activities.

7.2 Activity Duration Estimating

Duration = actual amount of time worked on an activity *plus* elapsed time. (This may need to take into consideration people working only halftime, waiting for some critical resource, or preceding activity). Best estimates will likely come from the people who have to do the work, although there will be a tendency to 'pad' their time estimates as a risk mitigation strategy.



A Network Diagram that illustrates the Precedence Diagramming Method (PDM)

The key outputs of duration estimating are:

- Duration estimates for each activity
- Document describing basis for estimates and assumptions made
- Updated work breakdown structure

7.3 Schedule Development

The goal of schedule development is to create a realistic project schedule that forms the basis for monitoring project progress. The key tools used in developing project schedules are GANTT charts, Network Diagram charts and critical path analysis.

GANTT Charts

A GANTT chart is a standard form at for displaying project schedule information by listing project activities and their corresponding start and finish dates in calendar format. GANTT charts were developed by Heniy Gantt during WWJ for scheduling work in job hops. Today they are usually produced by project management software. See example below.

Sample GANTT Chart

Activities on the Gantt chart should coincide with the activities on the WBS.

Notice the following features on the above Gantt chart:

1. **Milestones** — a significant event on a project with zero duration represented by a black diamond
2. **Summary tasks** — summarises the duration for all sub-tasks beneath it — represented by a thick black bar with downward pointing arrows at the beginning and end
3. **Task duration bars** — smaller lighter-coloured horizontal bars representing the duration of an individual task.

4. **Dependency arrows** — arrows connecting the individual task duration bars show relationships, dependencies and precedents between tasks.

A tracking GANTT chart is a variation of a Gantt chart that compares planned and actual project schedule information (also called total float). The planned dates are called 'baseline dates'. A white diamond on a tracking Gantt indicates a **slipped milestone** — or a milestone activity that was completed later than originally planned. Gantt charts are easy to create and provide a standard format for displaying planned and actual activities. However, they do not show relationships and dependencies between tasks as well as network diagrams or PERT charts do.

Critical Path Analysis

Critical path analysis or the Critical Path method (CPM) is a project network analysis technique used to predict total project duration. Within any project there will be some tasks, which have some slack or float time associated with them. That is, if they don't get done exactly on schedule, they won't impact other activities or the overall completion date. However, there are some activities, which if not completed on time will impact the timing of other activities and can throw the whole project off schedule. Thus the **critical path** for a project is *those series of activities that together determine the earliest time by which the project can be completed.*

To find the critical path:

1. Create a work breakdown structure;
2. Convert this into a network diagram; amount
3. Estimate the durations for each activity; and
4. Add together the durations for all activities for each path through the network diagram.

The *path with the longest total duration is the critical path.* There can be more than one critical path for a project if two or more have the

same longest total duration. The critical path can change over the life of the project as some activities slip and/or other activities are completed in less time than was initially anticipated. Project management software can automatically calculate and illustrate the critical path at any given time.

Critical Path Analysis and Schedule Trade-Offs

One of the uses of critical path analysis is to allow project managers to determine what trade can be made during the life of the project. For example, if a task on the critical path is behind schedule, it may be possible to add more resources to a subsequent task on the critical path to get the project back on schedule. If money is a bigger constraint than time, it might be possible to negotiate a delayed finish time to stay within budget, rather than paying overtime. One way of analyzing these trade-offs is by looking at slack times and early start and finish dates versus late start and finish dates for each activity.

Important definitions:

- **Free slack** — the amount of time an activity can be delayed without delaying the early start of any immediately following activity.
- **Early Start** - the earliest possible time an activity can start
- **Total Slack** - the amount of time an activity can be delayed from its early start can without delaying the planned project completion date.
- **Forward pass** — determine the early start and early finish dates for each activity
- **Early Finish** — the earliest possible time an activity can finish = early start + duration .
- **Backward pass** — determines late start and late finish dates for each activity
- **Late Start** — latest possible time an activity can start without delaying the project tasks, completion date

- **Late Finish** — latest possible date an activity can be completed without delaying the overall project completion date.

The easiest way to calculate these is through the use of project management software *e* : however, it can be done manually.

Techniques for Shortening a Project Schedule

Crashing is a technique for making cost and schedule trade-offs to obtain the greatest amount of schedule compression for the least incremental cost. This involves adding more resources on a critical path item. The trade-off is shortened project duration for higher overall project cost.

Fast Tracking calls for performing activities in parallel that you would normally do sequentially or in slightly overlapping time frames (e.g., starting to program or code before all of the analysis is complete). The trade-off is shortening the project duration at the risk of having to do work over and resulting in longer overall duration.

It is important to update the critical path as activities are completed. Remember, the critical path can and will change over the duration of a project.

PERT — Program Evaluation and Review Technique

PERT— a network analysis technique used to estimate project duration when there is a high :h is *degree of uncertainty about the individual duration estimates.*

PERT uses **probabilistic time estimates** — estimates of activity duration using optimistic, most likely, and pessimistic estimates of activity duration. Thus PERT attempts to address start the risk associated with duration estimates. PERT involves more work and is rarely used because there are better methods for assessing risk, which we shall discuss in a later block.

The basic PERT formula is as follows:

PERT weighted average = optimistic time + (4X most likely time) + pessimistic time 6

7.4 Controlling Changes to the Project Schedule

Project management is more about managing people than about using technology or drawing Gantt charts. The first step in having a workable schedule is making sure that it is realistic in the first place and then allowing for contingencies. A realistic schedule can only be developed with the full participation of all project team members. A second critical step is having regular progress meetings with honest reporting of project successes and bottlenecks. A problem ignored is a problem that is not being managed.

Key leadership skills that have been identified as being helpful for project managers in controlling schedule changes include:

- **Empowerment** This allows the project team to take responsibility for their ownactivities by involving them in creating the detailed schedule and providing timely status reports.
- **Incentives** Financial or other incentives encourage people to meet schedule know expectations. Programmers have been known to work longer hours to make up for ques project slippage provided there is a financial incentive and an adequate supply of pizza and refreshments!
- **Discipline** Many project managers have found that setting firm dates for key project milestones helps minimize schedule changes. .
- **Negotiation** It is important to be able to negotiate effectively. As a project manager you do not normally have formal authority to borrow resources directly from functional work groups. You will need to develop effective negotiation skills to negotiate for resources, money and time!

7.4 Software to Assist in Project Time Management

Project management software can automate many of the project time management functions from creating Gantt charts and network diagrams to doing critical path analysis and determining slack time.

The software contains numerous reports, filters and views that can assist you with scheduling and time management. However, it is just a tool. Being an expert in MS Project will not make you an excellent project manager. Developing strong leadership and people management skills and using the tools to support you, will!

Unit 8

Cost and Quality Management

Overview

This block examines the two core management functions – cost and quality management. Project Cost Management encompasses the process required that a project is completed within an approved budget. The four key processes involved in cost management are resource planning, cost estimating, cost budgeting and cost control.

At the end of this Block, you will be given an assignment, which is based on the body of knowledge of cost management. You will complete an earned value analysis based on a question provided.

8.1 Project Cost Management

The Importance of Project Cost Management

There are many reasons for project cost over runs:

- Poor Scope Definition
- Cost estimates that were too low to begin with
- Poorly defined requirements
- Many projects involve the use of new technology or business processes where there is no previous cost track record.
- Poor overall planning

Because projects cost money and take away resources that could be used elsewhere in the organisation, it is important for project managers to understand project cost management.

Project Cost Management — *the processes required to ensure that a project is completed within an approved budget.*

The four core processes involved in cost management are:

1. **Resource Planning** — developing a list of project resource requirements. What resources are required (people, materials, equipment) and in what quantities?
2. **Cost Estimating** — developing an estimate of the cost of resources needed to complete the project

3. **Cost Budgeting** — allocating the overall cost estimate to individual work items to create a performance measurement baseline.
4. **Cost Control** — controlling changes to the project budget

8.2 Principles of Cost Management

Life Cycle Costing considers the total cost of the project including both development (capital) costs and support (maintenance) costs. Net present value calculations are often used to compare total costs and benefits over the expected life of the development.

Cash Flow Analysis is used to determine monthly or annual costs and benefits for a project. This is especially important when a company is undertaking a number of projects simultaneously to ensure that they don't create a 'cash crunch' or severe cash shortage in any one given period.

Internal Rate of Return (IRR) or time-adjusted rate of return. This is the discount (interest) rate that would make the net present value of a project equal zero.

Tangible Cost and Benefits are those costs or benefits that can be monetised or easily measured in dollars.

Intangible Costs and Benefits are difficult to measure in monetary terms.

Direct Costs are those costs directly related to the project (e.g., salaries of project staff, consultants) that can be traced back in a cost-effective way.

Indirect Costs are related and allocated to the project but cannot be traced back in a cost- effective way (e.g., overhead costs such as hydro, office supplies, etc.).

Sunk Costs are dollars that have been spent in the past. Sunk costs should not be considered in future project investment decisions. This can lead to 'escalation of commitment.' The logic goes something like

this — "We've already invested too much in this to let it die. If we just spend $XXX more, we will see some benefit."

Learning Curve Theory states that when a task is done repetitively, the time and effort (and therefore the cost) it takes to do the task decreases in a regular pattern the more often it is done. For example, the first time you create a work breakdown structure in MS project it will take you a fair amount of time. However, after you have done fifty of them and as you get more familiar with the software, the amount of time and effort it takes you to do one will likely decline. If your project involves the production of a large quantity of items, learning curve theory should be used to estimate the costs because when many items are produced repetitively, the unit cost of those items normally decreases as more units are produced.

Reserves are a dollar amount included as part of a cost estimate to manager risk by allowing for future situations that are difficult to predict

- **Contingency Reserves** (known/unknowns). These dollars are included in a cost estimate to allow for future situations that may be partially planned for and are included in the project cost baseline (e.g., risks that have been identified in a work package)
- **Management Reserves** (unknown/unknowns). These dollars are included in a cost estimate to allow for future situations that are unpredictable (e.g., a supplier goes out of business, acts of god, etc.)

8.3 Resource Planning

If you know who's doing what in your project, you're halfway to a decent estimate. To start the process of resource allocation, there are some fundamental questions that a project manager needs to ask:

- What skill set do you require to complete the major project activities?
- Who is available to complete the activities?
- Do the available resources have the required skill sets to complete the activities?

- What level of authority do you need to free up internal resources? Procure external resources?
- How will the resources obtained affect the schedules and costs?
- How will you use these resources?

The answers to these questions will go a long way toward driving how your project performs in terms of scheduling and cost control. To further clarify resource requirements use the WBS to plan out your resource requirements. Then ask the question:
• What level of excellence are essential given the project constraints and the tasks identified?

Personnel affect schedules and costs based on their hourly rate and their ability to handle the tasks at hand (skill sets). These issues often drive the differences as to whether or not an organisation can meet schedule or quality demands of a project. The best and the brightest in any field often cost more than those who are less professionally adept, which in turn, drives costs.

Another factor for the project manager to consider is that the best resources are always in demand and become over allocated very quickly, as they are often assigned to many projects. The project manager needs to ensure that there is a clear understanding up front on the availability and commitment of these resources for their project!
Start the process of resource allocation by developing a Resource Responsibility Matrix (RRM). The RRM is developed after completion of the WBS. The project manager can use the WBS to create a matrix to assign resources according to the key deliverables of the project. Below is an example of a simple resource matrix using WBS activities/tasks to assign resources

Resource WBS	Fred	Rose	Bob	Barb	Fran	Len	Sue
1.0 Design	P	S	A	P	I	P	I
2.0 Development	A	S	P	P	I		I
3.0 Test	R	S	A			P	I
4.0 Pilot	A	S	P		P	I	P
5.0 Implementation	A	S	P	P	I	P	I
6.0 Training		S	A	P	P		P
7.0 Documentation		S	P	A	I	I	I

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Legends are an important part of the responsibility matrix: simply putting X's into the boxes will not designate roles clearly.
The *PMBOKTM* uses:
P = Participant
A= Accountable
R = Review
1= Input
S=Signature required

The development of a responsibility matrix is an elementary project management process. First identify the available individuals and place them on the matrix against the appropriate tasks. The second and most important task is to ensure that everyone knows what task he/she is assigned to. This is to ensure that who does what becomes an integral part of the project baseline.

Project Calendars

Once the project resources have been identified and committed the focus is now on establishing a project calendar. In today's flexible work environment, project team members work many different hours, shifts and days. Project calendars must be established up front. Consistent work calendars are necessary to ensure that tasks and resources are not scheduled and applied on non-workdays. Project calendars also establish a common frame of reference with the project sponsor, customer and the team. This makes it essential that the project manager develops a project calendar related to each resource on the project in order to ensure that there is an accurate assessment of the project timelines. Here are some key concepts to consider:

• What are the working hours? How about the teams? How many hours do they work? Depending on the organisation, some employees work 7, 8 or 10 hour days and modified work weeks.

• A base calendar has a standard number of workdays per week, recurring holidays, and special, company-wide one-time holidays; these should be adjusted to reflect the work schedules of the individual team members.
Multiple calendars should be established for each team member. Some team members may be willing to work Christmas or other statutory holidays. The project manager can establish a calendar for each major variance or standard. This critical information has a significant impact on the project manager's ability to meet the client deadline.

Definitions (durations)

- **Effort hours**: Total resource hours required to complete a task (24 hours **=** 3 resource days) e.g. effort is 3 resource days if 3 people work on a task that can be completed in 8 hours
- **Elapsed time:** Calendar durations including weekends, holidays, and breaks (24 hours **=** I day)
- **Working time:** Activity duration based on number of hours in a workday or work week (24 hours 3 days)
- **Productivity.** Rate at which work is produced, e.g. if a resource is twice as efficient it can get the work done in half the time.
- **Availability**. Resource is present and ready to work, e.g. resource only available ¼ time.
- **Contiguous duration:** Work time that cannot be interrupted
- **Interruptible duration:** Work time that can be interrupted
  A project manager must clearly understand and communicate with the team, sponsor and stakeholders, the type of durations being used in the project. A difference in interpretation of working time vs. elapsed time can make several months of difference in project completion.

- **Task Durations**

The project manager can use different approaches to modify the project duration that may allow the project manager to buy some time he/she did not know existed.
The project manager must examine the established time frame for the project and then establish the time frames for individual

activities/tasks. The project manager will need specific and accurate information to ensure that the activity/task is completed within the time allotted and to the agreed upon specifications. This can be accomplished by developing project completion criteria. It is important to establish clear and agreed to completion criteria for the project. Completion criteria are developed from clear objectives that are specific, measurable, agreed upon, realistic and time constrained. Each project activity must produce a defined deliverable.

As discussed earlier, it is essential that the project manager obtain commitment to the resources required to complete the project activities within the timeframe. If the resources available do not have the full skill set required for the project, then project durations will be impacted. Availability of the correct resources is critical to determining the overall duration of an activity and the entire project completion!

If the ideal resources are not readily available, it is often necessary to take on lesser-qualified individuals. The project manager is then faced with a challenge. This is where reviewing approaches to task duration will assist the project manager. Usually, we only ask the standard question of how long an activity will take without clearly understanding all of these issues which are critical in controlling the project. Looking at the options for task distribution will provide us with some ability to affect change by modifying an activity. For example:

- Must the activity bear a contiguous duration? Must it keep going?
- Is the activity/task Interruptible? Can it be broken up or interrupted?

Without considering this information the activity/task duration becomes static and lacking potential for well-considered change.

Key questions to ask when establishing duration:

- What are the completion criteria? (Twenty computers, Installed, networked)
- Are the data sources of the durations relevant, current, and realistic?
- Are the required resources available? (Len Jones for 3 days.)

- Is this a contiguous duration? (Yes, all machines are required to be installed before networking can be completed)
- What can we do with this data? (Have another resource pulling cables while Len does the installation of each computer)

8.4 Acquiring Resources

How can the project manager gain commitment from functional managers for critical project resources? Good planning and communication will provide you with the best tools to get what you need, when you need it!
Organisations vary in structure. The three most common structures in place are:

Functional

In a functional organisation people are organised into function groups or specialties such as human resources, marketing, operations, sales, information technology and finance. The projects are staffed with resources from these functional groups. In essence this means that the functional manager is responsible for each and every project.

Project

A project organisation has staff aligned around major projects. All the people required for the project are assigned full time to the project manager. The project manager is the functional head.

Matrix

A matrix organisation is a hybrid of the functional and project organisation. The resources are assigned to a functional group but will be temporarily assigned full or part-time to a project. The team members' workload is assigned organisationally by the functional manager and for the project by the project manager. This can create conflicts in priorities and is the most common form of organisation today. The matrix is most efficient in using people's time and skills and if the project does not require full time commitment from the people in

the functional groups. However, this type of structure only works if the functional manager and project manager recognise the challenges and work together.

Most of us work in some type of matrix structure when managing projects. In order to gain commitment for resources for our projects we need to establish good internal relationships with the functional managers and negotiate for our key resources. This process is often difficult due to conflicting operational priorities and demand for the most skilled resources. The functional manager has personal and organisational objectives to meet and sees the project manager as depleting the available resources to accomplish these objectives. This is where planning and effective communications will assist the project manager. What normally happens during the discussion of resources is the project manager requests a key resource full time for a period of time. This takes the person away from the operational tasks and impacts the functional organisation. By developing a detailed Task Assignment Matrix, the project manager can reflect a much better estimate of the time required for a specific resource, which in turn may facilitate better negotiations with the functional manager for the resource time, you are then asking for resources only when you need them. Below is an example of a Task Assignment Matrix (TAM) — developed from the Resource Responsibility Matrix.

Task days resource	Conceptual design	Prototype specification	Prototype design	Prototype development	Coding	Develop Test plan
Fred	10	12	10	30	35	15
Rose	5	15	5			10
Bob	8	1	8	21	24	
Kate	3	2	3			5
Steve	8	6	10	15	14	5

(Used with permission of Enterprise Project Management Ltd,)

This is only one example of how you might visually view the task assignments. Project management tools such as MS Project have facilities to provide resource allocation reporting as well. By using a tool such as the TAM, the project manager can plan out the activities in the project schedule against the defined task duration and resource, A great negotiating and communications tool!

A proactive communications strategy should follow this planning effort. Monthly meetings should be scheduled with the functional managers that you are sharing resources with. Use the TAM as a tool to communicate requirements. Remember, you need the resources to accomplish the project tasks but you do not normally own them. The onus is on you, the project manager to communicate requirements and gain commitment to the resources you need when you need them!

Cost Estimating

One of the key outputs of project cost management is a cost estimate. There are several types of cost estimates including:

- **Order of magnitude:** This estimate is made very early in project planning with an accuracy of—25 percent to *+75%* (often mistaken for SWAG — Silly Wild Ass Guess).
- **Budgetary Estimate** is a cost estimate used to allocate money into an organisation's money. (As in, "Jane we need a number to put into next years budget for your project. How much should we allow for it?") Accuracy is typically — 10% to *+25%.*
- **Definitive Estimate** is the most accurate of the three types. Based on itemized costing of all anticipated project resources, it is usually made within one year of project completion. Accuracy is typically —5% to + 10%.

All cost estimates should include supporting documentation that describes the assumptions used in arriving at the estimate.

A cost management plan is a document that describes how project cost variances (i.e., costs that are higher or lower than the original estimates) will be managed.

Cost Estimation Tools and Techniques

Analogous Estimates or Top-Down Estimates

- Use the actual costs of a previous or similar project as the basis for estimating current project costs.
- Accuracy depends on how close the two projects actually are in terms of scope

Bottom-Up Estimating

- Cost are estimated for individual work items and then summed to get a project total.
- Accuracy is determined by the size of the work items and the experience of the estimators.
- Usually too time-consuming to be practical on large projects.

Parametric Modeling

- Uses project parameters (or characteristics) in a mathematical model to predict project costs (e.g., *$50* per line of programming code or $10,000 per workstation, cost per square foot in construction)
- Can be quite simple or very complex.
- Accuracy depends on accuracy of historical information used to create the model, whether those parameters are quantifiable, and the scalability of the model.

COCOMO (Constructive Cost Model)

- COCOMO is a parametric model for estimating software development costs developed by Barry Boehm. COCOMO II is the latest computerised model that allows you to estimate cost, effort and schedule when planning

new software development. For more information, check out the following website: http://sunset.usc.edu/research/COCOMOII/index.html.

Typical Problems with Cost Estimates

Problem	Possible Solution
Cost estimation for large projects is complex and requires significant *effort.* Cost estimates are often asked for before there is a clear understanding of the requirements. .	Recognise the need to re-do estimates at various stages of project completion. Anticipate that later more accurate estimates will likely be larger than earlier estimates. Use progressive resource commitment and 'stage gates' as decision points to weigh costs against anticipated benefits. Don't get caught in 'escalation of commitment'. Be prepared to kill a project if the benefits no longer outweigh the costs
Lack of experience on the part of estimators and lack of data on which to base estimates.	Establish a repository of project information to assist in future project cost estimation. Provide training and mentoring to estimators.
Human nature is to underestimate costs. Also easy to forget items on a large project.	Get peers and senior managers to review cost estimates and ask questions to improve accuracy
Cost Goal Seeking — senior managers or others may have 'a figure in mind' for a project.	Project managers must develop confidence in their estimates and be prepared to defend them

Cost Budgeting

Project cost budgeting is the process of allocating the overall project cost estimate to individual work items to establish a baseline for measuring project performance. Required inputs are the work breakdown structure (WBS) to identify individual work items and the project schedule to allocate costs over time.

Cost Control

Project cost control is basically controlling changes to the project budget. It includes monitoring cost performance, ensuring only appropriate project changes are included in a revised cost baseline, and informing project stakeholders of authorised changes to the project that will impact project costs.

Earned Value Analysis

Note. If you 're planning on writing the PMP certification exam, Jean guarantee there will be several questions on this, and you will need to memorize the formulas!

EVA is a project performance measurement technique that takes into consideration project scope, time, and cost and compares actual performance to a project baseline. The baseline is the original project plan plus any approved changes. Earned Value Analysis requires the calculation of three values for each activity of summary activity from the work breakdown structure:

1. **Budgeted Cost of Work Scheduled (PV- Planned Value)** — the amount budgeted for that activity.
2. Ac**tual Cost of Work Performed (AP — Actual Cost)** — the actual cost (direct and indirect) for that activity over a given time period
3. **Budgeted Cost of Work Performed (EV) or Earned Value** — the percentage of the work actually completed multiplied by the planned cost.

EV = PV x percent complete (% complete obtained from person working on the actual work package)

Other Earned Value Calculations — Variance and Performance Indices

Cost Variance (CV) — the difference between the budgeted and actual cost of work performed. CV=EV-AP

Schedule Variance (SV) — the difference between the work performed and the work scheduled. SV=EV-PV

Cost Performance Index (CPI) — the ratio of the work performed to actual costs. If the CPI is < 1, the project is over budget; if the CPI *is*> 1 the project is under budget.

CPI = EV/AP

Schedule Performance Index (SPI,) — the ratio or work performed to work scheduled. If the SPI < 1, the project is behind schedule; if the SPI is >1, the project is ahead of schedule.
Note: Negative variance numbers or index values less than 1 indicate that a project is in trouble.
The earned value for the entire project is determined by summing the EV values for the individual project activities.

Time and Cost Projection Calculations

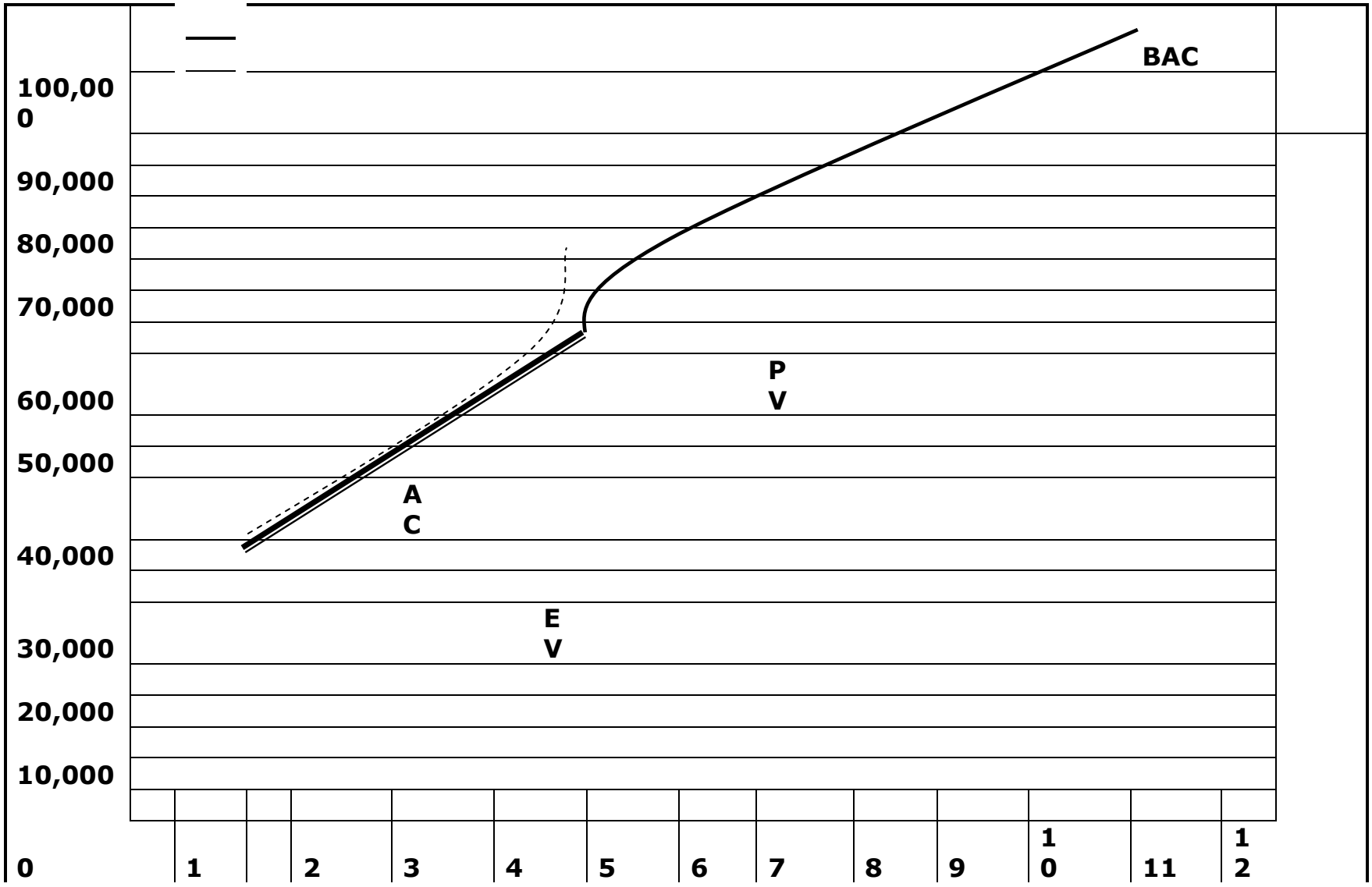
Budget at Completion (BAC) — the original time and cost estimate.
Estimate at Completion (EAC) — an estimate of what it will cost to complete the project based on performance to date. Calculated by dividing the original project budget by the cost performance index.

EAC = BAC (cost)/CPI

Estimated Time to Complete (ETC) — estimated time it will take to complete the entire project based on schedule performance to date. Calculated by dividing the original total time Or duration estimate for the project by the schedule performance index.

ETC = BAC (time)/SPI

Often, the easiest way to evaluate project status and performance over time is by displaying some of these key performance indicators in a graphical form. (See example below)


BAC
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
PV
AC
EV
1
2
3
4
5
6
7
8
9
10
11
12

Sample Earned Valued calculations

8.5 Sample Earned Value Calculations

Given:

Original Total Project Budget (BAC = $250,000 for a two year or 24-montn project)
Budgeted Cost of Work Scheduled to date (PV $50,000)
Actual Cost of Work Performed to date (AP = $45,000)
Percentage of work actually completed that was scheduled to be done by now: 80%

Calculations:

Earned Value = Budgeted Cost of Work Performed (EV = PV x % complete)
= $50,000 x 80% = **$40,000**
Cost Variance = CV EV — AP = $40,000 - $45,000 = **-$5,000**
Schedule Variance = SV = EV — **PV** = $40,000 - $50,000 = -**$10,000**
Cost Performance Index = CPI = EV/AP $40,000/$45,000 0.89 or **89%**
Schedule Performance Index = SPI EVIPV = $40,000/$50,000 = 0.80 or **80%**
Estimated Cost at Completion = EAC = BAC/CPI = $250,000/0.89 = **$280,899**
(In other words, at the rate we're going we will end up $30,899 over budget!)
Estimated Time to Complete (ETC) = BAC/SPI = 24 months/.80 **=30 months**
(In other words, at the rate we're going we will end up 6 months behind schedule!)
Based on the performance to date, this project is in fairly serious trouble!