Course Name	Project Management NQF 4
Module Code	325
Version No	1
Status	Complete
Unit Standards	120384, 120385, 120387, 120373, 120372
NQF Level	4

Project Management

LEARNER GUIDE

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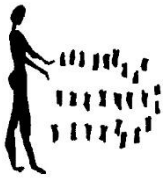	Summative Exercise
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Module 1

Introduction to Project Management

Communicate, communicate, communicate -
and then:
communicate some more.
Do it consistently - do it repetitively

Jack Welsh: General Electric

Introduction to Project Management

Unit Standards	
120373	Contribute to project initiation, scope definition and scope change and contr**ol**

Specific Outcomes

Contribute to the identification and co-ordination of stakeholders, their roles, needs and expectations

Contribute to the identification, description and analysis of the project needs, expectations, constraints, assumption, exclusions and deliverables

Contribute to preparing and producing inputs to be used for further planning activities

Contribute to the monitoring of the achievement of the project's scope

Unit Standards	
120372	Explain fundamentals of project management

Specific Outcomes

Explain the nature of a project

Explain the nature and application of a project

Explain the types of structures that are found in a project environment

Explain the application of organisation structures in a project environment

Explain the major processes and activities that are required to manage a project

Learning Outcomes

Be able to describe the fundamentals of Project Management and define Project Management

Understand the Project Management Body of Knowledge

Explain the Critical Constraints of a project

Demonstrate and describe the project stakeholders and role players

Be able to define and describe the Project Manager and Life Cycles

Be able to describe the Project Manager in the context of the organisation

Critical Cross-field Outcomes

Identify	Collecting
Working	Communicating
Science	Contributing
Demonstrating	

1.1 Introduction to Project Management

Project Management is a specialised management technique to plan and control projects under a strong single point of responsibility.

A project is generally deemed successful if it meets pre-determined targets set by the client, performs the job it was intended to do, or solves an identified problem within pre-determined time, cost and quality constraints. To meet these targets, the project manager uses project management systems to effectively plan and control the project.

In a world of relentless organisational change, managing the external environment and keeping pace with developments in information technology are just some of the pressures facing organisations the world over, whatever their size. The traditional management structures and functional hierarchies, on which organisations were founded, are being seen as less suitable for the fast-moving organisations of today. Organisations are realising the benefits that cross- functional teams can bring to the management of various problems and activities. As organisations become more complex, project management with its goal-centred framework and attention to detail, its mechanisms for monitoring and focus on outcomes offers an appealing and logical framework to enable organisations to move forward.

1.2 A Definition

Project Management is the discipline of organising and managing resources (e.g. people) in such a way that the project is completed within defined scope, quality, time and cost constraints. A project is generally a temporary and one-time endeavour undertaken to create a unique product or service that brings about beneficial change or added value. A one-time undertaking contrasts with processes, or operations, which consist of permanent or semi-permanent ongoing functional work to create the same product or service over and over again. The management of these two systems is often very different and requires varying technical skills and philosophy, hence requiring the development of project management.

The first challenge of project management is to ensure that a project is delivered within defined constraints. The second, more ambitious challenge is the optimised allocation and integration of inputs needed to meet pre-defined objectives. A project is a carefully defined set of activities that use resources (money, people, materials, energy, space, provisions, communication, quality, and risk, etc.) to meet the predefined objectives.

Project management is quite often the province and the responsibility of an individual project manager. This individual seldom participates directly in the activities that produce the end result, but rather strives to maintain the progress and productive mutual interaction of various parties in such a way that overall risk of failure is reduced.

A project manager is often a client representative and has to determine and implement the exact needs of the client, based on knowledge of the firm he/she is representing. The ability to adapt to the various internal procedures of the contracting party, and to form close links with the nominated representative, is essential in ensuring that the key issues of cost, time, quality, and above all, client satisfaction, can be realised.

In whatever field, a successful project manager must be able to envisage the entire project from start to finish and must have the ability to ensure that this vision is realised.

It is pertinent at this point to distinguish between **project, project management, technical processes and management processes**.

- Management processes, the processes that govern the operation of a system. Typical management processes include "Corporate Governance" and "Strategic Management".
- Operational processes, processes that constitute the core business and create the primary value stream. Typical operational processes are Purchasing, Manufacturing, Marketing, and Sales.
- Supporting processes, which support the core processes. Examples include Accounting, Recruitment, Technical support.
- Harold Kerzner, considered to be one of the leading authorities on project management, defines a project as any series of activities and tasks that
    - have a specific objective to be completed within certain specifications
    - have defined start and end dates
    - have funding limits (if applicable)
    - consume resources (i.e., money, people, equipment)

- Some other attributes that characterise a project include a singleness of purpose, a definite life cycle, complex interdependencies, some or all-unique elements and an environment of conflict.

Projects are usually unique in nature and vary considerably in size and duration. Compare the planning that needs to go into a large project such as the successful staging of the Olympic Games with that of a smaller project such as relocating offices. The costs involved in different projects also vary and large or small groups of people might be working on the project. Regardless of the nature and characteristics of any given project, the success of the project will invariably depend on the way in which it is managed.

Thus, projects differ from generic management primarily in that they have a specific end point, in terms of both product and time. Some authors also add that a project should be a unique, non-repetitive endeavour; that is, it should not be an activity that recurs.

The difference between a project and tasks/ non-project work can be described as follow:

- A project is typically of longer duration, has multiple contributors, and has multiple types of activity.
- Tasks are generally by one-person, shorter duration, simple goal or set of goals, and a single type of activity.

Kerzner goes on to define project management as involving project planning and project monitoring and including such items as:

Project Planning

- Definition of work requirements
- Definition of quantity of work
- Definition of resources needs

Project Monitoring

- Tracking progress
- Comparing the actual to the predicted
- Analysing impact
- Making adjustments

The importance of project work cannot be overstated in the current business environment. In a recent article, Tom Peters declared: "In the new economy, all work is project work. And you are

projects!" (Peters, 1999, p.116). Peters feels strongly that projects should be more than just dreary assignments that are grudgingly accepted. As such, projects are avenues for people to show their talents and shine, turning the projects into vehicles that make others stand up and take notice. The tools of project planning and project monitoring are important contributors to making project work a success, and in making it possible to impress others.

The various tools of project planning and project monitoring are closely tied. Planning clarifies the work to be accomplished and sets priorities for task completion. Planning involves scheduling – establishing timetables and milestones for completion. It also involves resource allocation – developing a budget that forecasts the amount of labour and equipment that will be needed. Alternatively, monitoring tracks progress to see whether the project is proceeding as planned. Is the schedule being adhered to? Are milestones being met? How likely is the project to be completed within, or even under, the projected budget? In the following sections, several key planning and monitoring tools will be presented. It should, however, be noted that the monitoring tools will be useful only if the planning has been conducted carefully and with sufficient attention to detail.

1.3 The Project Management Body of Knowledge (PMBOK)

The Project Management Institute has attempted to determine a minimum body of knowledge that is needed by a project manager in order for him or her to be effective. There are five processes defined by the PMBOK, together with nine general areas of knowledge. A complete document can be obtained from the PMI web site: www.pmi.org.

Project Processes

A process is a way of doing something. The PMBOK identifies five processes that are used to manage projects. Although some of them will be predominant at certain phases of a project, they may come into play at any time. Broadly speaking, however, they tend to be employed in the sequence listed as the following project progresses: initiating is done first, then planning, then executing, and so on. In the event that a project goes off course, re-planning comes into play, and if a project is found to be in serious trouble, it may have to go all the way back to the initiating process to be re-started.

Initiating

Once a decision has been made to do a project, it must be initiated or launched. There are a number of activities associated with this. One is for the project sponsor to create a project charter, which would define what is to be done to meet the requirements of project customers. This is a formal process that is often omitted in organisations. The charter should be used to authorise work on the project, define the authority, responsibility and accountability of the project team, and establish scope boundaries for the job. When such a document is not produced, the team may misinterpret what is required of them, and this can be very costly.

Planning

One of the major causes of project failures is poor planning; actually, most of the time the problem is due to no planning! The team simply tries to "wing it", to do the work without doing any planning at all. Many people are task-orientated, and see planning as a waste of time, so they would rather just get on with the work. As will be seen when dealing with controlling the project, failing to develop a plan means that there can be no actual control of the project.

Executing

There are two aspects to this process. One is to execute the work that must be done to create the product of the project. This is properly called technical work, and a project is conducted to produce a product. Note that the word product is being used in a very broad sense. A product can be an actual tangible piece of hardware or a building. It can also be software or a service of some kind. It can also be a result: consider; for example, a project to service an automobile, which consists of changing the oil and rotating the tires. There is no tangible deliverable for such a project, but there is clearly a result that must be achieved, and if it is not done correctly, the car may be damaged as a result.

Executing also refers to implementing the project plan. It is amazing to find that teams often spend time on planning a project, and then abandon the plan as soon as they encounter some difficulty. Once they do this, they cannot have control of the work, since without a plan there is no control. The key is to either take corrective action to get back on track with the original plan, or to revise the plan to show where the project is at present or continue forward from that point.

Monitoring and Controlling

These could actually be thought of as two separate processes, but because they go hand-in-hand, they are considered as one activity. Control is exercised by comparing where project work is to where it is supposed to be, then taking action to correct for any deviations from target. Now the plan tells where the work should be. Without a plan, you don't know where you should be, so control is impossible, by definition.

Furthermore, knowing where you are, is done by the monitoring progress. An assessment of quantity and quality of work is made, using whatever tools are available for the kind of work being done. The result of this assessment is compared to the planned level of work, and if the actual level is ahead or behind of the plan, something will be done to bring progress back in line with the plan. Naturally, small deviations are always present and are ignored, unless they exceed some pre-established threshold, or they show a trend to drift further off-course.

Closing

In too many cases, once the project is produced to the customer's satisfaction, the project is considered finished. This should not be the case. A final lessons-learned review should be done before the project is considered complete. Failing to do a lessons-learned review means that future projects will likely suffer the same headaches encountered on the one just done.

Knowledge Areas

As previously mentioned, the PMBOK identifies nine knowledge areas with which project managers should be familiar in order to be considered professionals. These areas are the following:

Project Integration Management

Project integration management ensures that the project is properly planned, executed, and controlled, including the exercise of formal project change control. As the term implies, every activity must be co-ordinated or integrated with every other one in order to achieve the desired project outcomes.

Project Scope Management

Changes to project scope are often the factors that "kill" a project. Scope management includes authorising the job; developing a scope statement that will define the boundaries of the project; sub-dividing the work into manageable components with deliverables; verifying that the amount of work planned has been achieved; and specifying scope change control procedures.

Project Time Management

Project Time Management includes the process required to ensure timely performance of the project. It consists of activity defining, activity sequencing, duration estimating, schedule development and time control.

Project Cost Management

This is exactly what it sounds like. It involves estimating the cost of resources, including people, equipment, materials, and such things as travel and other support details. After this has been done, costs are budgeted and tracked to keep the project within that budget.

Project Quality Management

One cause of project failure is that quality is overlooked or sacrificed, so that a tight deadline can be met. It is not very helpful to complete a project on time, only to discover that the thing delivered won't work properly! Quality management includes both quality assurance (planning has to meet quality requirements) and quality control (steps taken to monitor results to see if they conform to requirements).

Project Human Resource Management

Managing human resources is often overlooked in projects. It involves identifying the people needed to do the job, defining their roles, responsibilities, and reporting relationships, acquiring those people, and then managing them as the project is executed. Note that this topic does not refer to the actual day-to-day managing of people. PMBOK mentions that these skills are necessary but does not document them.

Project Communications Management

As the title implies, communication management involves planning, executing, and controlling the acquisition and dissemination of all information relevant to the needs of all project stakeholders. This information would include projects status, accomplishments, events that may affect other stakeholders or projects, and so on. Again, this topic does not deal with the actual process of communicating with someone. This topic is also mentioned, but not included, in PMBOK.

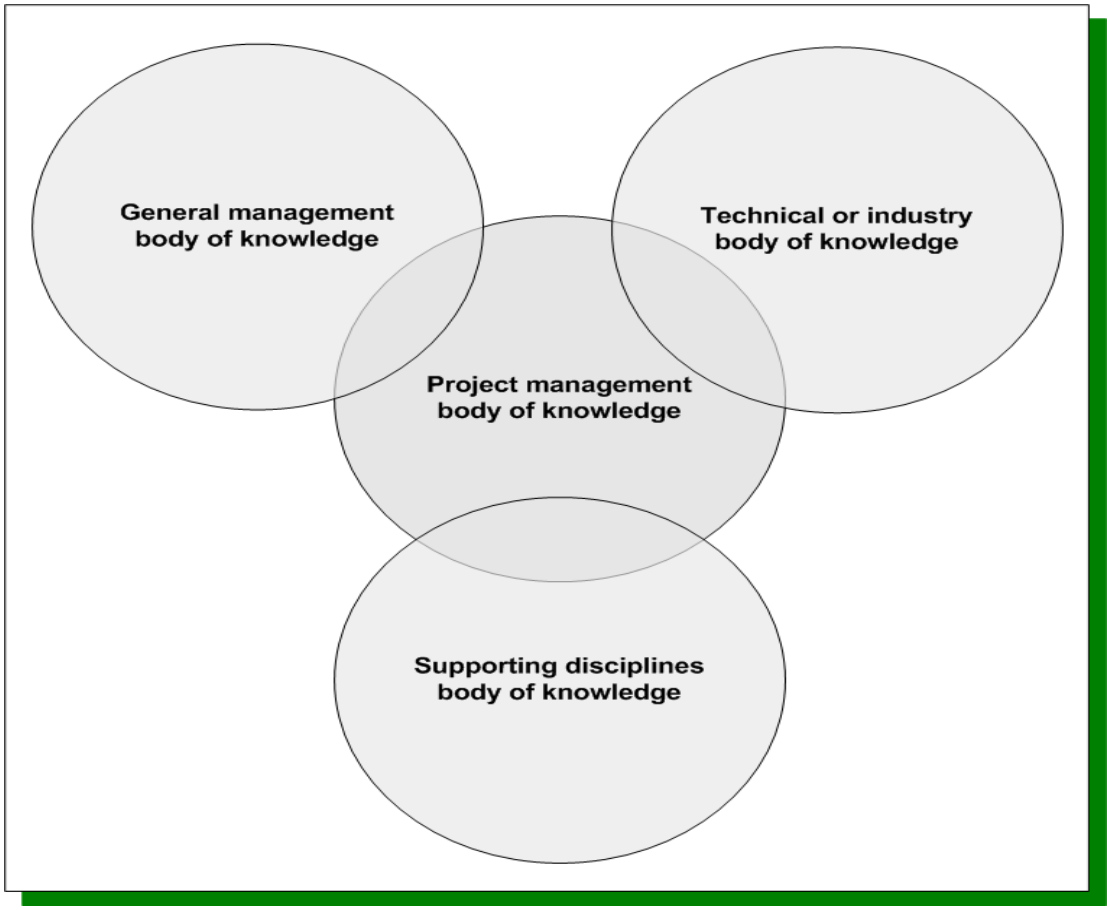
Project Risk Management

Risk management is the systematic process of identifying, quantifying, analysing and responding to project risk. It includes maximising the probability and consequences of positive events and minimising the probability and consequences of adverse events to project objectives. This is an extremely important aspect of project management that is sometimes overlooked by novice project managers.

Project Procurement Management

Procurement of necessary goods and services for the project is the logistics aspect of managing a job. It involves deciding what must be procured, issuing requests for bids or quotations, selecting vendors, administering contracts, and closing them when the job is finished.

The relationship between project management and general management is illustrated in the diagram below:



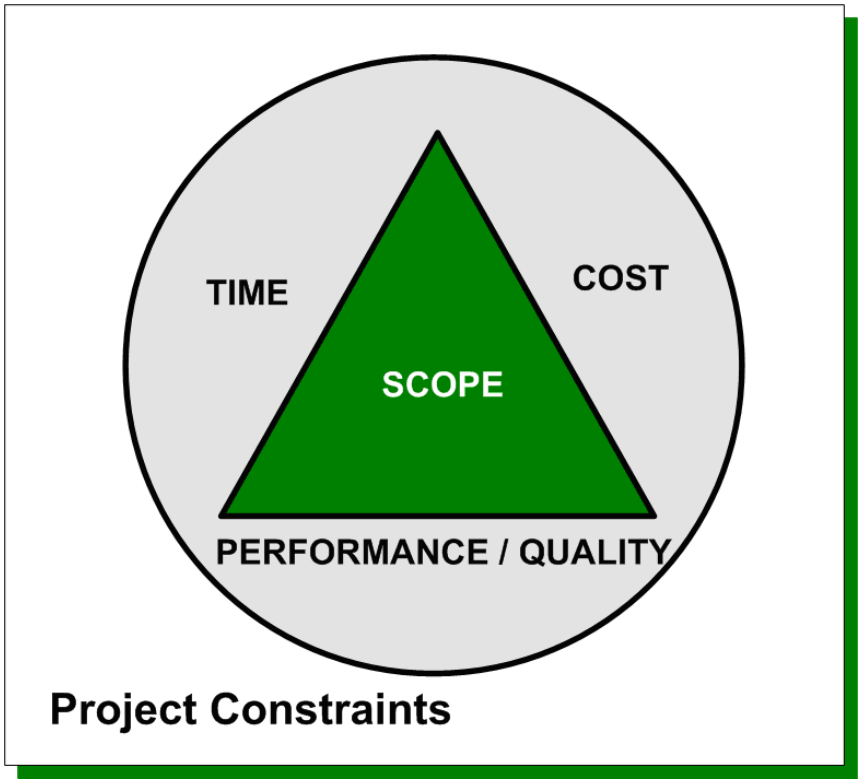
1.4 The Critical Constraints of a Project

Projects need to be managed within certain critical constraints. Young [4:80] regards these constraints as those things that are imposed on the project, knowingly or unknowingly, that one has no real control over. To identify the key constraints, some fundamental questions can be asked, such as:

- What is the available budget?
- Is there a specific cash-flow requirement to be satisfied?
- Is there a critical date when the project must be completed?
- Which minimum resources are required and are those available?
- Which external resources are required, and can they be funded?

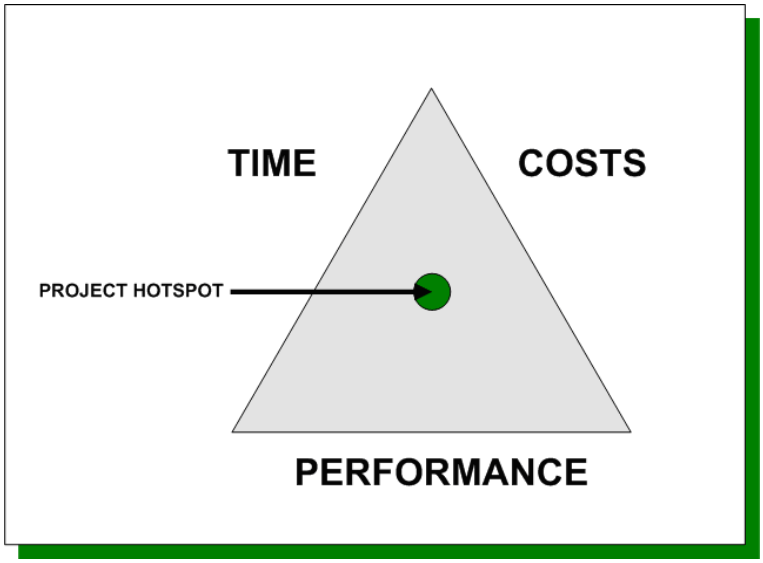
The key objectives of project management are to meet specified performance within cost and on schedule. It can be derived from this that the most critical constraints faced by the project manager are:

COST	It is the specified or allowable budget for the project. It is the target cost of the work to be done.
TIME	The work will be done over a specific scheduled period. It is the target date for when the project will be completed.
PERFORMANCE	It specifies what is to be done to reach the end-result. It includes the required features, technological specifications, quality, and quantity measures of the end-result.



It is worthwhile remembering that the above diagram should occur within the context of good customer relations.

Time, cost and performance interact constantly, and it is necessary to determine a balance between them. The balance between these three constraints in terms of precedence and priority is called the "hotspot" of the project. The hotspot can change or move during the course of the project, due to external and internal factors. Such a change will result in certain trade-offs to be considered. It is thus important to continuously determine the hotspot of the project and to manage it accordingly.



The **time** constraint refers to the amount of time available to complete a project. The **cost** constraint refers to the budgeted amount available for the project. The **performance** constraint refers to what must be done to produce the project's end-result. These three constraints are often competing constraints: increased performance typically means increased time and increased cost; a tight time constraint could mean increased cost and reduced performance; and tight budget could mean increased time and reduced performance.

The discipline of project management is about providing the tools and techniques that enable the project team (not just the project manager) to organise their work to meet these constraints.

Another approach to project management is to consider the three constraints as finance, time, and human resources. If a job needs to be finished in a shorter time, more people can be thrown at the problem, which in turn will raise the cost of the project, unless by doing this task, quicker costs will be reduced elsewhere in the project by an equal amount.

Estimating Time

For analytical purposes, the time required to produce a deliverable is estimated using several techniques. One method is to identify tasks needed to produce the deliverables documented in a work breakdown structure or WBS. The work effort for each task is estimated, and those estimates are rolled up into the final deliverable estimate.

The tasks are also prioritised, dependencies between tasks are identified, and this information is documented in a project schedule. The dependencies between the tasks can affect the length of the overall project (dependency constrained), as can the availability of resources (resource constrained).

Time is not considered a cost nor is it a resource, since the project manager cannot control the rate at which it is expended. This makes it different from all other resources and cost categories.

Cost

Cost to develop a project depends on several variables including (chiefly): labour rates, material rates, risk management, plant (buildings, machines, etc.), equipment, and profit. When hiring an independent consultant for a project, cost will typically be determined by the per diem rate of the consultant or firm, multiplied by an estimated quantity for completion.

Performance

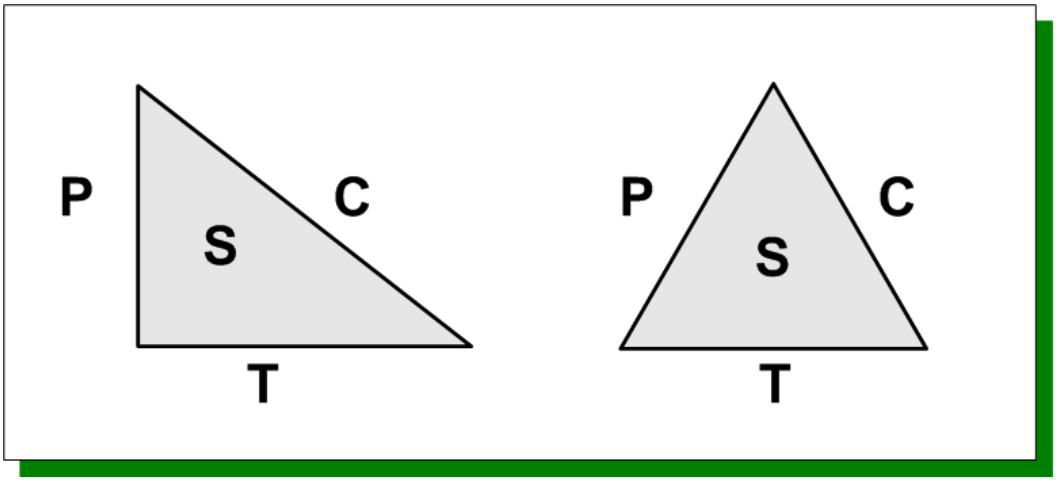
This encompasses the requirements specified for the end result. It is the overall definition of what the project is supposed to accomplish, and a specific description of what the end result should be or accomplish. A major component of scope is the quality of the final product. The amount of time put into individual tasks determines the overall quality of the project. Some tasks may require a given amount of time to complete adequately, but given more time, could be completed exceptionally. Over the course of a large project, quality can have a significant impact on time and cost (or vice versa).

Together, these three constraints have given rise to the phrase "On Time, On Spec, On Budget".

The relationship between the PCTS constraints can be written as follows:

$$C = f(P, T, S)$$

In words, this means, "Cost is a function of Performance, Time, and Scope." Graphically, it can be illustrated as a triangle, in which P, C, and T are the sides and S is the area. In geometry, if the values for the sides of a triangle are given, the area can be computed. Or, if the area and two sides are known, the length of the remaining side can be computed. This translates into a very practical rule of project management:



The sponsor can assign values to any three variables, but the project manager must determine the remaining one.

1.5 Project Stakeholders / Role Players

Most projects are comprised of a multitude of different tasks to be performed, and various people are involved in performing them or have a stake in the final outcome. Any given project might include the following role-players:

- ✓ ***The Customer/Client***

This is the person/company that orders the project. A project is conducted for and on behalf of the customer, who takes responsibility for paying for the work done. The customer also contributes to the funding and other project requirements. The customer and the project sponsor may be the same person.

- ✓ ***Project Sponsor***

The project sponsor is the authorising party who initiates the project. It could be a Board of Directors, a senior manager, a steering committee or any high-level individual. The sponsor will select the project manager and has the final say on the statement of work (SOW), decisions and strategic issues. The sponsor has the authority and/or financial strength to mandate, launch and support the project. The sponsor usually originates the project, due to his/her holistic view of what is to be achieved by means of the project.

- ✓ ***Project Manager***

The project manager is accountable to the sponsor for the day-to-day activities of a project. The project manager (PM) takes responsibility for planning, implementing and concluding the project. The PM needs to be a generalist with an array of skills to ensure a successful project. These skills include

the ability to co-ordinate team members; allocate resources; manage the budget; resolve conflict; liaise with sponsors and other stakeholders; manage change; and many others. The PM needs to be a person with special qualities in order to successfully manage the unique challenges and difficulties of a project.

✓ ***Project Team Member***

A project team member is an individual drawn into the project team because of his specific skills, expertise, knowledge and experience. The team members are responsible for the timely completion of all work set out in the plan and schedule. There are two types of team members:

✓ ***Core Team Member***

A core team member is part of the team throughout the duration of the project and serves either in a full-time or near full-time (60 %+) capacity.

✓ ***Extended Team Member*:** an extended team member will join the project team when his/her skills and expertise are needed for a limited period of time only. The extended team member might thus only be involved during one or a few stages of the project, depending on the need.

✓ ***Project Director***

The project director is the individual to whom the project manager often reports. The project director oversees the project but is not involved in the day-to-day activities of the project. The director might have more than one project manager reporting to him, in which case he is often referred to as a programme manager.

Various other positions may be established, depending on the nature and scope of the project, for example a work manager, an administrative manager, an IT manager, etc. In order to manage a project effectively, it is necessary to set up a **project office.** The project office is the facility where all documentation, co-ordination and communications take place. A project administrator is often appointed to manage the project office. The project office is set up to support the project manager in carrying out his/her duties.

1.6 The Project Manager

A project manager (PM) needs to wear many different hats, and therefore the PM needs to be generalist rather than a specialist. The PM needs to be multi-skilled in order to manage the complexities and to meet the heavy demands in a project. Young [4:30-31] identified the following **responsibilities** of a PM:

- Selecting the core team with the project sponsor
- Identifying and managing the project stakeholders
- Defining the project and securing stakeholder approval
- Planning the project and securing stakeholder approval
- Identifying and managing the risks
- Securing resource commitments and allocating resources to the work
- Monitoring and tracking project progress
- Solving the problems that interfere with progress
- Controlling costs
- Leading the project team
- Informing stakeholders of progress status
- Delivering the project deliverables and benefits
- Managing performance of everyone involved with the project

As a result, The PM needs the ability to handle stress and many PM's will tell you that they often feel that they need to be super-human to manage a project effectively! To handle the demands of a project, the PM must understand the basic goals of the project, have the support of top management, build and maintain a solid information network, and remain flexible about as many project aspects as possible.

It is even said that a project manager must *like* trouble and he must be capable of evaluating risk and uncertainty. Therefore, not everybody has the make-up of a project manager. Kerzner identified the following basic **characteristics** of a PM:

- ❖ Honesty and integrity
- ❖ Understanding of human resource problems
- ❖ Understanding of project technology
- ❖ Business management competence (management principles and communications)

- Alertness and quickness
- Versatility
- Energy and toughness
- Decision-making ability

A Project Manager needs, amongst others, the following **skills**:

- ***Credibility***

The PM needs both *technical* and *administrative* credibility. Technical credibility refers to the technical knowledge needed to direct the project. Although the PM does not need to have a high level of expertise, the stakeholders need to perceive the PM as a person with sufficient technical knowledge to successfully manage the project. Administrative credibility refers to the ability to perform various administrative responsibilities with apparently effortless skill. These responsibilities include, amongst others, keeping the project on schedule and within budget constraints, and reporting on project progress on a regular basis.

- ***Leadership***

The PM needs to possess various leadership qualities to effectively manage the team members. Enthusiasm, optimism, energy, tenacity and courage must be part of the PM's attitude and behaviour in leading the team members. The PM has to know and believe in the vision, share it with the stakeholders, and bring the vision to life. The PM as leader must influence the stakeholders positively through effective communications and by being visible (being available for the stakeholders, especially in times of crisis). Taking all this into consideration, it is apparent that the PM also needs to be a great motivator.

- ***Sensitivity***

The PM has to be politically sensitive: in his dealings and negotiations with various stakeholders, he needs to sense the feelings, priorities, agendas and personal objectives of the individuals involved, and keep everybody happy without jeopardising the successful achievement of the project. The PM also needs to sense interpersonal conflict on the project team or between team members and outsiders. Rivalries, jealousies, friendships and hostilities are issues the PM needs to deal with. The PM also has to sense when somebody is trying to cover up failures. In this sense, technical sensitivity comes to play.

- ***Management Skills***

The PM is not only a leader, but also a manager. The PM needs to be a competent problem-solver; decision-maker; communicator; entrepreneur; planner; organiser; controller and facilitator. These "soft skills" are essential attributes of a successful PM.

1.7 Project Lifecycles

The purpose of a project lifecycle is to provide a framework for dividing the project's scope of work into appropriately-sized phases or work divisions. Whereas the work breakdown structure is a hierarchical subdivision of the scope of work, the project lifecycle divides the scope of work into a sequence of project phases.

Different types of lifecycles are present in different types of industries that make sense in specific projects. The type of industry as well as the type of project will determine to a large extent which type of lifecycle will be applicable. Consider the following examples:

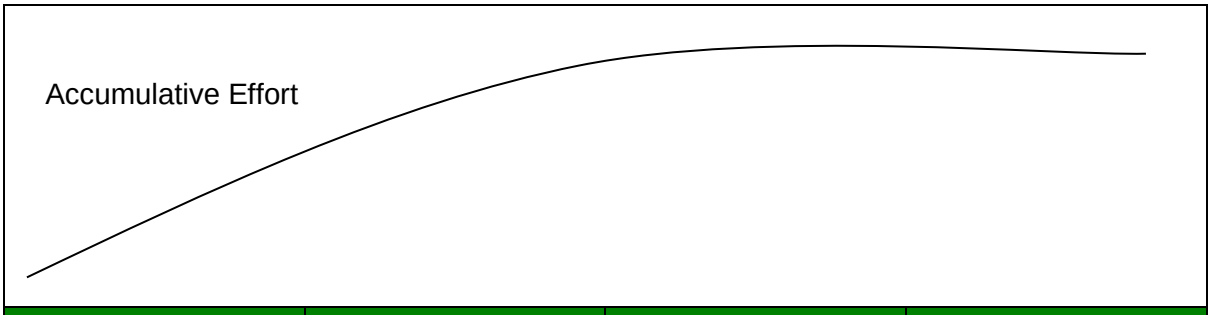
ENGINEERING	MANUFACTURING	COMPUTER PROGRAMMING	CONSTRUCTION
Start-up	Formation	Conceptual	Planning, data gathering and procedures
Definition	Build-up	Planning	Studies and basic engineering
Main	Production	Definition and design	Major review
Termination	Phase-out	Implementation	Detail engineering
	Final audit	Conversion	Detail engineering /construction overlap
			Construction
			Testing and commissioning

A generic project life cycle has been developed that covers the concepts from all industries. There is general agreement that most projects pass through a four-phase lifecycle under the following headings:

- **Concept and Initiation Phase**: The first phase starts the project by establishing a need or opportunity for the product, facility or service. The feasibility of proceeding with the project is investigated, and on acceptance of the proposal, moves to the next phase.
- **Design and Development Phase**: The second phase uses the guidelines set by the feasibility study to design the product, outline the build-method and develop detailed schedules and plans for making or implementing the product.
- **Implementation or Construction Phase**: The third phase implements the project as per the baseline plan developed in the previous phase.
- **Commissioning and Handover Phase**: The forth phase confirms that the project has been implemented or built to the design and terminates the project.

- ***Input, Process and Output Format***

The project lifecycle subdivides the project into a number of definable project phases or stages, and these phases in turn can further be subdivided into an input, process and output format. This is consistent with the approach of the body of knowledge to describe the project management process in terms of input, output, tools and techniques.



Concept	Design	Implementation	Commission
Input	**Input**	**Input**	**Input**
Project Brief (problem / opportunity) Project Charter (initiation)	Approval	Approval	Certificate of completion
Process	**Process**	**Process**	**Process**
Feasibility study	WBS, Estimate, Risk Analysis, CPM, Gantt chart, OBS	Award contracts, plan control, scope change control	Test, run-up equipment
Key Activities	**Key Activities**	**Key Activities**	**Key Activities**
Identify stakeholders Cost Benefit Analysis	Model testing Prototype testing	Plan and control	Quality testing
Hold Points	**Hold Points**	**Hold Points**	**Hold Points**
Market research Approval	Design approval	Required by client Required by QC	Client witness
Output	**Output**	**Output**	**Output**

Project Proposal (solution)	Baseline plan	Certificate of completion	Closeout report
Decision	**Decision**	**Decision**	**Decision**
Proceed yes or no	Proceed yes or no	Ready to hand over for commissioning	Project accepted. Hand over for operation

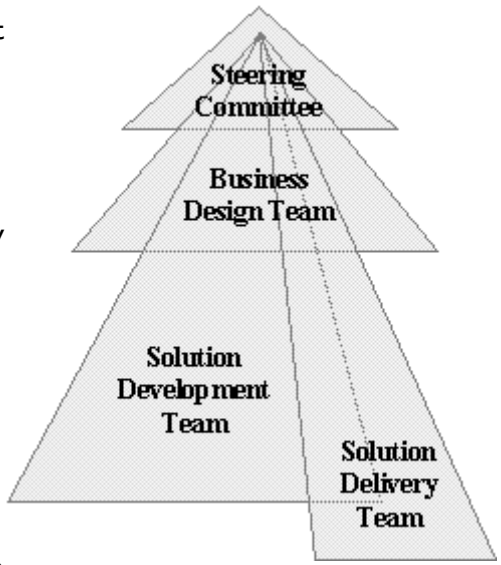
Project Lifecycle Components

Source: © Project Management Techniques – Rory Burke

1.8 Project Management Structures

The way a project team is structured can play a major role in how it functions. Different styles of team will have different characteristics. For example, do we wish to encourage discussion with the business representatives or to keep them at arm's length, so the developers can make good progress? Careful consideration of team composition and reporting relationships can make a big difference to the results.

The various roles in the team will depend on the nature of the project. As well as the main team roles, consider the other participants and how they fit into the picture.



Project roles and resources will have been identified as part of the planning, estimating and resourcing process. Note that the resources and optimum way of working will normally change during the project. Often an initial high-powered team will define the business solution, followed by a much broader team to deliver it, and then a line management and operational team to operate it. The will be a core team who remain fully involved throughout the project, but others will need to be brought in as required.

Team structure will probably be adjusted at each stage to meet the evolving nature of the project. The right structure for a small, high-powered, business-design team is unlikely to work for a large applications development team.

Styles of team

There are two main structural dimensions to the project team:

- what type of resource?
- what are they delivering?

For example, a website designer might be working with business managers and network specialists to create a storefront whilst another website designer is working with different business managers but maybe the same network specialist on an Intranet application for presenting internal management information on sales - both as part of the same project. So, does it make sense to have a team of developers, a team of managers and a team of network specialists, or should we have a team for the storefront and a team for the management information system?

Rather than seeing this as an "either or" choice, we could think of the project team as a matrix. Members of the various resource type teams will need to work together to share knowledge and ensure a consistent solution. People working together on the various processes or functional aspects of the solution will equally need to work together.

Each of these sub-teams, whether horizontal or vertical, will need a recognised leader. Team members will need to understand their individual roles.

The question then becomes how to structure this in terms of reporting and control.

Here are some basic rules that may help you decide how to structure the teams:

- People working together in a team usually see their teammates as "being on their side". They will normally work together and help each other to achieve their collective goals.
- Placing people in the same team generates collaboration, knowledge sharing and skills transfer - for example, between the specialists in a software package and the key future users of that package.
- Building a good, effective team is vital - team structure will influence the way the team behaves. Aim to create a collaborative team, where individuals share knowledge, co-operate, support each other and are motivated to achieve the team's goals.
- Interaction between team members is the best way to get a balanced view of all perspectives, e.g. business needs, practicality, technical feasibility, efficiency, performance.
- The understanding, knowledge, and capabilities of people working in other teams are rarely exploited to the full.

- People working in other teams are often viewed as a nuisance - they interfere with our team's progress.
- According to the complexity theory, putting a large number of people into a single team creates more interplay than progress.

Types of Project Team Structures

- ***Pure Project***

Tom Peters predicts that "most of the world's work will be 'brainwork', done in semi permanent networks of small project-orientated teams, each one an autonomous, entrepreneurial centre of opportunity; where the necessity for speed and flexibility dooms to the dodo's fate the hierarchical management structures we and our ancestors grew up with." [1] Thus, out of the three basic project organisational structures, Peters favours the **pure project** (nicknamed skunk works), where a self-contained team works full-time on the project.

Advantages

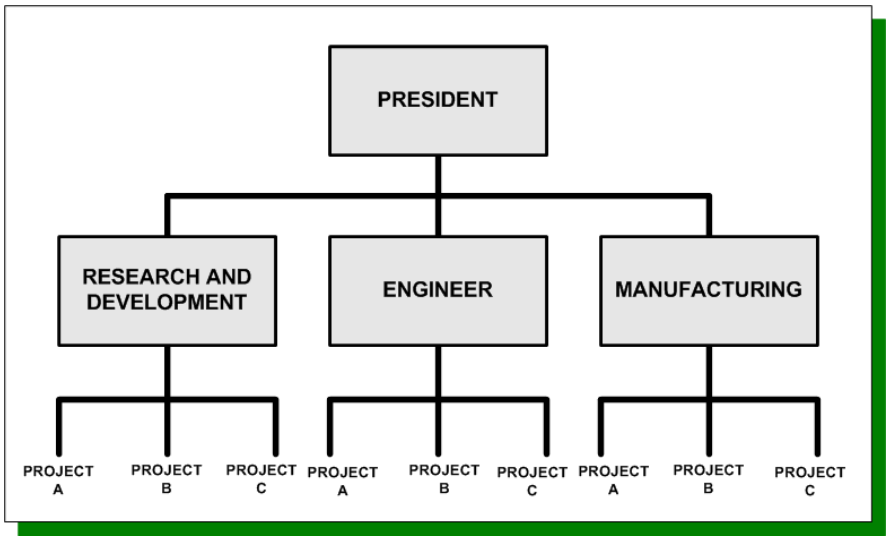
- The project manager has full authority over the project
- Team members report to one boss; they do not have to worry about dividing loyalty with a functional-area manager
- Lines of communication are shortened; decisions are made quickly
- Team pride, motivation, and commitment are high

Disadvantages

- Duplication of resources; equipment and people are not shared across projects
- Organisational goals and policies are ignored, as team members are often both physically and psychologically removed from headquarters
- The organisation falls behind in its knowledge of new technology due to weakened functional division
- Since team members have no functional area "home", they worry about life-after-project, and project termination is delayed

- ***Functional Project***

At the other end of the project organisation spectrum is the **functional project**, housing the project within a functional division.



Advantages

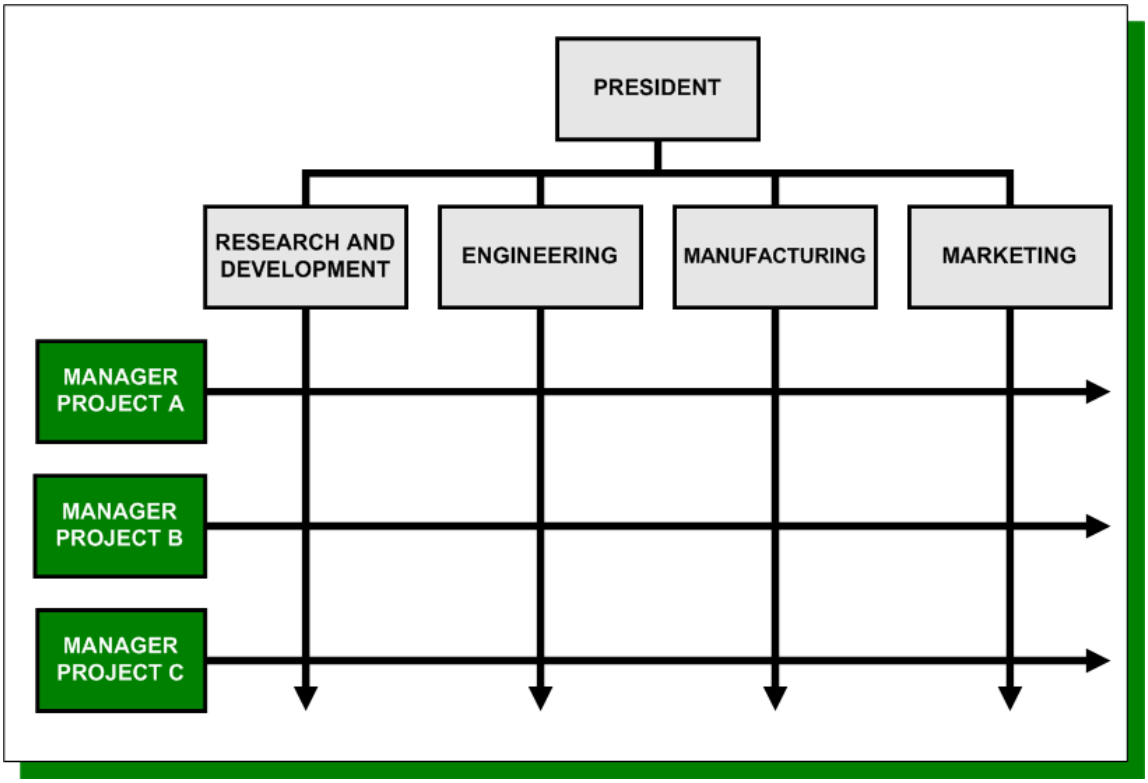
- A team member can work on several projects
- Technical expertise is maintained within the functional area, even if individuals leave the project or organisation
- The functional area is a "home" after the project is completed; functional specialists can advance vertically
- A critical mass of specialised functional-area experts creates synergistic solutions to a project's technical problems

Disadvantages

- Aspects of the project that are not directly related to the functional area get short-changed
- Motivation of team members is often weak
- Needs of the client are secondary and are responded to slowly

- ***Matrix Project***

The classic specialised organisational form – the **matrix** – attempts to blend properties of functional and pure project structures. Each project utilises people from different functional areas. The project manager (PM) decides what tasks will be performed, and when, but the functional managers control which people and technologies are used.



Advantages

- Communication between functional divisions is enhanced
- A project manager is held responsible for successful completion of the project
- Duplication of resources is minimised
- Team members have a functional "home" after project completion, so they are less worried about "life-after-project" than if they were a pure project organisation
- Policies of the parent organisation are followed; this increases support for the project

Disadvantages

- There are two bosses. Often the functional manager will be listened to before the project manager. After all, who can promote you or give you a raise?
- It is doomed to failure unless the PM has strong negotiating skills
- Sub optimisation is a danger, as PMs hoard resources for their own project, thus harming other projects

Module 2

Project Initiation

"In a poorly-operating system, people are doing their best, but they are often kept in the dark about how their performance affects that of others and the entire organisation. This results in people working at cross purposes with one another."

Johan A Woods

Project Initiation

Unit Standards	
120384	Develop a simple to facilitate effective project execution
Specific Outcomes	
Demonstrate an understanding of the purpose of the process of scheduling project activities Define and gather information about project activities from technical (subject matter) experts Develop a simple schedule for a project or part there-of.	
Unit Standards	
120373	**Contribute to project initiation, scope definition and scope change control**
Specific Outcomes	
Contribute to the identification and co-ordination of stakeholders, their roles, needs and expectations Contribute to the identification, description and analysis of the project needs, expectations, constraints, assumption, exclusions and deliverables Contribute to preparing and producing inputs to be used for further planning activities Contribute to the monitoring of the achievement of the project's scope	
Learning Outcomes	
Be able to explain the step of Project Initiation Understand the Selection of Projects Be able to develop define the Project definition	
Critical Cross-field Outcomes	
Identify Working Collecting	Communicating Science Demonstrating Contributing

2.1 Project Initiation

The selection of the right project for future investment is crucial for the long-term survival of the organisation. Project selection is ultimately the responsibility of senior management, whose decision should be based on informative data. The selection will enable management to:

- Ensure the project will meet company goals and objectives.
- Rank mutually exclusive projects.
- Often the project manager is the person who lobbies for the selection of a project.

Projects flow out of problems or opportunities. At work, they can be initiated by higher management, clients or staff members. A project is born, so to speak, when someone reacts to the level of frustration surrounding a problem or sees an opportunity to move into a new venture. When a decision is made to do something about the problem or opportunity, a project exists – and, typically, someone is given the responsibility for carrying it out. That person becomes the project manager.

A project's initiator is usually unclear about important aspects of the project. Project personnel tend to stress their own point of view during the stage of defining and structuring a project. If this set of personal biases and interests is left unchecked, disaster can result. However, disaster can be avoided by full discussion between the project manager, client and staff at the inception of a project. With a clear understanding of what is expected, the project manager will be better able to begin to define the project.

When the nucleus of a project team has been assembled, its first order of business should be to clarify the project and arrive at agreement as to the project's definition and scope, as well as the basic strategy for carrying it out. An orderly process can guide any manager through these steps. The following sequence of activities is useful in getting a project smoothly under way:

- Study, discuss and analyse;
- Write the project definition;
- Set the final objective;
- List imperatives and desirables;
- Generate alternative strategies;
- Evaluate alternatives; and

- Choose a course of action.

It is critical for the team to spend adequate time at the beginning to **study, discuss** and **analyse** the project. This establishes a clear understanding of what you are dealing with. It may be necessary to do research to see how similar projects structure their approach, or what other patterns of past experience can contribute to project planning. The purpose of this activity is to be sure that you are addressing the **right** problem or pursuing a **real** opportunity.

When you are confident that you have a firm grasp of the situation, prepare a **preliminary project definition**. This preliminary definition will of course be subject to revision as additional information and experience are acquired.

2.2 Selecting Projects

Project selection can be regarded as the process of evaluating individual projects or groups of projects, and then choosing to implement some set of them so that the objectives of the parent organisation will be achieved. In order to select the right projects, decision-aiding models are used in practice. Two types of models can be used: quantitative models or qualitative models. Regardless of the type of model chosen to select a project(s), some basic questions need to be asked at the outset:

- Will the proposed project maximise profits?
- Will the proposed project maintain market share, consolidate market position or open up new markets?
- Will the project maximise utilisation of existing resources, e.g. people?
- Will the project maximise the utilisation of existing capacity?
- Will the project boost company image?
- Will the project increase risk faced by the organisation?
- Is the project scope within the organisation's current skills and experience?

If the answer to any of the relevant questions is '*no*', the idea should be further considered. If the answers are primarily positive, the proposed project should be subjected to a screening process. Screening can be done by weighing up the proposed project against a set of criteria contained in a decision-making model. Consider the different types of models that can be used in the screening process:

Quantitative Models

Quantitative or numeric models invariably focus on financial data to support a project proposal. The data generated varies widely, but may include information on the following:

- Return on investment
- Return on net assets
- Break-even and payback period
- Cost of risks
- Net present value and/or internal rate of return
- Cost/benefit analysis
- Sensitivity analysis
- Market data

A large number of organisations using project evaluation and selection models use profit/profitability as the sole measure of acceptability. The main disadvantage of this approach is that it focuses on one decision criterion alone, e.g. payback period. Other numeric/quantitative models often used are ***scoring*** models, where a variety of criteria/factors is considered and scored to determine whether a project qualifies or not. The criteria can also be weighted according to their value in contributing to the company objectives at the time.

A detailed list of factors can be developed as appropriate based on:

Technology

Marketing

Finance

Manufacturing

Personnel

Administration

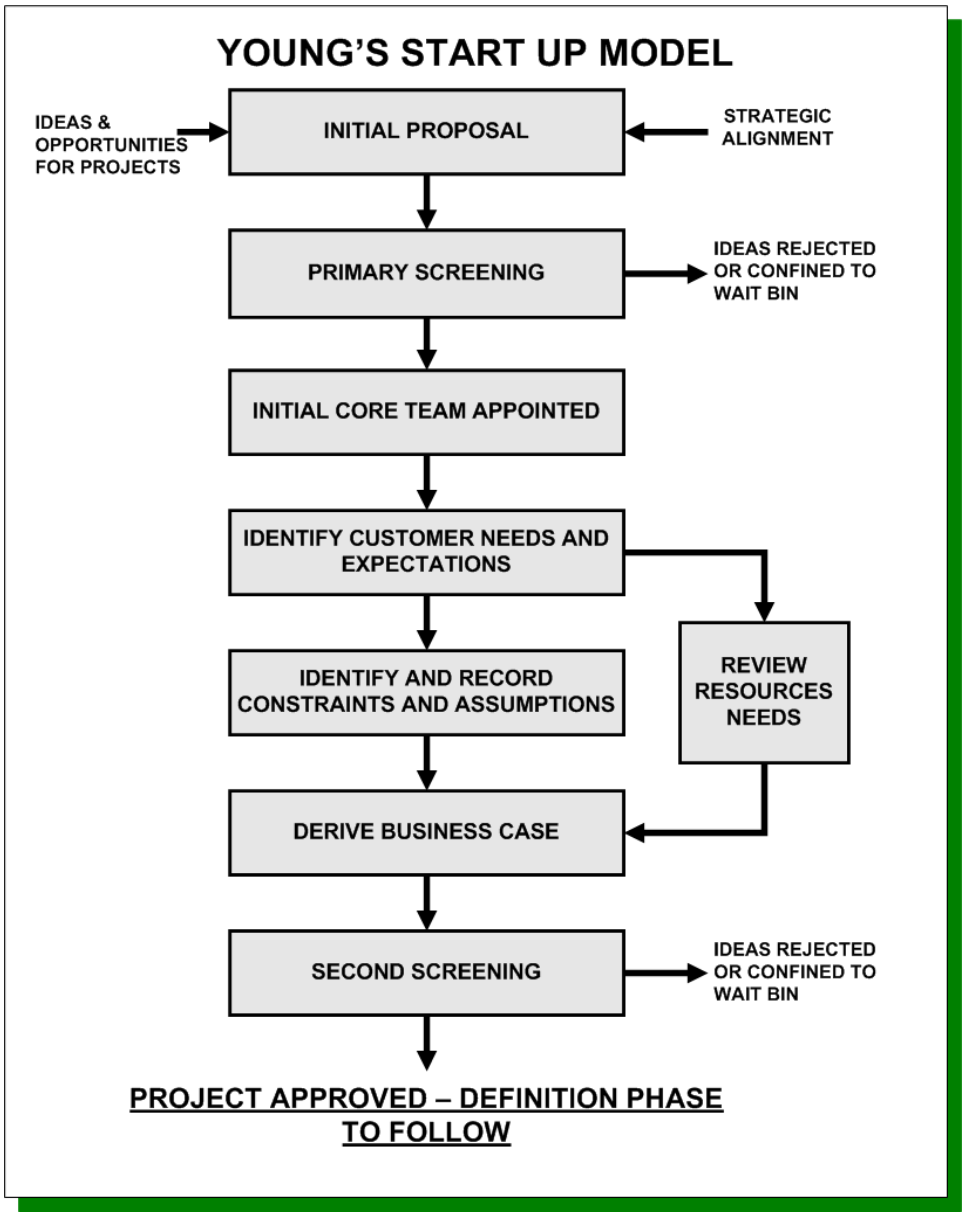
Qualitative Models

Qualitative or non-numeric models, do not use numbers as inputs. Meredith & Mantel [3: 45-47] describe four non-numeric models that are commonplace in many organisations:

- **The Sacred Cow:** Where a senior and powerful official in the organisation suggests a project, and the projects are undertaken regardless of the possibility of failure. The project is "sacred" in the sense that it will be maintained until successfully completed or until the official personally recognises the idea as a failure and terminates it.
- **The Operating Necessity:** Where a project is funded in order to protect or maintain an operating system under threat. An example could be the installation of additional power generators as back-up where a problem with regular failures is experienced. Cost/benefit analysis is often used in the decision-making process.
- **The Competitive Necessity:** Where a project is undertaken to maintain the organisation's competitive position. The refurbishment of a hotel is an example of such a project. Investment in an operating necessity project takes precedence over a competitive necessity project, but both types of projects may bypass the more detailed numeric analysis used for projects deemed less urgent or important to the survival of the organisation.
- **Comparative Benefit Model:** This model is often used when a variety of projects important to the organisation need to be considered, and no formal method of selecting projects exists. A selection committee then decides which projects will benefit the company most, and those projects are then funded. A rating system is often used to prioritise projects in order of importance.

Many organisations use more than one model to select projects. Quantitative and qualitative models can be used in combination with one another, or two numeric models can be used simultaneously. The main objective is to ensure that the right project(s) is selected and funded. Once a project is selected, a process is required to **start-up** the project. A project manager who needs to manage the process from this point onwards, is appointed at this stage. Young proposes the following start-up process:

- ***Young's Start-Up Model***



Once the initial proposal has passed the first screening (using one or more of the selection models discussed earlier), customer needs have to be defined that will ultimately allow the project team to produce deliverables specifically designed to meet the customer's expectations. A clear understanding of these needs will allow the development of the requirements that drive the planning process.

Particular effort must be made to understand the customer:

- explore priority and relative importance to other activities understand the customer's environment in which they must operate
- use political skills – not all customers are equal, and some needs cannot be addressed
- demonstrate technical competence and awareness of the customer's technical needs

- convert ill-defined needs into practical solutions keep an open mind and a creative approach analyse the mixed signals received through personal influences on needs
- attempt to expose the hidden expectations.

A clear *statement of need* should be the end-result, which can be reflected back to the customer for validation and acceptance with no ambiguity. Once the customer needs have been identified and accepted, project constraints need to be identified. This should be done in conjunction with the customer in order to gather the information required to guarantee success.

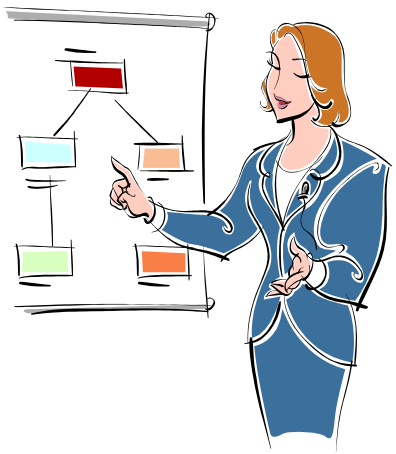
Assumptions about various aspects of the project also need to be clarified and recorded. These assumptions should later be validated as the project is implemented. A final screening must take place once all the relevant information has been gathered. A kick-off/launch meeting should then be held with the project sponsor and the other stakeholders. This meeting should be used to ask as many questions as possible, and to clarify all issues that still need attention.

The outcome of the meeting must be that the technical scope is established; the participants accept basic areas of performance responsibility; and some tentative overall schedules and budgets are spelled out. It is also the ideal opportunity for the project manager to showcase his ability to lead the project team. After this meeting a formal project definition can be developed.

2.3 Project Definition and Project Scope

The information derived from the kick-off meeting should now be used to draw up a preliminary statement of the project objectives and associated specifications. This preliminary document is called a **project scope.**

Project scoping is a very important activity as it determines the cost, time, quality and resource requirements of the project. Adequate time should be spent on this activity, because failure to derive all the relevant data for this foundation will lead to a poorly-defined project with a considerably reduced chance of achieving a successful outcome. An estimated seventy five percent of projects seem to fail due to poor project definition. What should be included in the project scope? The following elements:



- **The project origins**: a need or opportunity statement
- **The project rationale**: why is it necessary now?
- **The benefits of the project**: to the customer as well as your organisation

- **The project budget** (if known at this stage)
- **The current time-scale and expected deadlines**: subject always to detailed planning later
- **A project organisation chart:** A list to show who (team members) is involved in the project, with names, positions, contact numbers, and any other information deemed important.
- **A stakeholder list:** A list of everybody with an interest in the project, containing names; positions;

  Are they internal/external to the company; ranking of importance to the project, etc?
- **A statement of requirements:** A document recording needs and expectations identified, how these needs can be met in practice, which needs cannot be satisfied yet and why, assumptions made at this stage, and what the project is about and what is not included.
- **A project objectives statement:** The objectives should be defined in conjunction with the customer, and should include a statement of background, the project purpose, the overall project objective, the primary project deliverables and expected delivery dates, the primary benefits, the cost of the project, and the skills required. This data may also be incorporated in the **statement of work** (SOW).
- Describe the **problem or project request** briefly. By doing this, you restate the issues as described by your client, helping confirm your interpretation. Define the project's goals and objectives. This section doesn't have to be lengthy, but you need to include enough detail to ensure the client's needs and objectives are clearly outlined.
- Describe all **deliverables** that will establish the successful completion of the project. If your work includes programming changes, include an application design or a summary of the software development effort that provides enough detail for the client to see and agree on the deliverable. For a Web site design, this might include a short-written description as opposed to detailed Web page designs. Gauge the level of description you need based on your client's need for detail and the complexity of the project.
- **Statement of work (SOW):** A Statement of Work (SOW) is a written confirmation of what your project will produce and the terms and conditions under which you will perform your work. Both the people who requested the project and the project team should agree to all terms in the SOW before actual project-work begins. This document will include the purpose statement, scope statement, deliverables, goals, cost, and schedule, list of stakeholders, chain of command, agreements, assumptions and communication plan. Process

specifications, customer specifications, standard operating procedures, quality standards, purchasing procedures, and other useful data can also be included.

Define the specifics of the work plan to a level of detail that helps the client understand what you plan to do in the project and how the process will work. Clarifying issues that will keep your client out of the dark makes it easier for your client to do business with you, reduces questions, and helps you achieve a positive experience with your client. The plan needs to include key milestones and estimated timeframes to the extent that you can define them.

The SOW should be considered as a binding agreement.

The team must commit to producing certain results. The project's requesters commit that they'll consider the project 100 percent successful if these results have been produced.

The team must identify all restrictions regarding the approach to the work and what is needed to support the work. The project's requesters agree that there are no restrictions other than the ones that have been identified, and that they'll provide the support that is declared to be needed.

The team must identify all assumptions made when agreeing to the terms of the SOW.

Of course, predicting the future is impossible. In fact, the farther into the future one tries to look, the less certain predictions can be. However, the SOW represents the project commitments based on what is known today and expected to be true in the future. If and when situations change, the effect of the changes on the SOW is assessed and the necessary corresponding changes to the project are proposed. The project's requesters always have the option of accepting the proposed changes (allowing the project to continue) or cancelling the project.

- **A risk assessment:** Risks need to be identified and assessed and can be recorded in a **project risk log**. Risk management is a continuous process throughout the lifecycle of the project, and it is important that the team is focused on the risks.

Approval of Project Scope

Once the project manager has reviewed the project definition and ensured that all relevant information has been included, he can seek the approval of the project sponsor and customer. Approval of the project definition will lead to the detailed project planning stage.

Creating a definitive scope document helps eliminate confusion with any project and presents you in a more professional light. Consultants that provide professionally delivered services often get called back or recommended to other companies.

A comprehensive scope document should be signed off by all relevant stakeholders

Use the scope document as a means of managing your client's expectations from the start. Too many client dissatisfaction issues occur because the client's expectations aren't managed up front. Start every project venture out on the right foot by stating the project's scope clearly and you'll reward yourself with fewer problems down the road. Once you get into the habit of developing a scope document at the beginning of new projects, it will become a quick process and one that saves you valuable time later.

Changes to scope of project

The scope document should be adapted and updated continuously according to the changed needs of the stakeholder. Any changes to the scope should be thoroughly analysed in terms of it's impact on project deliverables, project time lines and stakeholder needs and expectations. All amendments should be properly authorised through a process of "Request of change". Changes should be logged and communicated to all relevant stakeholders and role-players.

(Refer Module 6 for project change templates).

Stakeholders should agree with management right at the start of the project on how progress will be reported and communicated to relevant stakeholders and role-players.

(Refer Module 6 for reporting template)

2.4 Project Communication Process

Without proper communication, a lot of conflict can be expected. It is absolutely essential that the necessary communication processes be identified and communicated to every stakeholder of the project. Good communication in the team, between the project manager and the team and between the project manager and the key stakeholders should be ensured. Feedback on the current progress of active tasks, problems encountered, problems anticipated, and technical difficulties encountered are needed throughout the implementation phase. An information system should be created, giving the project manager the information he needs to make informed, timely decisions that will keep project performance as close as possible to the project plan. Young recommends the use of a communication

plan to ensure regular and timeous feedback on project progress. We will focus on two communication mechanisms essential in the effective monitoring and tracking of the project:

- **Project status reports:** The key stakeholders expect to receive regular feedback on project progress in the form of status reports. The frequency and format of these reports should be agreed upon even before the project is launched. Kerzner suggests that status reports be kept short and concise, containing pertinent information only. A single page, standard template can be designed to ensure consistency and focus in reporting, recording: a concise summary of overall progress; a list of milestones due to be completed since the last report and their current status, e.g. on time or late; actions taken to correct any slipped milestones; forecasts for the project completion based on current information; reasons for any revision to earlier completion forecasts; any issues/problems still waiting for resolution; and costs to date compared to the budget.

  The data contained in the report will depend primarily on whether it is a routine report, an exception report or a special analysis report . Kerzner believes that frequent, meaningful status reports can reduce or even eliminate executive meddling on projects. Team members should issue status reports to the project manager and the project manager then report to the key stakeholders, e.g. the sponsor and management.

- **Meetings:** Project review meetings are another important communication mechanism. What kind of meetings may be required? Young identifies the following types of meetings:
  one to one meetings with the project sponsor; one to one meetings with team members; project progress meetings with the team; problem solving meetings; meetings with particular stakeholders, e.g. the customer; project review meetings with other stakeholders.

  These meetings can be highly structured or very much informal, but each meeting should have a definitive purpose. People often dread meetings; therefore, it is important to keep a meeting as short as possible, sticking to the agenda and ensuring a specific outcome is achieved. Status reports are often delivered at a face-to-face meeting, not necessarily always in a written format. Project progress meetings can be scheduled throughout the project and even be shown on the Gantt chart, whilst other meetings need to be scheduled as the need arises.

Module 3

Project Planning

Knowing is not enough; we must apply.
Willing is not enough; we must do."

Johann Wolfgang von Goethe

Project Planning

Unit Standards	
120384	Develop a simple schedule to facilitate effective project execution

Specific Outcomes
Demonstrate an understanding of the purpose of the process of scheduling project activities
Define and gather information about project activities from technical (subject matter) experts and within own field of expertise.
Develop a simple schedule for a project or part thereof.

Unit Standards	
120385	Apply a range of project management tools and techniques

Specific Outcomes
Demonstrate an understanding of project management tools and techniques
Use a range of project management tools and techniques
Apply corrective action steps where project management tools and techniques usage problems occur

Learning Outcomes
Be able to develop Project Plan and Work Breakdown Structure (WBS)
Demonstrate how to use of WBS
Describe the advantages and disadvantages of Gantt Charts
Be able to describe the program evaluation and review technique and critical path method
Identify definitions of Network Teams
Be able to estimate the duration of activity
Be able to develop a schedule

Critical Cross-field Outcomes	
Identifying	Communicating
Working	Science
Collecting	Demonstrating

3.1 Project Planning

By this stage, the benefits and costs of the project have been clearly documented, the objectives and scope have been defined, the project team has been appointed and a formal project office environment established. It is now time to undertake detailed planning to ensure that the activities performed in the execution phase of the project are properly sequenced, resourced, executed and controlled.

3.2 Develop Project Plan

The first step is to document the Project Plan. A "Work Breakdown Structure" (WBS) is identified, which includes a hierarchical set of phases, activities and tasks to be undertaken on the project. After the WBS has been agreed upon, an assessment of the effort required to undertake the activities and tasks is made. The activities and tasks are sequenced, resources are allocated, and a detailed project schedule is formed. This project schedule will become the primary tool for the Project Manager to assess the progress of the project.

3.3 Work Breakdown Structure

The Work Breakdown Structure (WBS) shows the total project divided into components that can be measured in terms of time and cost. It may be presented in tabular or graphical form, or both. Whether in tabular or graphical form, the WBS divides the project into a series of hierarchical levels; in graphical form it resembles an organisational chart of tasks (rather than positions). The complexity of the project and the degree of control desired during the project monitoring will determine the number of levels. We suggest starting with three levels, with level one being the final or total project, level two being the major tasks or subsections of the project, and level three containing definable tasks or sub-components of level two. Again, if the project is very complex, the WBS should include additional levels, until the final level specifies discrete activities that can be examined in terms of the time and cost required to complete the activity.

At the final level, the Work Breakdown Structure should include at least two pieces of information that are needed for co-ordination of effort: the estimated time to complete the activity and the name of an individual who is responsible for seeing that the activity is completed. Often a third piece of information, the estimated cost of completing the activity, is also included. This allows for better integration of cost and schedule information needed to complete monitoring the project. When cost

information is included, people refer to the Work Breakdown Schedule as a *costed WBS*. It should be noted that time and cost estimates should be developed by the persons most knowledgeable about those specific activities. Thus, if project team members come from different functional areas, the project manager should consult with managers from those different functional areas before making time and cost estimates.

3.4 How to use a WBS:

Purpose of the WBS

To reduce the total project into small elements that are so clearly defined that they, individually, can be accurately defined, budgeted, scheduled and controlled.

The small elements are called activities or work packages.

The WBS ensures that all activities, even minor ones, are accounted for.

Characteristics of Activities

Stand alone – clearly distinguished from other activities

Time aspect – has a start date, finish date and/or duration

Deliverable – it delivers an end-product

Human resources – responsible person/department assigned to it

Measurable – must be able to measure activity progress

Activity Definition

The element or task that must be performed in order to reach the project end-result. It requires time and resources.

Once the key activities have been identified in the WBS, they should be organised in a logical sequence to maximize concurrency. The duration of and people responsible for each activity should be disregarded at this stage, because it may result in errors in the project logic. An easy way to organise the activities in a logical sequence is to create a project logic diagram, whereby each key activity is written on a separate small card or self-adhesive note sheets. These cards can then be used to build a picture of the entire project, from start to finish. By making it visual (arranging cards on a table, or arranging the notelets on a wall), the project team can question and debate the validity of the logic as it grows. The notelets/cards can be connected with arrows to show the logical flow of the project. Provision should be made for both series activities and concurrent activities, focusing on the dependencies between activities.

Assign Responsibility:

The project manager needs to ensure that the work is done on time and according to quality specifications. Responsibility for the execution of each key activity should be assigned in a fair and even way to the various team members. Young suggests that each member of the team should be persuaded to accept the role of key activity owner (KAO) for one or more key activities. The KAO must then accept the obligation for his key activity to confirm:

- The work to be done is identified at the detailed task level
- The dependencies are clearly identified
- The time estimates are accurate and subject to constant scrutiny
- The work gets done on time in accordance with the quality specifications
- Regular monitoring is maintained
- Regular accurate status reports are issued
- Problems and issues are alerted promptly to the project manager.

Determine the Duration Of Activities*:*

The next step is to estimate and forecast the duration of each key activity. An estimate is a decision about how much time is required to complete an activity at an acceptable standard of performance. The "size" of the activity and the amount of "effort" required in completing the work need to be determined. Duration is the conversion of effort taking into account the number of people involved, their capacities and an allowance for non-productive time. Duration is never the same as the schedule, since it is measured in real working days that take non-available days, weekends, public and staff holidays into account.

In forecasting duration, it is also essential to make provision for contingencies. Murphy's Law requires that a buffer be built into the estimated duration of each activity. This can be done by developing four time estimates for each activity: the most likely time (estimated time required if normal problems and interruptions occur), the optimistic time (estimated time required if virtually no problems occur), the pessimistic time (estimated time required if problems and interruptions of an unusual nature occur) and the expected time (some form of weighted average of the most likely, optimistic and pessimistic time estimates).

Duration of activities could best be determined in consultation with project specialists and appropriate role-players.

Also refer to methods of determining duration later in this Module.

Rules in Developing a WBS

The rules for developing a WBS are as follows:

- Heading with accompanying activities
- Activities must be verb and noun statements
- Written in present tense
- Each activity must have a unique number
- Sequence of activities is not important
- No activity must be overlooked
- During the WBS process the following questions are asked:
- What is needed?
- What is next?
- Is the WBS functionally oriented?

The table below indicates the steps to develop a WBS

STEP	ACTION
1	Divide the project into major categories/sub-projects
2	Divide these categories into sub-categories/sub-projects
3	Divide these sub-categories into sub-subcategories/headings
4	Divide these sub-subcategories into activities
This level-by-level breakdown continues so that the scope and complexity of work elements is reduced with each level of breakdown	

A WBS ties the entire project together; it portrays scope graphically, allows resources to be assigned, permits estimates of time and cost to be developed, and thus provides the basis for the schedule and the budget.

An estimate is a *guess,* and an exact estimate is a contradiction in terms.

Be careful that ballpark estimates don't become targets.

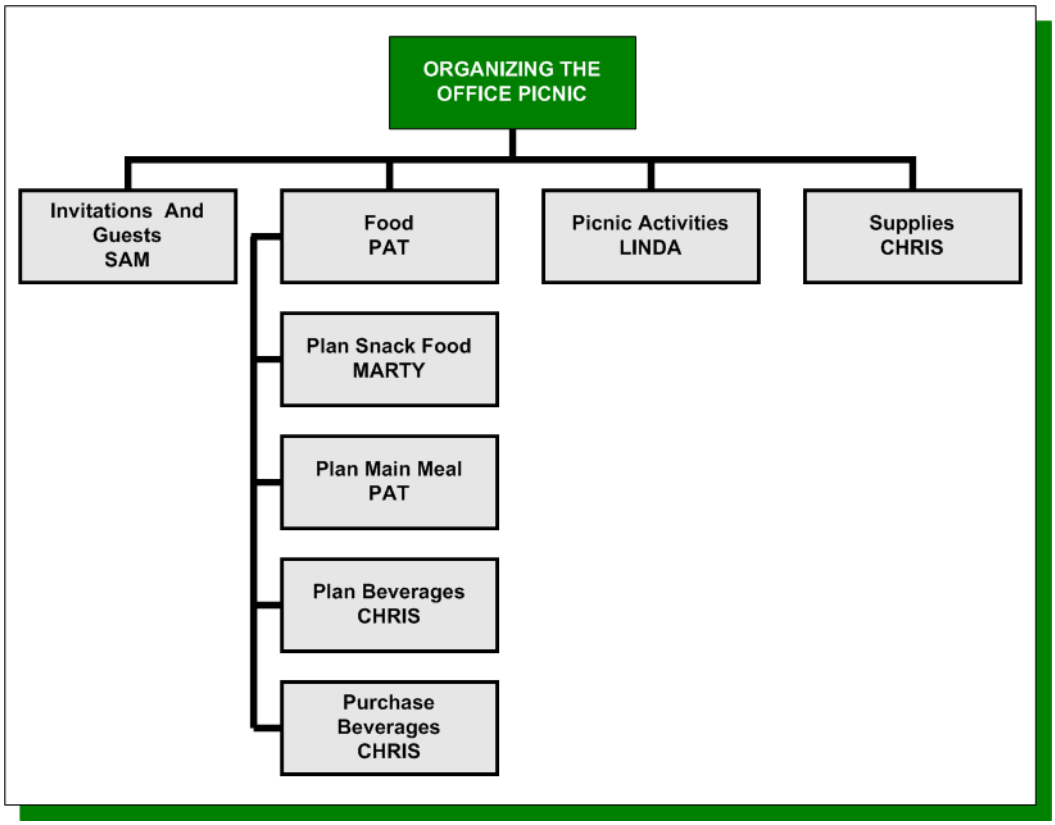
Consensual estimating is a good way to deal with activities for which no history exists.

No learning takes place without feedback; estimate; then track the actual time to improve estimating ability.

3.5 Examples of a Work Breakdown Structure:

PROJECT: ORGANISING THE OFFICE PICNIC			
	TASK	**ESTIMATED TIME (DAYS)**	**RESPONSIBLE PERSON**
TASK 1	**Do** invitations and determine number of guests		
	Activity 1.1: Get material from last year's picnic	.5	Sam
	Activity 1.2: Edit last year's invi	.5	Sam
	Activity 1.3: Set up invitation log	5	Sam
	Activity 1.X: Do final estimate of number of guests	.5	Sam
TASK 2	**Plan and purchase food**		
	Activity 2.1: Plan snack food	.5	Zodwa
	Activity 2.2: Plan main meal	2	Pat
	Activity 2.3: Plan beverages	.5	Chris
	Activity 2.X: Purchase beverages	.5	Chris
TASK 3	**Plan picnic activities**		
	Activity 3.1: Do informal poll of activities enjoyed at last year's picnic	5	Linda
	Activity 3.2: Find out where sports equipment is held	.5	Zodwa
	Activity 3.X: Buy new equipment,	1	Linda
TASK 4	**Plan and purchase supplies**		
	Activity 4.1: Plan food-supplies (plates, cups, plastic ware, etc.)	.5	Zodwa
	Activity 4.2: Plan decorations	.5	Chris

	Activity 4.X: Pick up decorations from Picnic Store	.5	Zodwa



3.6 The use of Gantt Charts for Work Breakdown structures

A **Gantt chart** is a popular type of bar-chart that illustrates a project schedule. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of the project. Terminal elements and summary elements comprise the work breakdown structure of the project. Some charts also show the dependency (i.e., precedence network) and relationships between activities.

Gantt charts can be used to assess the status of each project activity after the work is underway. They indicate the float of each activity.

Guidelines for Drawing a Gantt Chart

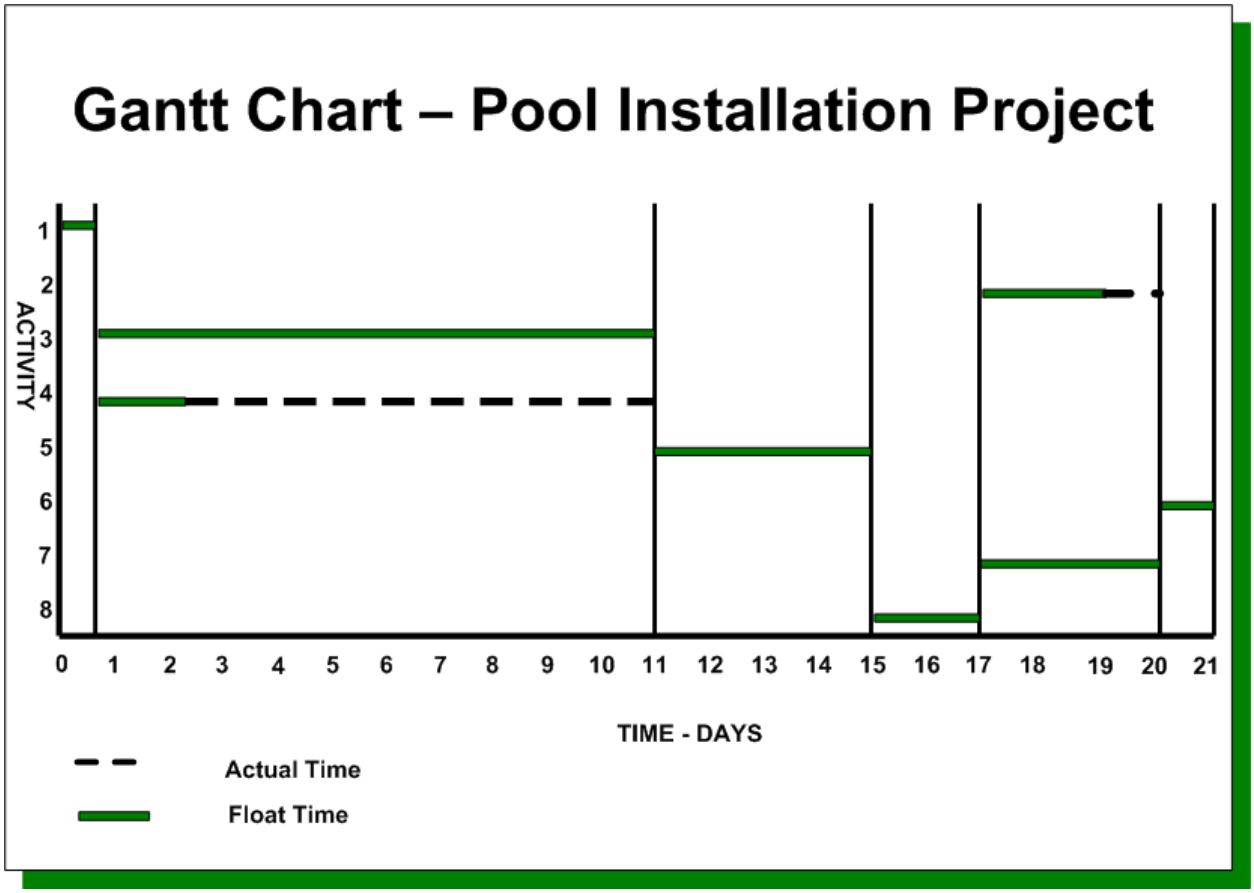
- Horisontal Scale = Time units (hours, days, weeks) / Costs
- Vertical Scale = Project activities
- Indicate the first project activity on top of the vertical scale
- Start and the beginning and ending of each bar, indicate finish times of each activity

- Project activities are sequentially listed on the Gantt chart according to time
- The same logic sequence in the CPM schedule must be maintained in the Gantt chart
- Completed activities = task bar

The table below indicates the work breakdown structure, duration and activity sequencing for the construction for the installation of a pool:

ACTIVITY NO	ACTIVITY/WORK PACKAGE	DURATION	PREDECESSOR	RESOURCES
1	Decide on pool shape	1 day	Start	Owner
2	Install pump	3 days	8	1 x electrician
3	Dig hole	10 days	1	4 x labourer
4	Order pool	1 day	1	Project Manager
5	Insert pool	4 days	3 and 4	4 x labourer
6	Test functions	1 day	2 and 7	Project Manager and Owner
7	Lay paving	4 days	8	2 x pavers
8	Connect water-pipes	2 days	5	1 x plumber

Below is the Gantt chart for the above example:



If it is presumed that the project is currently at day eight of the project life cycle, the following can be seen from the Gantt chart:

- Activity four, if not started yet, is in a float time and can still be started either on day eight, nine or ten, and the duration of the project will not be affected.
- Activity three needs to be in the seventh day. If it has fallen behind it will delay the overall completion of the project.
- Activities two and four each have a float time.

3.7 Advantages and Limitations of Gantt Charts

Gantts charts have become a common technique for representing the phrases and activities of a project Work Breakdown Structure (WBS), so they can be understood by a wide audience.

A common error made by those who equate Gantt chart design with project design is that they attempt to define the project work breakdown structure at the same time that they define schedule activities. This practice makes it very difficult to follow the 100% rule. Instead, when the WBS is fully defined to follow the 100% rule, the project schedule can be designed.

Although a Gantt chart is easily comprehended for small projects that fit on a single sheet or screen, they can become quite unwieldy for projects with more than about 30 activities. Larger Gantt charts may not be suitable for most computer displays. A related criticism is that Gantt charts communicate relatively little information per unit area of display. That is, projects are often considerably more complex than can be communicated effectively with a Gantt chart.

Gantt charts only represent part of the triple constraints of projects, because they focus primarily on schedule management. Moreover, Gantt charts do not represent the size of the project or the relative size of work elements, therefore the magnitude of behind-schedule condition is easily miss-communicated. If two projects are the same number of days behind schedule, the larger project has a larger impact on resource utilisation, yet the Gantt does not represent this difference.

Although project management software can show schedule dependencies as lines between activities, displaying a large number of dependencies may result in a clutter or an unreadable chart.

Because the horizontal bars of a Gantt chart have a fixed height, they can misrepresent the time-phased workload (resource requirements) of a project. A related criticism is that all activities of a Gantt chart show planned workload as constant. In practice, many activities (especially summary elements) have front-loaded or back-loaded work plans, so a Gantt chart with percent-complete shading may actually miss-communicate the true performance status.

3.8 Duration Estimation

Introduction

It involves assessing the number of work periods needed to complete each identified activity.

Activity duration estimating represents the act of quantifying the amount of time that it is anticipated for the activity to be completed.

CPM Definitions

- **Early Start:** The earliest date by which an activity can start.
- **Early Finish:** The earliest date by which an activity can be completed.

- **Late Start:** The latest date by which an activity needs to start before it will delay the project's completion date.
- **Late Finish:** The latest date by which an activity needs to be completed so that it will not delay the project's completion date.
- **Target Start**: The date an activity is planned to start.
- **Target Finish**: The date an activity is planned to finish.

Process

Responsible functional managers must evaluate each activity and must submit their best estimates based on historical data.

Functional managers must submit their estimates using three possible completion assumptions:

Most optimistic completion time (a): This time assumes that everything will go according to plan

Most pessimistic completion of time (b): This time assumes that everything will not go according to plan and that the maximum potential difficulties will develop.

Most likely completion time (m): This is time that will most often occur.

The activity duration can be found from the expression:

$$\text{Activity Duration (te)} = \frac{a + 4m + b}{6}$$

te = activity duration

a = most optimistic time

b = most pessimistic time

m = most likely time

Task: Calculate the activity duration from the following info:

Most optimistic time = 6 days

Most pessimistic time = 17 days

Most likely time = 10 days

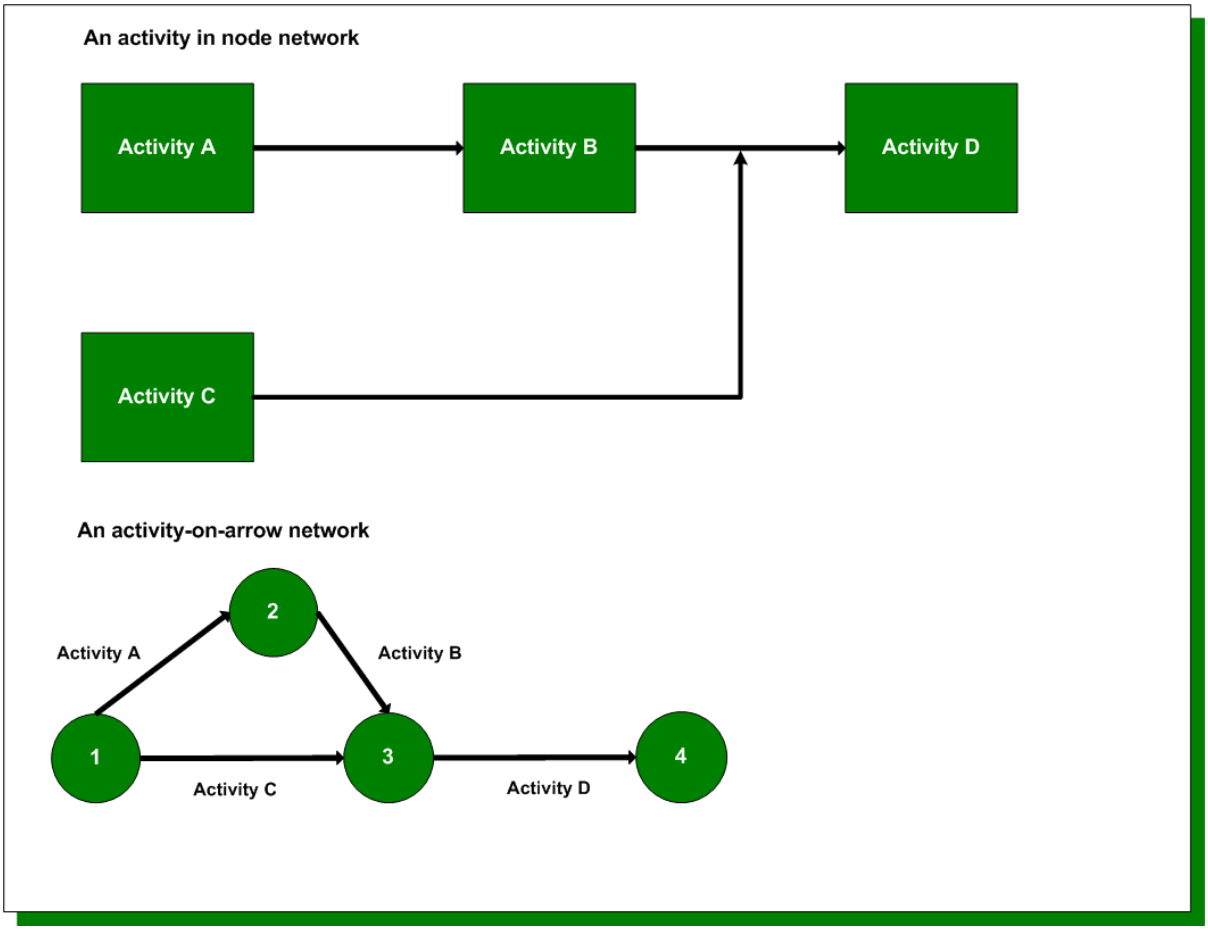
Answer……

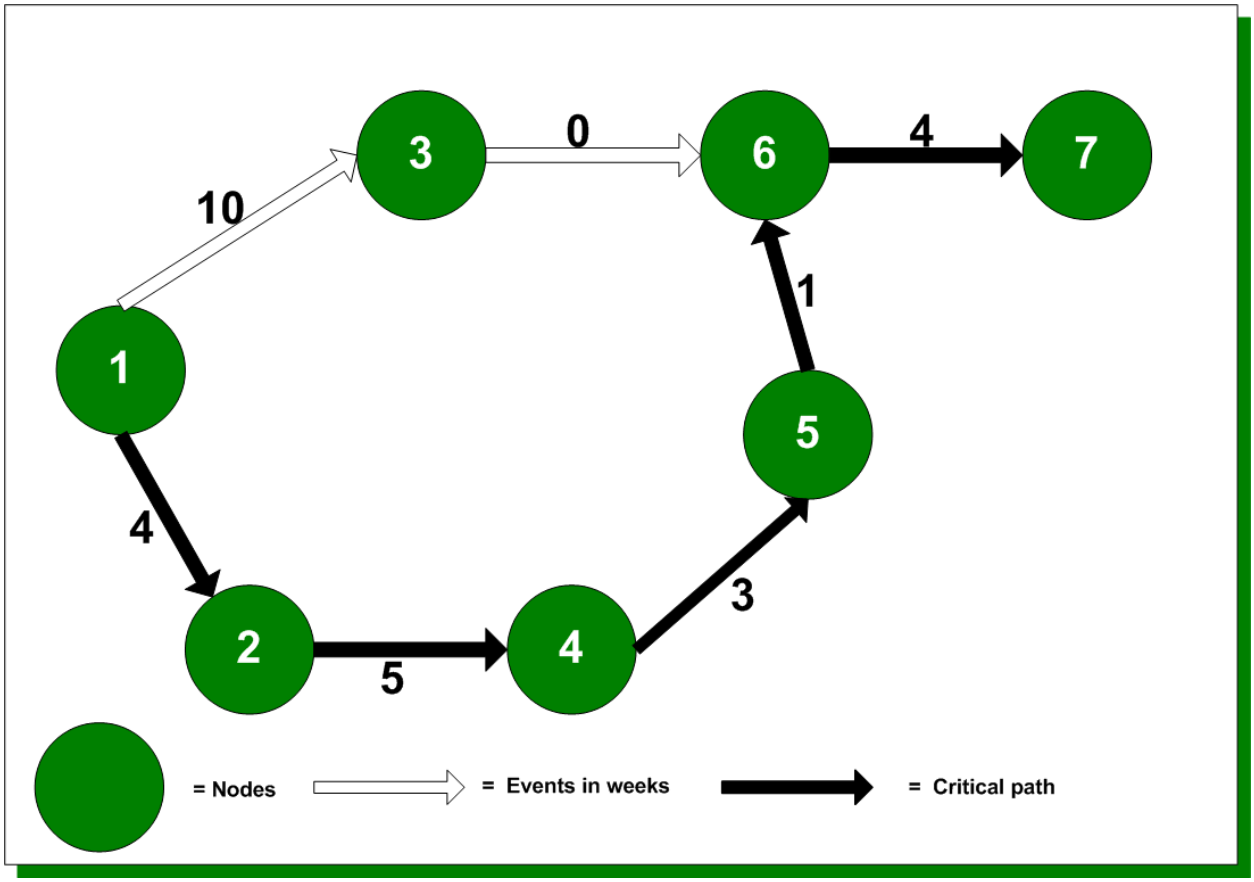
3.9 The use of Critical Path Method to map project duration during WBS

The WBS provides information on the estimated time of completion for each individual activity, but it does not indicate the order in which the activities can or will take place. It does not indicate whether Activity A must be completed before Activity B can proceed, or whether the two can proceed concurrently. When a project is fairly simple, these interrelationships are not difficult to discern, and a schedule can be constructed directly form the WBS by laying out the activities in the order in which they are to be carried out. Alternatively, when a project is complex, it is almost impossible to construct a schedule before the interrelationships among the various activities are made explicit. Network diagrams are graphical tools for making these interrelationships explicit. Until recently, the most popular network diagramming techniques have been *Program Evaluation and Review Technique* (PERT) and *Critical Path Method (CPM).*

PERT was introduced by the Special Project Office of the United States Navy in 1958 as an aid in planning (and controlling) its Polaris Weapon System, a project that involved approximately 3,000 contractors. At virtually the same time, a similar technique, Critical Path Method (CPM), was introduced by the Du Pont Company. The methods are very similar and in essence show the flow of activities form start to finish. Over the years, the two methods have essentially merged, and people often refer to PERT/CPM diagrams and/or analysis. More recently, with the increased use of project management computer software, other similar approaches have been developed and have gained some popularity and acceptance. Because the basic logic of the network diagramming is basically the same across the various techniques, the more traditional approaches will be presented.

As was implied above, PERT/CM diagrams allow the project manager to see the flow of tasks associated with a project by showing the interrelationships between activities. They allow the project manager to estimate the time necessary to complete the overall project, given the interdependencies among tasks; and to identify those critical points where a delay in task completion can have a major effect on overall project completion. In performing the PERT/CPM analysis, one assumes that all tasks or activities can be clearly identified and sequenced and that the time necessary for completing each task or activity can be estimated.





The figure above shows a simple PERT/CPM diagram. In the diagram, arrows designate activities. The circles at the beginning and end of the arrows are referred to as nodes; they designate starting and ending points for activities. These points in time, called events, consume no time in and of themselves. An activity is referred to as Activity i,j or Activity i-j, where i is the start node and j is the end node. Because of the way the diagram is constructed, the PERT/CPM diagram is sometimes referred to as an arrow or activity-on-arrow network diagram. Alternatively, activity-in-node (usually drawn in boxes) uses the arrows simply to show the necessary ordering of the activities. In activity-on-arrow diagrams the numbers along the arrows indicate the expected time for the activity to be completed.

Note the Activity 3, 6 has an expected time of zero weeks. This type of activity, called a dummy activity, is used to indicate that Activity 6, 7 cannot begin until Activity 1, 3 is complete.

The critical path is that chain of activities which takes the longest time to proceed through the network. It indicates the least possible time in which the overall project can be completed, and it is the path that needs to be watched most carefully to ensure that the project stays "on track"

To identify the critical path, it is necessary to understand the concept of *slack* or *float*. In the figure below, the critical path, 1-2-4-5-6-7, takes 17 weeks form start to finish. Note, however, that there is another path, 1-3-6-7, which only takes 14 weeks form start to finish. This means that Activity 1, 3 could begin three weeks later than Activity 1, 2 and the project would still be completed on time, assuming, of course, that the time estimates are fairly accurate. It is then said that Activity 1, 3 has a total float or slack of three weeks. While this is easy to see in the figure, it requires more effort when the diagram is more complex.

The first step in identifying the critical path is to identify the earliest start and finish times. Start at the first node of the diagram; this has an earliest start time of zero. For the other nodes, the earliest start time equals the earliest finish time of the previous activity. For all activities, the earliest finish time is the sum of the earliest start time plus the estimated time of activity.

Next, take the largest finish time for the last node and subtract the estimated time for completion of that activity from the latest finish time of the previous activity. To identify the critical path, make a list of latest finish time and earliest start time. Time available is then calculated as the difference between the earliest start time and the latest finish time. If available time is equal to the estimated time for completing the activity, there is no float and that activity is on the critical path.

As indicated above, the critical path is important because it is the path that must be most closely monitored. It is the path for which there is no slack, and activities must begin and end on time in order for the project schedule to be met. Alternatively, activities that are not on the critical path can

begin any time between the earliest and latest start dates. The determination is usually in accordance with the availability of resources, primarily human resources.

The table below shows the calculations as discussed:

Identifying the Critical Path

ACTIVITY	LATEST FINISH TIME (-)	EARLIEST START TIME (-)	TIME ESTIMATE	(=) FLOAT
1,2	4	0	0	0*
1,3	13	0	10	3
2,4	9	4	5	0*
3,6#	13	10	0	3
4,5	12	9	3	0*
5,6	13	12	1	0*
6,7	17	13	4	0*

* Critical path

Dummy activity – has no time duration

3.10 Schedule Development

Once the Work Breakdown Structure has been approved, the team can identify how the project deliverables will be produced. With activity identification and definition, the team is determining "how" the project's scope (i.e. Work Breakdown Structure elements) will be delivered. At this point in the project planning, the team should not be concerned with how long, by whom, or how much time specific activities will take to complete. This process is primarily concerned with the activities and tasks (actions) required to deliver the committed project work. To accomplish this phase of project planning, techniques such as brainstorming, seeking expert judgment and gathering historical and background information must be used.

Teams can now decide on the order of the activities and their associated durations. These steps will help teams to determine the overall project schedule (when) and it's associated critical path (how long). By definition, the Critical Path is the longest time path on the project's network diagram, thus representing the minimal amount of time required to complete the project. At the conclusion of these steps, a project team can understand when the project can be optimally completed, based on relationship of activities, dependencies, sequence and duration.

Project scheduling is in essence the conversion of the WBS into an operating timetable. It serves as a basis for monitoring and controlling project activity and, taken together with the plan and budget, is probably the major tool for the management of projects. The basic approach to all scheduling techniques is the development of a network diagram that graphically portrays the sequential relations between the tasks in the project. Such networks are powerful tools to ensure the timeous execution and control of the various project activities and have the following benefits:

- It is a consistent framework for planning, scheduling, monitoring and controlling the project
- It illustrates the interdependence of all activities, tasks, work packages and work elements
- It denotes the times when specific individuals must be available for work on a given task
- It aids in ensuring that the proper communications take place between departments and functions
- It determines an expected project completion date
- It identifies so-called critical activities that, if delayed, will delay the project completion time
- It also identifies activities with slack time that can be delayed for specific periods without penalty or from which resources may be temporarily borrowed without harm
- It determines the dates on which tasks may be started – or must be started if the project is to stay on schedule
- It illustrates which tasks must be coordinated to avoid resource or timing conflicts
- It also illustrates which tasks may be run, or must be run, in parallel to achieve the predetermined project completion date
- It relieves some interpersonal conflict by clearly showing task dependencies
- It may, depending on the information used, allow an estimate of the probability of project completion by various dates or the date corresponding to a particular priority probability.

Allocate Resources

It is now time to identify, allocate, and align the team members with the Work Breakdown Structure of the project. During the resource planning processes, the team is answering the "who" questions associated with the project's work. Depending on the skill level and number of the resources that are available, this step could either increase or decrease the amount of time needed to get the project done. At this point, it is necessary to revisit the Critical Path and overall duration of the project and adjust where necessary.

Most of the hurdles and roadblocks that occur during a project arise due to poor or inadequate project planning. Putting the cart before the horse and jumping head first into a project can be tempting, but

that haphazard approach will almost always lead to future headaches. Taking a strategic approach to project planning - from the Work Breakdown Structure to the timeline - will help to ensure that the hard work of everybody involved aligns with the scope of the project, ultimately ensuring successful completion of the project at hand.

The critical path method (Activity on Node) in conjunction with the precedence diagram, WBS and the activity sequencing enables the project manager and his/her project team to develop the project schedule.

The cornerstone of any well-managed project is the schedule. This is a tool that identifies and organises project tasks into a sequence of events, which then form a project management plan. The process of building the schedule enables the project manager to identify the risk points, understand the proper linkage of events that assists in resource planning and allows the PM to establish goals for the team and the project.

The ultimate purpose of project management is to obtain the most efficient use of resources. This can be a problem, however, if there are wide swings in resource needs. There will be times when team members feel they can't get enough done, and times when they can't get enough to do. Even when it is carefully planned, a project will not consistently need the same amount of time from the same amount of people. One approach to maximise the use of people is to use the information from the WBS, together with the information regarding the amount of float, to schedule activities that are not on the critical path.

Kimmons defines resource levelling as "the process of scheduling work on non-critical activities so that resource requirement on peak days will be reduced".

Although in this sense *resources* refers to all project resources that are limited within a specified time period, including personnel, equipment, and materials, resource levelling is most often used to allocate personnel to different project activities.

To determine the optimal use of resources, the project manager needs to begin by assuming that all activities will begin at their earliest start dates. Based on this assumption, the project manager can then draw a graph, showing the required personnel by job type (title) over a period of time. This graph will show peaks, times where there is a great amount of work to be done, and valleys, times when there is less work to be done.

Using the PERT/CPM diagram and the table that depicts the float associated with each activity, the project manager can then level the resources by mobbing the start dates for some of the activities that have float to a later time (but prior to the latest start date). The process continues until the

changes in personnel requirements form one-time period to the next are minimised; that is, until the peak and valleys are evened.

Of course, with large, complex projects, the project manager would want to rely on computer software to perform this type of analysis.

The project schedule should be presented, as is the case with all other project documents – to stakeholders, authorities and role-players in an agreed upon format. Any changes to project schedule should be appropriately be authorised according to project change request procedure.

3.11 The use of Project Network Approaches for Scheduling

PERT: Program Evaluation and Review Techniques

CPM: Critical Path Method

Either one of these approaches can make use of any one of the following methods:

AON = Activity on Node. This means that all activities are assumed to occur within the node (schematic block)

AOA = Activity on Arc. This means that all activities are assumed to occur on the arrow connecting the nodes.

Note: The Activity on Node (AON) method is most often used where:

Activity = Node

Event = The start and finish times of an activity

Definitions of Network Terms

- **Activity:** An activity always consumes time and may also consume resources. Examples include paperwork, labour, negotiations, and machinery operations and lead times for purchased parts of equipment.
- **Critical**: A critical activity or event is one that must be achieved by a certain time, having no latitude (slack or float) whatsoever.
- **Critical Path**: The critical path is the longest path through the network and determines the earliest completion of project work.

- **Events:** Beginning and ending points of activities are known as events. An event is a specific point in time. Events are commonly denoted graphically by a circle and may carry identity nomenclature (e.g., words, numbers, and alphanumeric codes).
- **Milestone:** This is an event that represents a point of special significance in a project. Usually it is the completion of a major phase of the work. Project reviews are often conducted at milestones.
- **Network**: Networks are called arrow diagrams. They provide a graphical representation of a project plan showing the relationship of the activities.

3.12 Procedure to Complete a Project Network

STEP	ACTION
1	Use the WBS and activity sequencing to complete the network
2	Decide which activities will be the start and finish activities
3	Link the activities to their predecessors as identified in the activity sequencing
4	All nodes must be entering or exit lines except for the start and finish nodes
5	Ensure that there are no loops
6	Eliminate superfluous lines

Example: Pool Installation Project

The table below demonstrates the work breakdown structure and activity sequencing for a pool Installation:

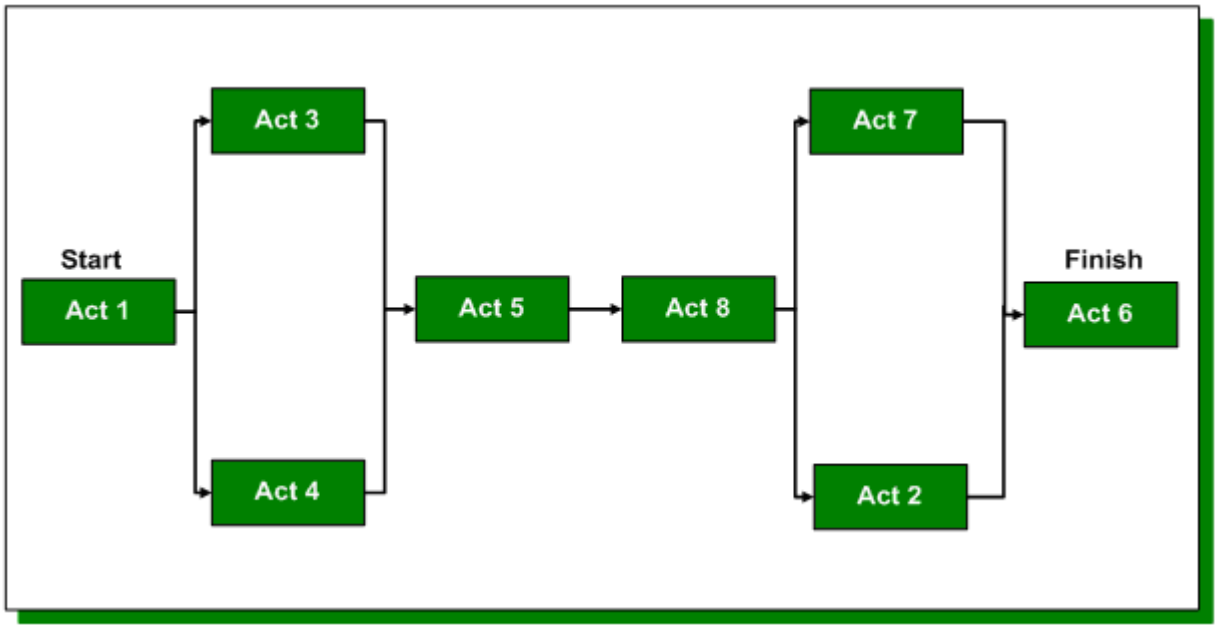
ACTIVITY NUMBER	ACTIVITY/WORK PACKAGE	DURATION	PREDECESSOR	RESOURCES
1	Decide on pool shape	1 day	Start	Owner
2	Install pump	3 days	8	1 x electrician
3	Dig hole	10 days	1	4 x labourer
4	Order pool	1 day	1	Project Manager

5	Insert pool	4 days	3 and 4	4 x labourer
6	Test functions	1 day	2 and 7	Proj. Manager + Owner
7	Lay paving	4 days	8	2 x pavers
8	Connect water pipes	2 days	5	1 x plumbers

Note: For demonstration purposes the activities have been kept at a high level only. A specific activity can be broken down in numerous sub-tasks.

Below is the Logic Network for the above project:

Precedence Diagram – Pool Installation Project



3.12 Further Elements Which Need to be Included in the Project Planning Process:

- ✓ **Resource Planning**: lists the labour materials and equipment required
- ✓ **Financial Planning**: lists the labour, equipment and material costs
- ✓ **Risk Planning**: identifies potential risks and actions taken to mitigate them
- ✓ **Quality Planning**: sets quality assurance and control measures
- ✓ **Acceptance Planning**: sets out the criteria which need to be met to gain customer acceptance
- ✓ **Communication Planning**: describes the information needed by stakeholders

- ✓ **Procurement Planning**: describes products to be sourced by external suppliers

3.13 The use of Project Management Tools

The project team can compile and/or use a range of project management tools that will assist in the planning as well as the execution of a project. The project manager can use these tools to monitor and control the execution of the various project activities. It is however critical that the output of the tool/ technique should meet the requirements of the client and the project.

Below is a summary of a range of tools available:

- **PROJECT PROCESS FLOW CHART:**

This is a chart that indicates the process flow of project activities.

- **PROJECT LIFE CYCLE CHART:**

The chart indicates the various phases of the project, resources required, duration per phase, total duration.

- **PRODUCT LIFE CYCLE CHART:**

When the project involves the development of a product, this chart will indicate when the project cycle starts and finishes and when production of the new product starts.

- **'HOT-SPOT' CHART:**

The chart indicates the position of the 'hot-spot' of the project regarding the constraints.

- **PLANNING DOCUMENT:**

When planning (general and/or detail) are undertaken, this document assists the team to plan thoroughly.

- **SOW - STATEMENT OF WORK:**

Work that has to be performed is defined and stated in this document.

- **WBS - WORK BREAKDOWN STRUCTURE:**

The WBS breaks down the specific work into fine detail, indicates whose responsible for it and on which level work will be performed.

- **RESPONSIBILITY MATRIX:**

Responsibilities are reflected on a matrix that is manager-friendly.

- **TASK LIST:**

This is a list of all the tasks/work that need to be done. It may include duration, individuals involved, resources needed, etc.

- **SKILLS REQUIREMENT WORKSHEET:**

This is none other than a skills audit for each job/task that have to be done. It indicates where there are enough skills or an absence of skills for a job.

- **SKILLS INVENTORY:**

This is a total skills audit of all the members on the project team.

- **NETWORK DIAGRAMS:**

It consists of Gantt, CPM- PERT and Precedence network diagrams.

- **SCHEDULES:**

Schedules reflect the duration of activities, starting times/dates and finishing times/dates

- **ZERO-BASE BUDGET:**

This is a way of establishing the priorities and getting down to the bottom line for a changing project based on the cost of getting things done.

- **BUDGET TRACKING CHART:**

The actual expenses versus the budget for the expenses are reflected and compared on the graph at a given point in time during the project life cycle.

- **PROJECT PRIORITY WORKSHEET:**

The worksheet prioritizes work/jobs and offers trade-off options for a given time and indicates precedence.

- **RISK MANAGEMENT WORKSHEET:**

Risks are identified, assessed, solutions developed and controlled via this tool.

- **INTERNAL REPORT:**

Any reporting regarding to the project can be reflected in this form of report. The format, detail and topics on reporting can be customized and included in the report pro forma.

- **IT SOFTWARE PROGRAMMES:**

Examples of IT software that are available in the market are: Fast Track, Artemis, Knowledge Plan, Quick Gantt, Turbo project, Mesa Systems, Microsoft Project, Project Homa Page Plan, Primavera, Project Scheduler, Project Invision, On Target, Time Line & Web Project.

- **PROJECT CHECK LIST:**

This tool has all activities/tasks that takes place on a project in sequence. As an activity/task is performed, it gets ticked off, reflecting dates, individuals involved and outcomes/results.

Evaluating Project Management Tools

The project manager should continuously evaluate the effectiveness of the project management tools and techniques that are applied. When assessing the effectiveness of the tools/ techniques consider the following:

- Making sure it was a shared tool – i.e. making sure it was accessible to the team
- Making sure it included an alert/notification feature
- The ease of inputting and changing data
- The ability to assign priorities to tasks
- Ensuring the tool supported task dependencies
- The tool allow for comment on tasks
- Security features
- Gantt charts feature
- The ability to assign roles and responsibilities

Project team members should have a standard process for assessing tool effectiveness as well as procedure to communicate problems to the project manager/ relevant authority. When problems are experienced with a tool/ technique relevant role-players or stakeholders should be consulted.

Once solutions were sourced in consultation with the relevant authorities a change request sheet should be completed and dually authorised. Thereafter the change control log sheet should be

completed. The change should be communicated to all relevant role-players/ stakeholders. (Refer Module 6 for templates).

Module 4

Project Execution

The talent of success is nothing more than doing what you can do, well.

Henry W. Longfellow

Project Execution

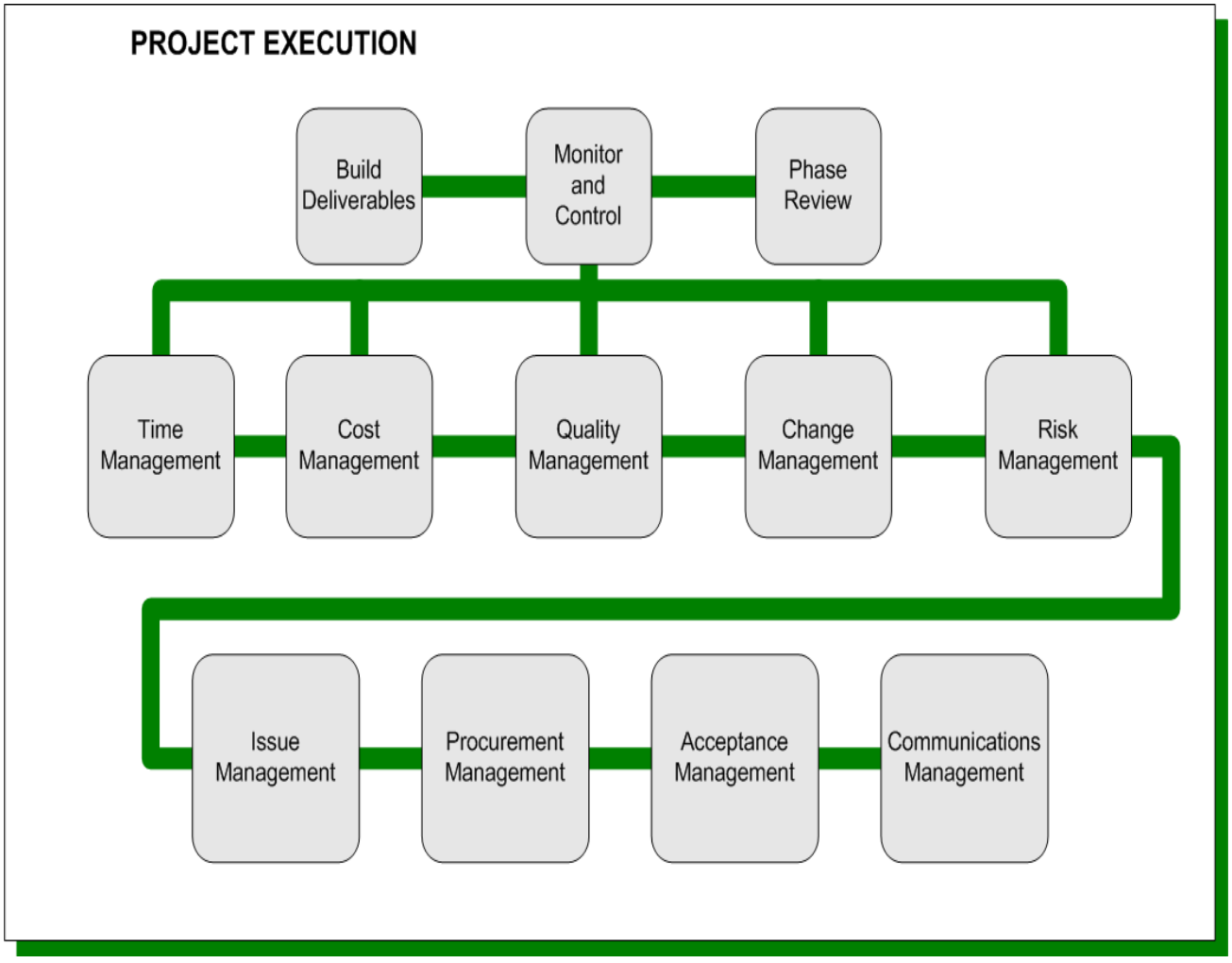
Unit Standards	
120387	Monitor, evaluate and communicate simple project schedules
Specific Outcomes	
Describe and explain a range of project schedule control processes and techniques Monitor actual project work versus planned work (baseline) Record and communicate schedule changes	
Learning Outcomes	
Understand and apply project execution Apply monitoring and control processes Apply control systems Effective implement, document and report on project changes Executive project evaluation Application monitoring and evaluation tools	
Critical Cross-field Outcomes	
Identifying Working Collecting	Communicating Science Demonstrating

4.1. Project Execution

This phase involves the execution of each activity and task listed in the Project Plan. While the activities and tasks are being executed, a series of management processes are undertaken to monitor and control the deliverables being generated by the project.

This includes the identification of changes, risks and issues, the review of deliverables being produced against the acceptance criteria. Once all the deliverables have been produced and the customer has accepted the final solution, the project is ready for closure.

The Execution phase is typically the longest phase of the project (in terms of duration). The deliverables are physically constructed and presented to the customer for acceptance within the phase. To ensure that the customer's requirements are met, the Project Manager monitors and controls those activities, resources and expenditure required to build each deliverable throughout the execution phase. A number of management processes are also undertaken to ensure that the project proceeds as planned.



4.1.1. Build Deliverables

This phase requires the physical construction of each deliverable for acceptance by the customer. The actual activities undertaken to construct each deliverable will vary, depending on the type of project (e.g. engineering, building development, computer infrastructure or business process re-engineering projects).

Deliverables may be constructed in a 'waterfall' fashion (where each activity is undertaken in sequence until the deliverables are finished) or an 'iterative' fashion (where iterations of each deliverable are constructed until the deliverable meets the requirements of the customer). Regardless of the method used to construct each deliverable, careful monitoring and control processes should be employed to ensure that quality of the final deliverable meets the acceptance criteria set by the customer.

4.2. Project Control Systems

Project control is that element of a project that keeps it on-track, on-time, and within a budget. Project control begins early in the project with planning and ends late in the project with post-implementation review, having a thorough involvement of each step in the process. Each project should be assessed for the appropriate level of control needed: too much control is time- consuming, too little control is too costly. If control is not implemented correctly, the cost to the business should be clarified in terms of errors, fixes, and additional audit fees.

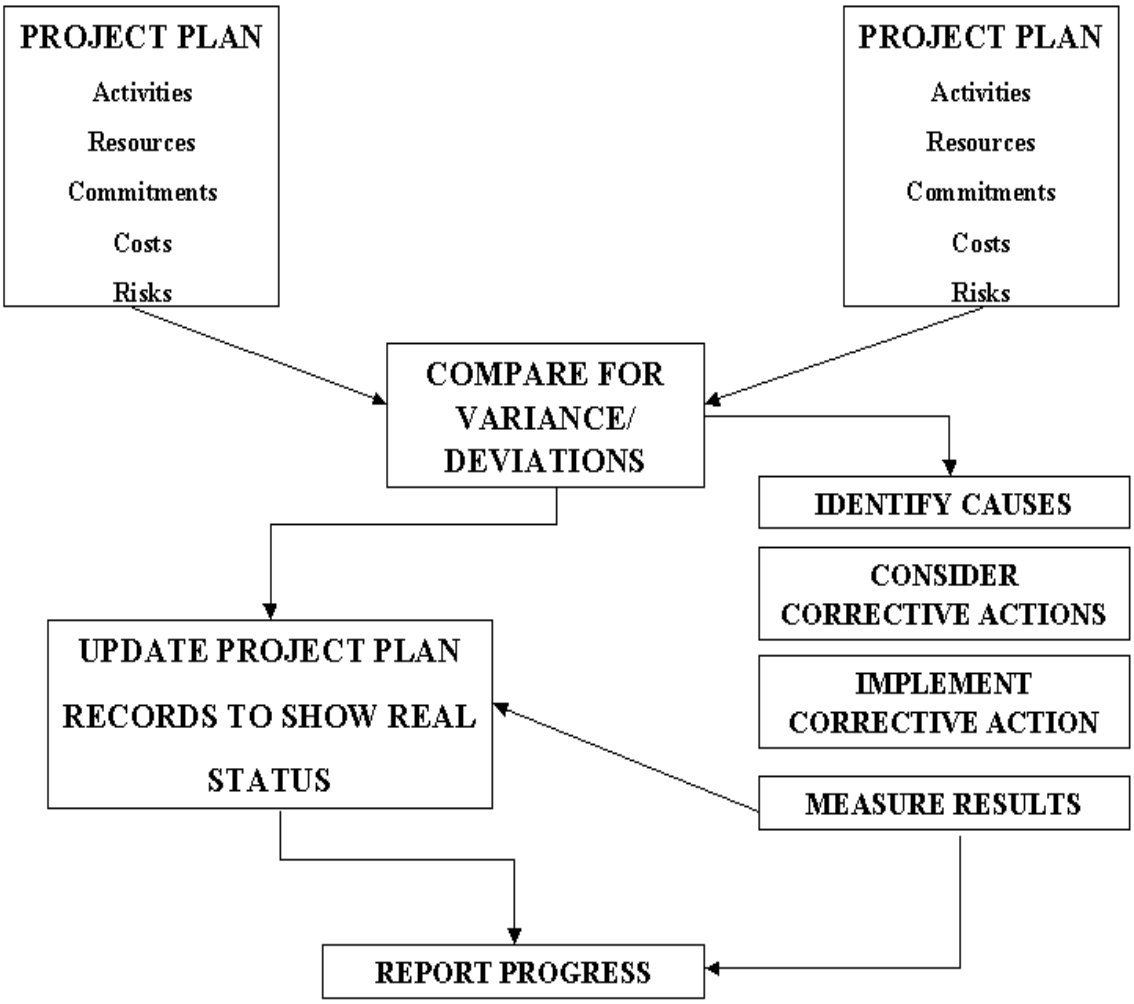
Control systems are needed for cost, risk, quality, communication, time, change, procurement, and human resources. In addition, auditors should consider how important the projects are to the financial statements, how reliant the stakeholders are on control systems, and how many control systems exist. Auditors should review the development process and procedures of how they are implemented. The process of development and the quality of the final product may also be assessed if needed or requested. A business may want the auditing firm to be involved throughout the process to catch problems earlier on, with the aim of fixing them easily. An auditor can serve as a controls consultant as part of the development team or as an independent auditor as part of an audit.

A business sometimes uses formal systems development processes. These assure that systems are developed successfully. A formal process is more effective in creating strong controls, and auditors should review this process to confirm that it is well-designed and is followed in practice. A good formal systems development plan outlines:

- A strategy to align development with the organisation's broader objectives
- Standards for new systems
- Project management policies for timing and budgeting
- Procedures describing the process

There are four primary resources that need to be monitored: time, money, people and materials. Monitoring involves looking at actual expenditures of resources, comparing actual with estimated, and, where necessary, deciding what adjustments need to be made in the work plan to accommodate discrepancies between actual and estimated.

Young describes a simple system that starts with a comparison of the actual results of work done with the desired results (the project plan). Variances are identified; triggering a process whereby the possible causes are identified and evaluated. A number of solutions need to be generated and considered, after which the best solutions are implemented. The results of the corrections are then measured. These corrective actions need to be recorded – the project plan is updated to reflect the real status of the project. Progress is then reported. The system can be depicted as follows:



Variances/deviations are not only identified through formal measurements, but also through keen observations by the project manager who keepings a close watch on everything. Managing by walking around (MBWA) is a technique well known in management circles; in the case of project management we might as well call it Monitoring by Walking Around. Monitoring is collecting, recording and reporting information concerning any and all aspects of project performance that the project manager or others in the organization wish to know and is part and parcel of the control process. What should be monitored and consequently controlled?

Booyens identified the following things to monitor:

- The status of work
- The volume of completed work
- Costs and expenditures
- Attitudes of role-players – the team, stakeholders and customers
- Team cohesion.

4.3 Project Changes

Coping with changes and changing priorities have been reported as the most important single problem facing the project manager. Minor changes can be reacted to fairly quickly, but significant change is much more serious and can have a demotivating effect on the project team unless it is something they have sought in the interests of the project. Change can stem from the customer, the end user, the sponsor or from technical problems. The most common changes are due to the natural tendency of the customer and team members to improve the product or service. The customer may become aware of new demands and performance requirements during the course of the project; new technologies may become available; or better ideas occur to the team as work progresses. Without control, a continuing accumulation of little changes can have a major negative effect on the project's schedule and cost. How should change then be controlled?

Meredith & Mantel suggest the use of a formal *change control system* that:

- Review all requested changes to the project (both content and procedure)
- Identify all task impacts
- Translate these impacts into project performance, cost and schedule
- Evaluate the benefits and costs of the requested changes
- Identify alternative changes that might accomplish the same ends
- Accept or reject the requested changes
- Communicate the changes to all concerned parties
- Ensure that the changes are implemented properly
- Prepare monthly reports that summarise all changes to date and their project impacts.

EXAMPLE:

The following table outlines the different sub-tasks allocated to an activity of a production project. The activity, "Handover" is the last activity on the schedule that was given to you by the previous Project Manager that resigned a few days ago.

The project is already 3 days late and the Client has indicated that penalties will be levied after the project exceeds the schedule by 5 days. This gives you another 2 days to complete the "Handover" activity.

You have a meeting scheduled with all the parties concerned and your Project Controller gathered the following information:

ACTIVTY NO. 407: **HANDOVER**

ORIGINAL DURATION: **6 DAYS**

TIME LEFT FOR COMPLETION: **2 DAYS (before penalties are levied)**

Health and Safety Division Approval (Weight – 30%)

	Department	**Inspected**	**Snag list provided**	**Snag list completed**	**Approved**	**Signed off**	**% Complete**
WEIGHT		**10%**	**20%**	**50%**	**10%**	**10%**	**100%**
	Occupational Health office	Yes	Yes	No	No	No	
	Fire Prevention office	Yes	Yes	50%	No	No	
	Reaction Unit Section	Yes	Yes	Yes	Yes	No	
	Production Safety Manager	Yes	No	No	No	No	

Production Commissioning (Weight – 70%)

		Production Specification Manuals received	**Test Runs completed**	**Test Report received**	**Approved**	**% Completed**
WEIGHT		**20%**	**65%**	**10%**	**5%**	**100%**
	Body Shop	Yes	No	No	No	
	Paint Shop	Yes	Yes	Yes	Yes	
	Engine Section	No	No	No	No	
	Trim and Mechanical section	Yes	Yes	Yes	No	

You have to calculate the progress (% complete) of this last activity and determine if the rate of progress is sufficient to complete the project before penalties are levied.

If the rate of progress is insufficient to complete the activity, list all the different options you can think of in order to ensure completion within time.

All changes to projects and schedules should be properly authorised (request for change template, Module 6), appropriately communicated and documentary proof should be kept.

4.4 Project Monitoring and Evaluation

Whilst the Project Team is physically producing each deliverable, the Project Manager implements a series of management processes to monitor and control the activities being undertaken. An overview of each management process follows.

Time Management

The previous module covered the scheduling of time and its centrality in project planning. Once the implementation starts, time management becomes the process within which the time spent by staff undertaking project tasks is recorded against the project. As time is a scarce resource on projects, it is important to record the time spent by each member of the team on a Timesheet to enable the Project Manager to control the level of resource allocated to a particular activity. A Timesheet Register provides a summary of the time currently spent on the project and enables the Project Plan to be kept fully up to date.

Cost Management

Managing costs rests on the foundation of financial planning and is the process by which costs (or expenses) incurred on the project are formally identified, approved and paid. Expense Forms are completed for each set of related project-expenses such as labour, equipment and materials costs. Expense Forms are approved by the Project Manager and recorded in an Expense Register for audit purposes.

Quality Management

Quality is defined as "the level of conformance of the final deliverable to the customer's requirements". Quality Management is the process by which the quality of the deliverables is assured and controlled for the project, using Quality Assurance and Quality Control techniques. Quality reviews are frequently undertaken, and the results recorded in a Quality Register.

Change Management

Change Management is the process by which changes to the project's scope, deliverables, time-scales or resources are formally defined, evaluated and approved prior to implementation. A core aspect of the Project Manager's role is to manage change within the project successfully. This is achieved by understanding the business and system drivers requiring the change, documenting the benefits and costs of adopting the change and formulating a structured plan for implementing the change. To formally request a change, it is often necessary to complete a Change Form. The change requests details, which may then be recorded in a Change Register.

Risk Management

Managing risk involves anticipating risks during the planning phase and identifying risks which emerge during the project. It includes the process by which risks to the project (e.g. to the scope, deliverables, time-scales or resources) are formally identified, quantified and managed during the project. A project risk may be identified at any stage of the project by completing a Risk Form and recording the relevant risk details in the Risk Register.

Risks are generally classified according to their probability and severity ratings.

Communications Management

Communications Management is the process by which formal communication-messages are identified, created, reviewed and communicated within a project. The most common method of communicating the status of the project is via Project Status Report. Each communication item released to the project stakeholders is captured in a Communications Register.

Procurement Management

Procurement Management is the process by which a product is sourced from an external supplier. To request the delivery of product, from a supplier, a Purchase Order must be approved by the Project Manager and sent to the supplier for confirmation. The status of the purchase is then tracked, using a Procurement Register until the product has been delivered and accepted by the project team.

Issue Management

Issue Management is the method by which issues currently affecting the ability of the project to produce the required deliverable are formally managed. After completion of an Issue Form (and logging the details in the Issue Register), each issue is evaluated by the Project Manager and a set of actions are undertaken to resolve the issue at hand.

Acceptance Management

Acceptance Management is the process by which deliverables produced by the project are reviewed and accepted by the customer as meeting his/her specific requirements. To request the acceptance of a deliverable by the customer, an Acceptance From is completed. The Acceptance Form describes the criteria from which the deliverable has been produced and the level of satisfaction of each criterion listed.

Perform Phase Review

At the end of the Execution Phase, a Phase Review is performed. This is basically a checkpoint to ensure that the project has achieved its stated objectives as planned.

Project evaluation appraises the progress and performance of a project compared to the project's planned progress and performance. Project evaluation conducted in a formal way is called project auditing. The project audit is a thorough examination of the management of a project, its methodology and procedures, its records, its properties, its budgets and expenditures and its degree of completion. The focus of the audit may be the entire project or only a part of the project. Meredith & Mantel make the following observations on a project audit:

- The audit report should contain at least the current status of the project, the expected future status, the status of crucial tasks, a risk assessment, information pertinent to other projects and any caveats and limitations.
- Audit depth and timing are critical elements of the audit because, for example, it is much more difficult to alter the project based on a late audit than an early audit.

- The difficult responsibility of the auditor is to be honest in fairly presenting the audit results. Data interpretation may even be required on occasion.
- Several essential conditions must be met for a credible audit: a credible evaluation/audit team, sufficient access to records and sufficient access to personnel.

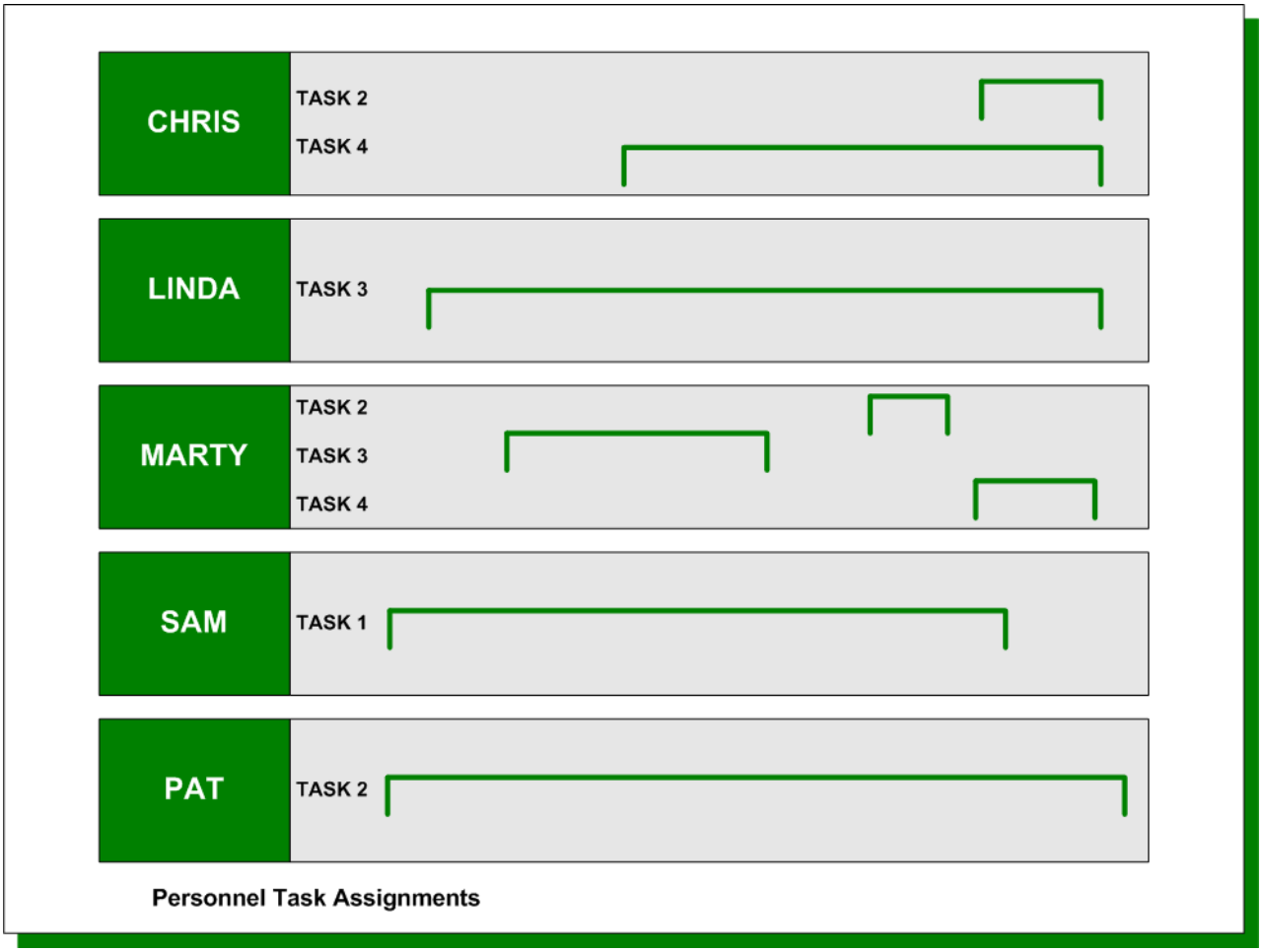
There are other issues that need to be monitored and controlled, such as conflict, which often arises when disagreements between stakeholders occur; ethical issues, especially in procurement management; *motivational levels* of the project team and so on. These issues are beyond the scope of this course, but it is recommended that you investigate and study them before embarking on an important project.

Refer to Module 6 for a template on project reporting. Records of project monitoring and evaluation should be kept, updated and appropriately communicated continuously.

4.4.1 Using Specialised Gantt Charts for Monitoring

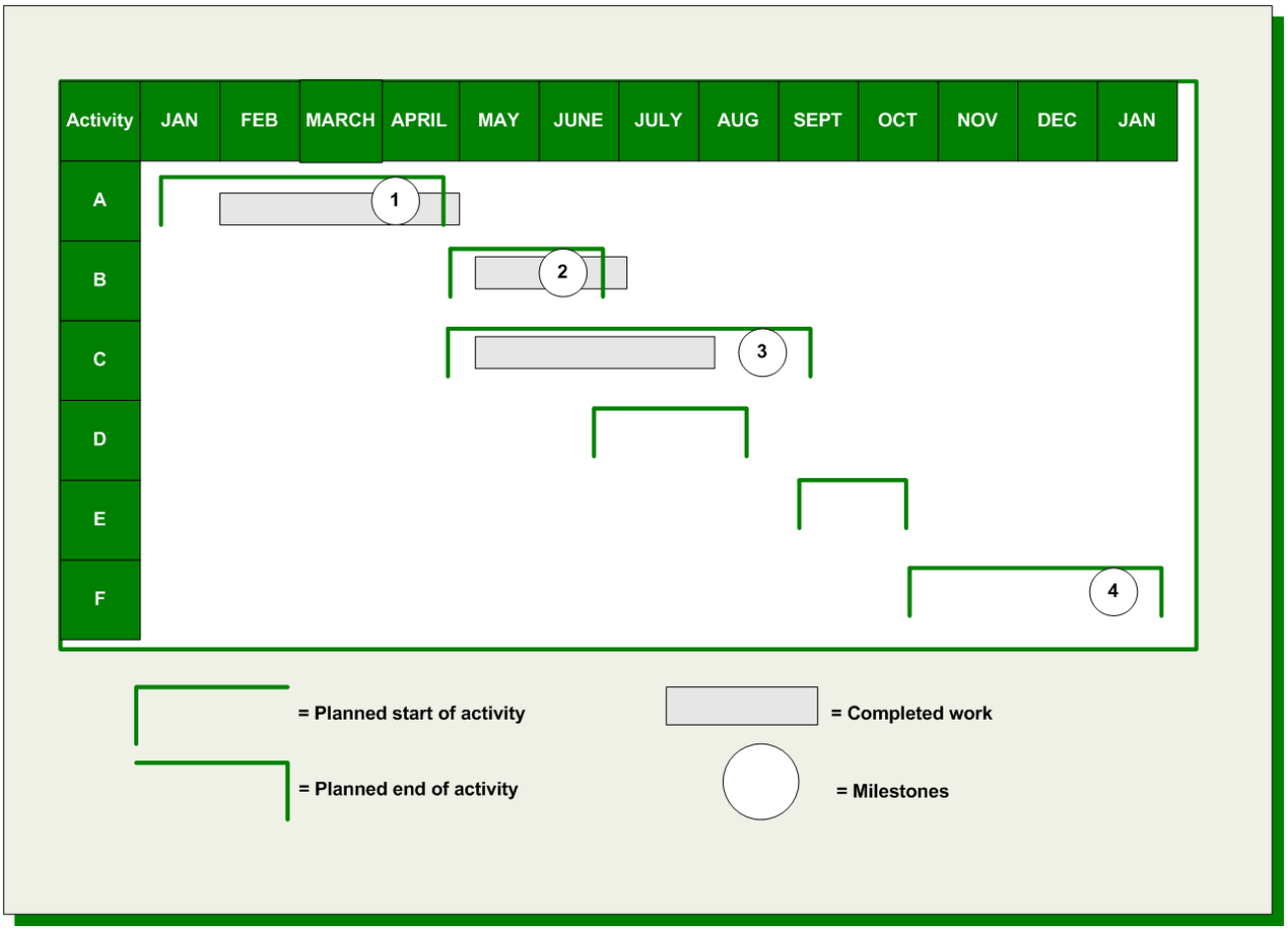
Once the Gantt chart is constructed, it can be used to integrate information about projected use of time with information about projected use of other resources. Two types of integrated Gantt charts are commonly used. The first shows personnel task assignments. By listing each individual along the vertical axis, followed by all the task/activities, then followed by all the tasks/activities to which that individual is assigned, the project manager can see at a glance which tasks/activities each person is assigned to at each time-period of the project. If the task distribution across individuals is uneven or if some individuals were mistakenly given too many work assignments during a single time period, this chart gives the project manager another chance to redistribute task assignments.

The second type of integrated Gantt Chart is the Bar Chart Cost Schedule. This Gantt Chart simply shows the projected performance to be spent in each time period. It also allows the project manager to calculate the cost slope by dividing the cost of the activity by the duration of the activity (in whatever unit of time is being used). Thus, if Activity A costs R4, 500 and is expected to take three weeks to complete, the cost slope in rand per week is R1, 500. While this piece of information is not interesting in isolation, it becomes interesting when the project manager compares it to the cost slopes of other activities, because it gives a sense of the relative cost of activities per time period.



Gantt Charts as Monitoring Tools.

The Gantt chart is also a useful project-monitoring tool. By using different colours or different symbols, the Gantt chart can help the project manager to track down how close the project is performing to the planned schedule. When a given task runs in excess of the allotted time, the Gantt chart can be used to determine whether or not the schedule needs to be re-arranged. The figure below shows that Activity A and B ran over schedule approximately one week each, whereas Activity C was completed almost one month ahead of schedule.



4.5 Using a Human Resource Matrix to Monitor Utilisation of People

One final planning/monitoring tool is the human resource matrix. As with the Gantt chart used to show the personnel task assignments, this matrix can be used to see whether workload is evenly distributed across individuals. The human resource matrix lists the tasks/activities along the vertical axis and the names across the top of the matrix (see Figure). For each task/activity, one person is designated to have primary responsibility (P), and others may be designated to have secondary responsibility (S).

TASK	CHRIS	LINDA	MARTY	PAT	SAM
1				P	
2	S		S	C	P
3		P	S	C	
4	P		S	C	

Other designations can also be added as needed. For example, one can label an individual as (C) if that individual needs to be consulted; or (B) if a person can provide backup, and so on. Project teams need to be able to adapt the project management tools to meet their needs best.

One advantage of this chart above the personnel task assignment chart is that it makes it clear whether or not time spent on the project is time in a leadership capacity. Further, it makes it clear at a glance whether someone has too many leadership (primary) assignments. Alternatively, while it reveals who is assigned to which task/activity, it is not as informative as the personnel task assignment chart with respect to how much time is being spent during each time by each person. Therefore, it is probably wise to use the two charts together for keeping track of how human resources are being utilised.

Controlling the Project Budget

While project success is generally defined in terms of project completion within constraint of time and cost, and at an appropriate level of performance, the project manager will be rated a success or failure as a project manger according to whether the project comes in under budget, on budget, or over budget.

Monitoring Cost Variances and Cost/Schedule/Integration

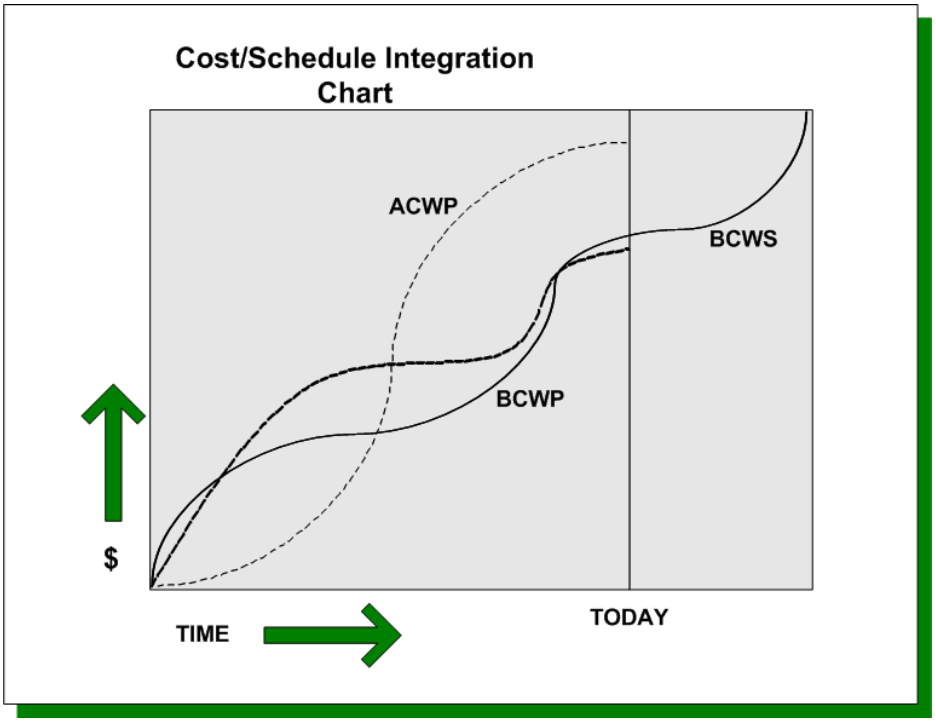
In monitoring the budget, the project manager is concerned with two types of information. The first involves the amount of money budgeted for the work to be performed (budgeted cost of work performed – BCWP) versus the actual cost of performing the work (actual cost of work performed – ACWP). The difference between the two quantities (BCWP-ACWP), called the cost variance, is an indication of how close the estimated cost was to actual costs, with a positive number indicating monetary savings and a negative number indicating a budget overrun.

The second type of information involves the amount of money projected to be spent on the actual work performed during the time period (budgeted cost of work performed – BCWP) versus the amount projected to be spent during the time period (budgeted cost of work schedule–BCWS). The difference between the two quantities, (BCWP – BCWS), called the schedule variance, is an indication of whether the money is being spent according to the projected scheduler.

Here a positive number is an indication that the project is running ahead of schedule – that is, more work is being performed than was originally scheduled – whereas a negative number is an indication that the project is running behind schedule – less work is being performed than was actually scheduled. Alternatively, a negative number could be an indication that some work is being performed out of its scheduled sequence. Schedule variance should be examined in conjunction with the Gantt chart or PERT/CPM network diagram to determine the actual status of specific activities or milestones.

Cost and schedule variances can be examined graphically or in a table. To examine these variances graphically, the project manager needs to calculate cumulative BCWS, BCWP, and ACWP at each time period. It means that for each reporting period (usually monthly) the project manager needs to calculate the total projected budget for the work that has actually been performed up to that time period (cumulative BCWP), and the total budget actually spent up to that time period (cumulative ACWP). The three amounts are plotted at each time period along the vertical axis, with time across the horizontal axis. The points are then connected to make a smooth curve (see Figure). Note, that the cumulative BCWS curve extends from the lower-left corner, where no money has been budgeted to be spent before the beginning of the project, to the upper-right corner, where all the money is budgeted to be spent by the end of the project.

When the cumulative BCWS curve lies above the cumulative ACWP curve, the project is running under budget. Alternatively, if the cumulative ACWP lies above the cumulative BCWP curve, the project is running over budget and the project manager needs to understand shy. Similarly, if the cumulative BWCS lies below the BCWP, then the project may well be running ahead of schedule. Alternatively, if the BCWS lies above the BCWP, the amount that the project manger expected to spend up to that time period is less than the amount actually being spent, and the project may be behind schedule. In the figure below, the project was initially running under budget but is now running considerably over budget. It was also initially behind schedule but is catching up.



A performance analysis report presents cost and schedule variance in a tabular form. This report is usually generated on a monthly basis, although, depending on the complexity of the project, it could be done more or less often. The report includes two tables, one with information above performance in the current time period and the second with information about cumulative performance. The first table presents five pieces of information for each category of expenditure:

- ✓ the amount budgeted for this time period (BCWS)
- ✓ the amount budgeted for the work performed (BCWP)
- ✓ the amount actually spent in the current time period (ACWP), cumulative information.

Again, the project manager should be concerned when the performance analysis report indicates negative cost or schedule variances.

Module 5

Project Closure

The talent of success is nothing more than doing what you can do, well.

Henry W. Longfellow

Project Closure

Unit Standards	
Unit Standards	
120372	Explain fundamentals of project management
Specific Outcomes	
Contribute to the monitoring of achievement of the project scope	
Unit Standards	
120387	Monitor, evaluate and communicate simple project schedules
Specific Outcomes	
Describe and explain a range of project schedule control processes and techniques	
Monitor actual project work versus planned work (baseline)	
Record and communicate schedule changes	
Learning Outcomes	
Apply procedures applicable to project completion	
Perform project closure	
Review project completion	
Critical Cross Field Outcomes	
Identifying	Communicating
Working	Science
Collecting	Demonstrating

5.1 Project Completion

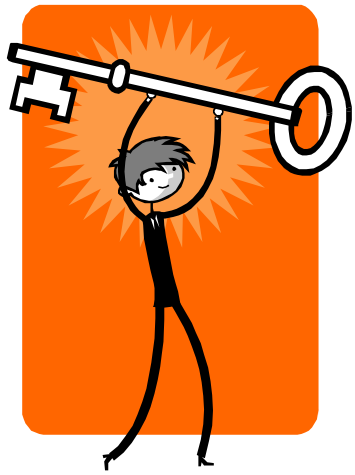
The goal of project management is to obtain client acceptance of the project result. This means that the client agrees that the quality specifications of the project parameters have been met. In order to make this go smoothly, the client and project manager must have well-documented criteria of performance in place from the beginning of the project. This is not to say that nothing can change, but when changes are made, the contract must be amended to list the changes on specifications along with any resulting changes in schedule and budget.

Objective, measurable criteria are always best, while subjective criteria are risky and open to interpretation. There should be no room for doubt or ambiguity, although this is often difficult to achieve. It is also important to be clear about what the project output is expected to accomplish. For example, these three outcomes may produce entirely different results: the project/product performs the specified functions; it was built according to approved design; or it solves the client's problem.

The project may or may not be complete when results are delivered to the client. Often there are documentation requirements such as operating manuals, complete drawings and the final report which have to follow delivery. There may also be people to be trained in operating the new facility or product, and a final audit is common. Finally, project team members need to be re-assigned; surplus equipment, materials and supplies disposed of; and facilities released.

The final step of any project should be an evaluation review. This is a look back over the project to see what was learnt that will contribute to the success of future projects. This review is best done by the core project team and typically in a group discussion.

Here is an example of a project completion check-list:



- Test project output to see that it works
- Write operations manual
- Complete final drawings
- Deliver project output to client
- Train client's personnel to operate project output
- Re-assign project personnel
- Dispose of surplus equipment, materials and supplies
- Release facilities
- Summarise major problems encountered and their solutions

- Document technological advances made
- Summarise recommendations for future research and development
- Summarise lessons learnt in dealing with the interfaces
- Write performance evaluation reports on all project staff
- Provide feedback on performance to all project staff
- Complete final audit
- Write final report
- Conduct project review with upper management
- Declare the project complete

5.2 Closure

Following the completion of all project deliverables and acceptance by the customer, a successful project will have met its objectives and be ready for formal closure. Project Closure is the last phase in the project and must be conducted formally so that the business benefits delivered by the project are fully realised by the customer.

5.3 Perform Project Closure

Project Closure involves undertaking a series of activities to wind up the project, including:

Identifying any outstanding items (activities, risks or issues)

Producing a hand-over plan to transfer the deliverables to the customer environment

Listing the activities required to hand over documentation, cancel supplier contracts and release project resources to the business

Communicating closure to all stakeholders and interested parties

A Project Closure Report is submitted to the Customer and/or Project Sponsor for approval. The Project Manager is then responsible for undertaking each of the activities identified within the Project Closure Report on time and according to budget.

The project is closed only when all activities identified in the Project Closure Report have been completed.

5.4 Review Project Completion

The final activity undertaken on any project is a review of its overall success by an independent resource. Success is determined by how well it **performed** against the defined objectives and **conformed** to the management processes outlined in the planning phase. To determine performance, a number of questions are posed. For example:

- Did it result in the benefits defined in the Business Case?
- Did it achieve the objectives outlined in the Terms of Reference?
- Did the deliverables meet the criteria defined in the Quality Plan?
- Was it delivered within the schedule outlined in the Project Plan?
- Was it delivered within the budget outlined in the Financial Plan?

To determine conformance, a review is undertaken of the level of conformity of the project activities to the management processes outlined in the Quality Plan. The above results, key achievements and lessons learnt are documented within a Post Implementation Review report and presented to the Project Sponsor for approval.

5.5 Glossary of Terms

TERM	DESCRIPTION
ACCEPTANCE MANAGEMENT	The process by which deliverables produced by the project are reviewed and accepted by the customer as meeting their specific requirements
ACCEPTANCE PLANNING	The process of identifying the milestones, criteria and standards for the acceptance of project deliverables by the customer
BUSINESS CASE	A document outlining the justification for the initiation of a project. It includes a description of the business problem (or opportunity), a list of the available solution options, their associated costs and benefits and a preferred option for approval
CHANGE MANAGEMENT	The process by which changes to the project scope, deliverables, time-scales or resources are formally defined, evaluated and approved prior to implementation

TERM	DESCRIPTION
COMMUNICATIONS MANAGEMENT	The process by which formal communications messages are identified, created, reviewed and communicated within a project
COMMUNICATIONS PLANNING	The process of identifying the type and regularity of information to be provided to all project stakeholders to keep them informed of the progress of the project
COST MANAGEMENT	The process by which costs (or expenses) incurred on the project are formally identified, approved and paid
DELIVERABLE	A quantifiable outcome of the project which results in the partial (or full) achievement of the project objectives
DEPENDENCY	A logical relationship between two or more project activities. The four types of dependencies include: start-to-finish, start-to-start, finish-to-start, finish-to-finish
FEASIBILITY STUDY	A document which identifies each of the solution options to a particular business problem (or opportunity) and assesses the likelihood of each option's achieving the desired result
FINANCIAL PLANNING	The process of identifying the financial resources required to undertake the project. This includes a list of the types of costs to be incurred on the project (e.g. labour, equipment, materials and administration costs) and a schedule outlining when the respective costs are likely to be incurred
ISSUE	Events which are currently affecting the ability of the project to produce the required deliverables
ISSUE MANAGEMENT	The process by which issues are formally identified, communicated, monitored and resolved
JOB DESCRIPTION	A document which describes a role and its responsibilities within a project
MILESTONE	The recognition of an important event within the project, usually the achievement of a key project deliverable

TERM	DESCRIPTION
PHASE REVIEW	A checkpoint at the end of each project phase to ensure that the project has achieved its started objectives and deliverables as planned
PROCUREMENT MANAGEMENT	The process by which product is actually sourced from a preferred supplier, including the on-going management of the supplier relationship
PROCUREMENT PLANNING	The process of identifying the products to be sourced externally and the methods for acquiring them
PRODUCT	Goods or a service which is acquired form an external supplier to assist with the production of a project deliverable
PROJECT	A unique endeavour to produce a set of deliverables within clearly specified time, cost and quality constraints
PROJECT ACTIVITY	A set of project tasks which usually results in the partial (or full) completion of a project deliverable
PROJECT LIFECYCLE	A series of project phases which are undertaken in either sequential or parallel order
PROJECT MANAGEMENT	The skills, tools and management processes required to successfully undertake a project
PROJECT OFFICE	The physical premises within which Project Administration staff (e.g. the Project Manager and support staff) reside
PROJECT PHASE	A set of project activities and tasks which usually result in the completion of a project deliverable
PROJECT PLAN	A document which lists the phases, activities, tasks, time-frames and resources required to complete a project
PROJECT SCHEDULE	A series of planned dates within which activities and tasks have to be completed to achieve project milestones
PROJECT TASK	A specific work item to be undertaken which usually results in the partial completion of a project deliverable

TERM	DESCRIPTION
PROJECT TEAM	A team of people who report to the Project Manager
QUALITY	The level of conformance of the final deliverable(s) to the customer's requirements
QUALITY ASSURANCE	The preventative steps taken to eliminate any variances in the quality of the deliverable produced form the quality targets set
QUALITY CONTROL	The curative steps taken to eliminate any variances in the quality of the deliverable produced from the quality target set
QUALITY MANAGEMENT	The process by which the quality of the deliverables and management processes is assured and controlled for the project, using Quality Assurance and Quality Control techniques
QUALITY PLANNING	The process of identifying the approach taken to ensure the quality of the deliverables produced by the project and of the quality criteria and standards to be achieved as well as the Quality Assurance and Quality Control techniques to be undertaken
REQUEST FOR INFORMATION	A document which is issued by a project to a wide group of potential suppliers to enable those suppliers to provide summarised information, outlining how they will meet the procurement requirements of the project
REQUEST FOR PROPOSAL	A document which is issued by a project to a short-listed group of suppliers to enable the suppliers to submit a detailed proposal, outlining how they will meet the procurement requirements of the project
RESOURCE	The labour, equipment and materials used to undertake a Project
RISK	Any event which is likely to adversely affect the ability of the project to achieve the defined objectives

TERM	DESCRIPTION
RISK MANAGEMENT	The process by which risks to the project (e.g. to the scope, deliverables, time-scales or resources) are formally identified, quantified and managed during the project. The process entails completing a number of actions to reduce the likelihood of occurrence and the severity of impact of each risk
RISK MITIGATION	A set of actions to be taken to avoid, transfer or mitigate a risk, based on its priority. This includes the preventative actions to be taken during the project to reduce the likelihood of the risk's occurring, as well as the contingent actions to be taken to reduce the impact on the project should the risk eventuate
RISK PLANNING	The formulation of a document which outlines the foreseeable project risks and provides a set of actions to be taken to both prevent the risk from occurring and reduce the impact of the risk should it eventuate
SCOPE	The total aggregation of deliverables to be produced by the project
SOLUTION	A set of deliverables which, once combined, solve a particular business problem (or realise a particular business opportunity)
STATEMENT OF WORK	A document which defines the procurement requirements of the project in sufficient detail to enable potential suppliers to determine if they are able to meet those requirements
SUPPLIER CONTRACT	An agreement between the Project Team and an external supplier for the acquisition of a defined set of products to meet the procurement requirements of the project
TENDER DOCUMENT	A formal document included during the tender process which outlines the information required to provide the Project Team with the confidence that a supplier can meet

TERM	DESCRIPTION
	the procurement needs of the project. The RFI and RFP are both examples of Tender Documents
TENDER MANAGEMENT	The process by which interested suppliers are identified, evaluated and selected for the supply of products (goods or services) to the project. This process entails formalising the procurement requirements and tender documentation, receiving tender responses and selecting a preferred supplier
TERMS OF REFERENCE	A document which outlines the purpose of the project, the manner in which the project will be structured and how it will be successfully implemented
THE LABOUR, EQUIPMENT AND MATERIALS USED TO UNDERTAKE A PROJECT	The process of identifying the resources required completing the project. This includes a list of the types of resources required and a schedule providing the use of, and activities undertaken by each resource
TIME MANAGEMENT	The process within which time spent by staff undertaking project tasks is recorded against the project

Module 6

Project Management Tools and Resources

Project Management Checklist

A: SET UP - INITIATION	Y	N	COMMENTS
1 Developed the business case?			
2 Is a full options appraisal necessary?			
3 Is the project in line with the strategic plan?			
4 Has the project received sign off by sponsor or project board?			
B: SET UP - DEFINITION			
1 Has a PID or project definition form been completed?			
2 Are roles explicit and documented?			
3 Are levels of authority clear?			
4 Have you carried out a stakeholder analysis and planned accordingly?			
5 Have you assessed risks and put a plan into action to monitor them?			
6 Are you clear what is driving the project Quality, Cost or Time (1 only)			
7 Have clear project review procedures been established?			
8 Has planning started for a start up workshop (or series of workshops)?			
9 Team selection - have you got the correct mix of skills and professional experience?			

	Y	N	COMMENTS
5 Have you identified the critical path for the project?			
6 Have you developed a communications plan and included its component parts into the Gantt charts?			
7 Are you continuing to carry out risk analysis throughout the project?			
8 Are quality standards high? How do you know?			
D: DELIVERY			
1 Have you identified the appropriate type of control – loose versus tight?			
2 Project reporting – are you clear who reports what and to whom and how?			
3 Do you have a clear procedure for managing change?			
4 Have you developed a planned versus actual schedule? How up to date is it?			
5 Tolerance – have you an agreed tolerance figure?			
6 Variations – are these quickly flagged?			

C: DELIVERY PLANNING 1 Have you broken the project down into its component parts – work breakdown? 2 How accurate are your estimates? If a low percentage; then recalculate. 3 Have you developed a milestone chart or produced a Gantt chart? 4 Have you developed an overall project budget? Have you sought advice from financial experts				**E: CLOSEDOWN AND REVIEW** 1 Post project review has been planned? 2 Learning identified? 3 Is the project still delivering the benefits intended? 4 Is there a case for abandoning the project – off schedule or delivered a significant part of it? 5 End of project review reports are produced and circulated?			

Project Scope Forms

Project Definition Sheet

Project Definition Form [or PID]			
Project Title:		**Sponsor:**	
State below the link with the corporate agenda – the actual wording please.			
Project Background:			
Project Benefits:			
Project Objectives:			
Project Deliverables:			
This project will include:		**This project will not include:**	

Success Criteria:	
Constraints:	
Key Assumptions:	
Project Manager:	
Project Sponsor:	

Project Board/Steering Group Members:		**Project Team Members:**	

Budget			
Total costs (attach a breakdown of the overall budget)			
Start Date:		**Completion Date:**	
Signature of Project Manager:		**Date:**	
Approval from Sponsor:		**Date:**	

Stakeholders' Analysis

Stakeholder Analysis

The purpose of stakeholder analysis is to inform the project manager and sponsor who should contribute to the project, where barriers might be and the actions that need to be taken prior to detailed project planning.

Stakeholder	Their interest or requirement from the project	What the project needs from them	Perceived attitudes and/or risks	Actions to take

Project Responsibilities

Defining Project Responsibilities

	PERSONNEL							
TASKS/ACTIVITIES	Names							

Risk Analysis

Risk Analysis Sheet

Risk Analysis

Score as follows, for Likelihood and Impact: High = 3, Medium = 2, Low = 1

Nature of Risk or Uncertainty	Likelihood High/ Medium/ Low	Impact High/ Medium/ Low	Likelihood x Impact [Score]	Actions required and who will take responsibility to manage the risk

Risk Analysis Score sheet

Organizational Factor	Value	Score	Problem	Counter Measure
Number of user areas and decision makers?	Equal to number of user areas/decision makers		Not obtaining consensus	Identify key representative. Establish decision making process/responsibilities.
Multiple geographical locations?	Equal to number of geographical arrears divided by the number of implementation sites		Time to distribute deliverables and co-ordinate activities	Select a pilot implementation site then a phased implementation. Establish focal point for development activities.
Previous user IS project experience?	Y = 0, N = 1		Unrealistic expectations. Lack of knowledge of roles and commitment.	Schedule briefing and training sessions early in project. Increase user involvement/participation.
Size of departments impacted?	<200=0, 200-500=1, 500-2000=3, >200=5		(This is the number of people whose function will be changed as a consequence of the new system) Complexity of requirements and possibility of conflicts.	Training requirements and implementation logistics. Consider phased implementation if self-contained increments can be identified. Plan implementation as early as possible.
Inappropriate level of sponsorship?	Y=10, N=0		When a problem arises, the sponsor may not have the authority, or perspective, to support the project adequately.	Extend project board to include a more appropriate sponsor.
Key users unavailable?	Y=5, N=0		Lack of understanding of	Use techniques which are less dependant on user input, e.g. relational data

			requirements. Lack of involvement of users in production of deliverables with a consequential lack of commitment to project.	analysis rather than data modelling. Use user representative on Project Board to "encourage" user participation.
Organisational changes required (in terms of structure/responsibility)?	Y=2, N=0		Resistance to system by organisation.	Hold briefing throughout project on what the repercussions will be. Increase user involvement. Obtain top management commitment.
Level of changes required to user procedures?	High=3, Moderate=2, Low=1		Users inadequately prepared for a successful implementation and handover.	Increase level of user training, use of prototypes and presentations of the new procedures, both systems and users.
Are users dually involved in the management and execution of the project?	Y=0, N=3		Lack of commitment to assuring quality of technical deliverables and to plan.	Increase user participation I the technical activities by use of JAD, and the interactive sessions, to gather information and create models. Determine user roles in the project organisation (Project Board, Project Coordinators).
Will extensive education be required to facilitate use of the system?	Y=2, N=0		Inadequate budget and time frame for training.	Include prior walkthrough of the training sessions and materials to gain commitment from user management.
Organisational Total		0	Low risk	

Risk Analysis Score sheet

External Dependency Factor	Value	Score	Problem	Counter Measure
Multiple vendors/contractors?	Y=2, N=0		Coordination	Ensure adherence to standards, both technical and managerial. Emphasise the importance of regular status reporting.
Poor vendor support?	Y=1, N=0		Time wasted waiting for response to queries or due to rework arising from mistaken assumptions made by the project team in the interim.	Impose contractual constraints/safeguards. Request documentation in advance. Ensure effective account manager. Identify a user group with other clients.
Critical dependence on external suppliers?	Y=2, N=0		May miss milestones waiting for deliverables.	Ensure suppliers are aware of schedule commitment. Request interim status reports and review of partially complete deliverables so that the project tea, can verify the supplier's estimates of the effort to go. Impose contractual obligations.
Number of inter-project dependencies?	<3=0, 3-5=3, >5=5		Time wasted awaiting completion of other projects not within the stage manager's control.	Have a co-ordination project with the critical path specified in terms of projects. Recommend a strategic/architectural plan is produced.
Overlapping scope with other projects?	Y=3, N=0		Parallel, or duplicate, development of similar areas with different approaches causing confusion and irritation to the user.	Establish cross-project standards to ensure consistency. Establish change control procedures to manage the different changes proposed by different systems. Recommend a strategic/architectural plan is produced.

Contradicts LRSP directions?	Y=10, N=0		Projects initiated for no justifiable reason, e.g. political.	Ensure Project Board and Strategy Committee are aware of the situation.
Plan requires extensive recruitment of resources?	Y=2, N=0		Time and expense	Investigate training current resources. Plan gradual take on to allow for familiarisation and training. Investigate viability of using short term experienced contractors.
External Dependency		0	Low Risk	

Risk Analysis Score sheet

Planning Factor	Value	Score	Problem	Counter Measure
Dependant on scarce resources/skills?	Y=5, N=0		Competition for resources or personnel with appropriate skills.	Make resource requirements known as early as possible.
Complex task dependencies?	Y=3, N=0		Critical dependencies unknown, increase chance of slippage.	Increase level of planning. Tighten project control.
Critical implementation date?	Y=5, N=0		May have to cut back on quality and/or functionality, or project discarded if date missed.	Verify significance of date. Ascertain which portions of system are required for that date. Consider incremental development. Plan and control at detailed level.
Informal control procedures?	Y=5, N=0		Inaccurate Project Status Information.	Encourage take on of formal controls by training and provision of project management software.
Effort versus elapsed time?	Effort time/Elapsed time		The greater this ratio, the greater the number of simultaneous tasks. Increased staff associated wit development and associated	Increase control procedures and introduce additional level of management. Divide into achievable sub-systems.
Number of Major subsystems?	<3=1, >=3=3		Managing Interfaces.	Have a co-ordination project. Establish overall architectural plan. Minimise project interdependencies.
Subsystem more than 3 elapsed?	Y=2, N=0			Increase the number or control points.
Subsystem more than 12 elapsed months?	Y=2, N=0		Increased chance of slippage due to possible changes in requirements or scope over longer elapsed time.	Increased the number or control points.
Level of confidence?	>85% =1, <85% =3		Level of planning experience of unknowns	Ensure management tolerances and

			within the plan may make estimates low.	contingencies are identified.
Key dates set by project team from the plan?	Y=0, N=3		No commitment to plan, unachievable date.	Verify significance and justification for dates. Produce a plan.
Experience of project manager?	High=0, Moderate=1, Low=3, None allocated=4		Plans may not exist. Control procedures may not be adequate.	Provide training and support from experienced project manager. Increase involvement by Project Manager.
Planned resources available?	Y=0, N=5		New plan will be required to fit with maximum resource constraint or project could be cancelled/postponed.	
Planning Factor Total		0	Low risk	

Risk Analysis Score sheet

Business Case Factor	Value	Score	Problem	Counter Measure
Major increase in costs possible?	Y=3, N=0		If greater than ±5%, then likely to miss stage end targets.	Set appropriate tolerance levels. Investigate mechanisms for further controlling costs.
Evolving business requirements?	Y=5, N=0		Do not know where project should be heading, difficulty in justification, significant rework likely.	Use iterative development approach. Establish detailed scoping study. Increase user involvement.
Incomplete definition of scope/requirements?	Y=5, N=0		Cannot estimate effort as a lot of rework is likely.	Involve more senior user representatives. Establish detailed scoping study. Increase time spent in analysis.
Ill-defined benefits?	Y=2, N=0		Difficult to select optional solution, potential for project being cancelled.	Use CRA to help define tangible benefits. Establish focused sessions with user to evaluate benefits.
Lead time for return on investment?	Twice development time = 2, Five times or more the development time = 5.		May never achieve pay-back.	Reduce scope of system to include most profitable segments.
Mission critical system?	Y=5, N=0		Business may fail if project fails.	Increase planning and level of control.
Fundamental to IS strategy?	Y=5, N=0		Foundation system impacting other developments.	Increase planning and level of control.
Business commitment to development?	High=1, Low=3		System perceived as belonging to I.S. department.	Hold assessments requiring user sign-off. Increase user involvement. Produce detailed Business Case.

Business Case Total		0	Low Risk	

Risk Analysis Score sheet

Technical (Environment) Factor	Value	Score	Problem	Counter Measure
Inappropriate development tools?	Y=2, N=0		Required tools unavailable.	Review and associated justification. Evaluate other productivity areas.
New/unfamiliar technology?	J=5, N=0		Time required for learning curve during development.	Conduct training. Recruit experienced staff. Obtain vendor.
Stable development team?	Y=0, N=5		Lost information. Time required for handover.	Document in standard format as project progresses. Increase attendance at reviews to spread.
Low team knowledge of business area?	Y=1, N=0		Increased reliance on users.	Increased user participation. Increase frequency and formality of training.
Project team skills?	Expert=0, Balanced=1, Trainee=5		If the balance of expertise is low, then there is an increased risk of defects.	Increase the frequency of Quality Assurance Reviews and Project Checkpoints. Include experienced staff as specialized technical support. Account for experience level when planning.
Use of development method/standards?	Y=0,N=2		Project team does not know what to do. Tasks may be duplicated or omitted.	Implement a standard approach to development, ensure staff familiarity.
Technical (Project) Factor				
Complexity of functions?	Low=0, Moderate=2, High=5		Increased risk of defects.	Increase effort in Logical Design to validate. Increase level of reviews. Use formal techniques.

Complexity of database?	Low=0, Moderate=2, High=5		Performance problems.	Increase data validation steps throughout. Ensure thorough Physical Design Tuning. Increase DBA involvement.
Database to be shared b a number of applications?	Y=3, N=0		Difficult to tune successfully in Physical Design.	Attempt to establish overall volumes and requirements. Keep design flexible.
Number of physical system interfaces?	<3=0, >=3=3		Increase risks of systems failure.	Increase time in defining interfaces in detail. Involve experts from associated systems.
Clearly specified requirements?	Y=0, N=3		Rework may be necessary as system may not meet users' needs.	Increase user involvement.
Number of design decisions at discretion of systems architect.	0-25% = 0, 25-6% = 3, 60%+ = 5		Rework may be necessary as system may not meet user's needs.	Increase user involvement.
Is a package solution available?	Y=0, N=3		Effort required in design, construction and testing.	Ensure buy/build option is appropriately conducted.

Risk Analysis Score sheet

If using a package, was the package evaluated and selected, based upon detailed specifications?	Y=0, N=3		Mismatch likely.	Carry out evaluation if cost justified.
If using a package, were package changes required?	0-5% = 0, 5-15% = 3, over 15% = 5		Required information may be difficult to obtain, or not supported.	Contract vendor to do changes. Evaluate alternative solutions. Minimize changes to front/back ends.
Complex on-line networks?	Y=2, N=0		Increased risk of technical problems (incompatibility, etc.)	Add activities to prototype the on-line architecture. Involve technical experts in physical design stage.
Multi-level hardware requirement?	Y=2, N=0		Interfaces, data distribution.	Separate technical feasibility project started early. Ensure availability of required skills.
Technical (Operational) Factor				
Upward compatible hardware?	Y=0, N=3		Hardware constraints will increase problems in physical design and implementation.	Increase time scheduled for physical design and construction stages. Involve technical

				experts in physical design stage.
24 hour availability?	Y=3, N=0		Tight timing constraints will increase problems in physical design and construction.	Increase time scheduled for physical design and construction stages. Involve technical experts in physical design stage.
Rapid response time (below 2 seconds)?	Y=3, N=0		Tight timing constraints will increase problems in physical design and construction.	Increase time scheduled for physical design and construction stages. Involve technical experts in physical design stage.
Small batch window?	Y=3, N=0		Tight timing constraints will increase problems in physical design and construction.	Increase time scheduled for physical design and construction stages. Involve technical experts in physical design stage.
High-volume throughput?	Y=3, N=0		Tighter performance constraints will increase problems in physical design and construction.	Increase time scheduled for physical design and construction stages. Involve technical experts in physical design stage.
Very large database?	Y=3, N=0		Performance and storage constraints will increase	Increase time scheduled for

			problems in physical design and construction.	designing the database and for storage and performance predictions. Involve technical experts in physical design stage.
Short recovery cycle?	Y=3, N=0		Tighter recovery constraints will increase problems in physical design and construction.	Increase time scheduled for physical design and construction stages. Involve technical experts in physical design stage.
Technical Total			Low Risk.	

Risk Analysis Score sheet

External Dependency Factor		Score	Risk
External Dependency Total		0	
Organisational Total		0	
Planning Total		0	
Business Case Total		0	
Technical Total		0	
Overall Project Total		0	Low Risk

Reporting

Milestone Chart

Milestone Chart

Main milestones/phases shown on higher chart and sub-milestones for each phase on charts below

	TIME [in suitable units -days, weeks, months, etc.]													
MILESTONES	**Responsibility**													

Milestone Report

Project:

Date of Milestone meeting/discussion:

Deliverables due	Due date	R/A/G*	Action to take to bring deliverable or task back on schedule

* **R** = Red flags [off plan - describe in detail: quality, cost, time]

A = Amber [is almost off schedule or will definitely be off schedule NOTE: you may need to agree the precise definition before use]

G = Green flags [to plan or better - show savings]

Project Reporting Form

Project Title:	Number:
Project Sponsor:	Project Manager:

Progress Report	Report No.

RAG Status*: **RED / AMBER / GREEN**

Headlines

Tasks, Milestones, Outcomes delivered this period		Completion dates	
Tasks, Milestones, Outcomes	Comments	Plan	Actual

Major Risks and Issues Include an assessment of the impact and any actions taken

Recommendations and Requests for Decisions or Support

Tasks, Milestones, Outcomes scheduled for next period		Completion dates	
Tasks, Milestones, Outcomes	Comments	Plan	Forecast

* RED	"*Major concern - escalate to the next level*" Slippage greater than 10% of remaining time or budget, or quality severely compromised. Corrective Action not in place, or not effective. Unlikely to deliver on time to budget or quality requirements
AMBER	"*Minor concern – being actively managed"* Slippage less than 10% of remaining time or budget, or quality impact is minor. Remedial plan in place.
GREEN	"*Normal level of attention*" No material slippage. No additional attention needed

Controls

Change Request Sheet

Project Title	**Project Number**
Project Manager	

CHANGE REQUEST		
Originator Phone:	Date of request	Change request no. *allocated by Change Controller*
Items to be changed		Reference(s)
Description of change (reasons for change, benefits, date required) Estimated cost, and time to implement (quotation attached? Yes No)		
Priority / Constraints (impact on other deliverables, implications of not proceeding, risks)		

CHANGE EVALUATION		
What is affected	Work required (resources, costs, dates)	
Related change requests		
Name of evaluator	Date evaluated	Signature

CHANGE APPROVAL			
Accepted Rejected Deferred	Name	Signed	Date
Comments			

CHANGE IMPLEMENTATION			
Asset	Implementer	Date completed	Signature

Change Control Log

Project Title	**Project Number**
Project Manager	

Change number	Description of change	Date received	Date evaluated	Date approved	Date completed

Bibliography / Reading List

References and Resources

Books

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4. P Oosthuizen, M Koster, P de la Rey. Goodbye Project Management, Thomson Publishing 1998.

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