UNIVERSITY OF CROSS RIVER STATE

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

COURSE TITLE: SOFTWARE PROJECT MANAGEMENT

Project management has been practiced since early civilization. Until the beginning of twentieth century civil engineering projects were actually treated as projects and were generally managed by creative architects and engineers. Project management as a discipline was not accepted. It was in the 1950s that organizations started to systematically apply project management tools and techniques to complex projects. As a discipline, Project Management developed from several fields of application including construction, engineering, and defense activity. Two forefathers of project management are commonly known: Henry Gantt, called the father of planning and control techniques who is famous for his use of the Gantt chart as a project management tool; and Henri Fayol for his creation of the five management functions which form the foundation of the body of knowledge associated with project and program management. The 1950s marked the beginning of the modern Project Management era. Project management became recognized as a distinct discipline arising from the management discipline.

WHAT IS A PROJECT?

All of us have been involved in projects, whether they be our personal projects or in business and industry. Examples of typical projects are for example:

Personal projects:

- obtaining an MCA degree
- writing a report
- planning a party
- planting a garden

Industrial projects:

- Construction of a building
- provide electricity to an industrial estate
- building a bridge
- designing a new airplane

Projects can be of any size and duration. They can be simple, like planning a party, or complex like launching a space shuttle.

Project Definition:

A project can be defined in many ways :

A **project** is “a temporary endeavor undertaken to create a unique product, service, or result.” Operations, on the other hand, is work done in organizations to sustain the business. Projects are different from operations in that they end when their objectives have been reached or the project has been terminated.

A project is *temporary*. A project’s duration might be just one week or it might go on for years, but every project has an end date. You might not know that end date when the project begins, but it’s there somewhere in the future. Projects are not the same as ongoing operations, although the two have a great deal in common.

A project is an *endeavor*. Resources, such as people and equipment, need to do work. The endeavor is undertaken by a team or an organization, and therefore projects have a sense of

being intentional, planned events. Successful projects do not happen spontaneously; some amount of preparation and planning happens first.

Finally, every project creates a *unique product* or *service*. This is the **deliverable** for the project and the reason, why that project was undertaken.

PROJECT ATTRIBUTES

Projects come in all shapes and sizes. The following attributes help us to define a project further:

-A project has a unique purpose. Every project should have a well-defined objective. For example, many people hire firms to design and build a new house, but each house, like each person, is unique.

- *A project is temporary.* A project has a definite beginning and a definite end. For a home construction project, owners usually have a date in mind when they'd like to move into their new homes.
- *A project is developed using progressive elaboration or in an iterative fashion.*

  Projects are often defined broadly when they begin, and as time passes, the specific details of the project become clearer. For example, there are many decisions that must be made in planning and building a new house. It works best to draft preliminary plans for owners to approve before more detailed plans are developed.
- *A project requires resources, often from various areas.* Resources include people, hardware, software, or other assets. Many different types of people, skill sets, and resources are needed to build a home.
- *A project should have a primary customer or sponsor.* Most projects have many interested parties or stakeholders, but someone must take the primary role of sponsorship. The **project sponsor** usually provides the direction and funding for the project.
- *A project involves uncertainty.* Because every project is unique, it is sometimes difficult to define the project's objectives clearly, estimate exactly how long it will take to complete, or determine how much it will cost. External factors also cause uncertainty, such as a supplier going out of business or a project team member needing unplanned time off. This uncertainty is one of the main reasons project management is so challenging.

PROJECT CONSTRAINTS

Like any human undertaking, projects need to be performed and delivered under certain constraints. Traditionally, these constraints have been listed as scope, time, and cost. These are also referred to as the Project Management Triangle, where each side represents a constraint. One side of the triangle cannot be changed without impacting the others. A further refinement of the constraints separates product 'quality' or 'performance' from scope, and turns quality into a fourth constraint.

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 scope constraint refers to what must be done to produce the project's end result. These three constraints are often competing constraints: increased scope typically means increased time and increased cost, a tight time constraint could mean increased costs and reduced scope, and a tight budget could mean increased time and reduced scope.

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

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

Time:

For analytical purposes, the time required to produce a product or service 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 prioritized, 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 constraint), as can the availability of resources (resource constraint). Time is not considered a cost nor 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 : labor 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 consultant's or firm's per diem rate multiplied by an estimated quantity for completion.

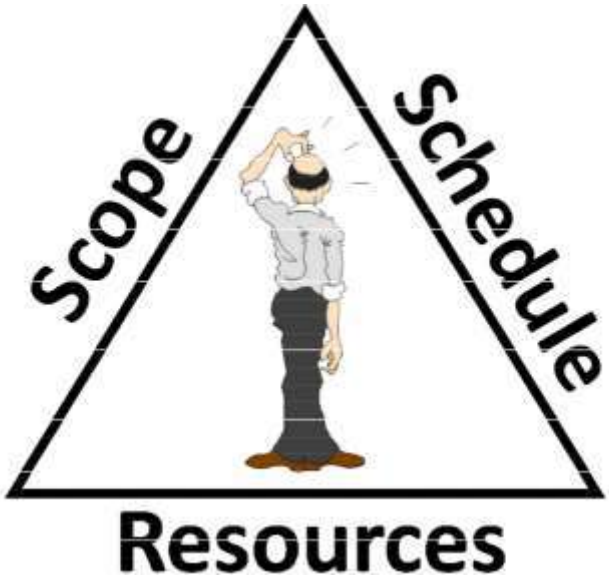


Figure 1.1 : The Project management Triangle

Scope:

Scope is requirement specified for the end result. The overall definition of what the project is supposed to accomplish, and a specific description of what the end result should be or accomplish can be said to be the scope of the project. 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 viz. Scope, Schedule & Resources have given rise to the phrase "On Time, On Spec, On Budget". In this case, the term "scope" is substituted with "spec(ification)"

WHAT IS PROJECT MANAGEMENT

Project management is “the application of knowledge, skills, tools and techniques to project activities to meet the project requirements.” The effectiveness of project management is critical in assuring the success of any substantial activity. Areas of responsibility for the person handling the project include planning, control and implementation. A project should be initiated with a feasibility study, where a clear definition of the goals and ultimate benefits need to be determined. Senior managers' support for projects is important so as to ensure authority and direction throughout the project's progress and, also to ensure that the goals of the organization are effectively achieved in this process.

Knowledge, skills, goals and personalities are the factors that need to be considered within project management. The project manager and his/her team should collectively possess the necessary and requisite interpersonal and technical skills to facilitate control over the various activities within the project.

The stages of implementation must be articulated at the project planning phase. Disaggregating the stages at its early point assists in the successful development of the project by providing a number of milestones that need to be accomplished for completion. In addition to planning, the control of the evolving project is also a prerequisite for its success. Control requires adequate monitoring and feedback mechanisms by which senior management and project managers can compare progress against initial projections at each stage of the project. Monitoring and feedback also enables the project manager to anticipate problems and therefore take pre-emptive and corrective measures for the benefit of the project.

Projects normally involve the introduction of a new system of some kind and, in almost all cases, new methods and ways of doing things. This impacts the work of others: the "users". User interaction is an important factor in the success of projects and, indeed, the degree of user involvement can influence the extent of support for the project or its implementation plan. A project manager is the one who is responsible for establishing a communication in between the project team and the user. Thus one of the most essential quality of the project manager is that of being a good communicator, not just within the project team itself, but with the rest of the organization and outside world as well.

Features of projects:

Projects are often carried out by a team of people who have been assembled for that specific purpose. The activities of this team may be co-ordinated by a project manager.

Project teams may consist of people from different backgrounds and different parts of the organisation. In some cases project teams may consist of people from different organisations.

Project teams may be inter-disciplinary groups and are likely to lie outside the normal organisation hierarchies.

The project team will be responsible for delivery of the project end product to some sponsor within or outside the organisation. The full benefit of any project will not become available until the project as been completed.

Project Classification:

In recent years more and more activities have been tackled on a project basis. Project teams and a project management approach have become common in most organisations. The basic approaches to project management remain the same regardless of the type of project being considered. You may find it useful to consider projects in relation to a number of major classifications:

a) **Engineering and construction**

The projects are concerned with producing a clear physical output, such as roads, bridges or buildings. The requirements of a project team are well defined in terms of skills and background, as are the main procedures that have to be undergone. Most of the problems which may confront the project team are likely to have occurred before and therefore their solution may be based upon past experiences.

b) **Introduction of new systems**

These projects would include computerisation projects and the introduction of new systems and procedures including financial systems. The nature and constitution of a project team may vary with the subject of the project, as different skills may be required and different end-users may be involved. Major projects involving a systems analysis approach may incorporate clearly defined procedures within an organisation.

c) **Responding to deadlines and change**

An example of responding to a deadline is the preparation of an annual report by a specified date. An increasing number of projects are concerned with designing organisational or environmental changes, involving developing new products and services.

Project Management Tools and techniques:

Project planning is at the heart of project management. One can't manage and control project activities if there is no plan. Without a plan, it is impossible to know if the correct activities are underway, if the available resources are adequate or of the project can be completed within the desired time. The plan becomes the roadmap that the project team members use to guide them through the project activities. Project management tools and techniques assist project managers and their teams in carrying out work in all nine knowledge areas. For example, some popular time-management tools and techniques include Gantt charts, project network diagrams, and critical path analysis. Table 1.1 lists some commonly used tools and techniques by knowledge area.

Knowledge Area	Tools & Techniques
Integration management	Project selection methods, project Management methodologies, stakeholder analyses, project charters, project management plans, project management software, change requests, change control boards, project review meetings, lessons-learned Reports
Scope management	Scope statements, work breakdown structures, mind maps, statements of work, Requirements analyses, scope management plans, scope verification techniques, and scope change controls
Cost Management	Net present value, return on investment, Payback analyses, earned value management, project portfolio management, cost estimates, cost management plans, cost Baselines
Time management	Gantt charts, project network diagrams, critical-path analyses, crashing, fast tracking, schedule performance measurements
Human resource management	Motivation techniques, empathic listening, responsibility assignment matrices, project organizational charts, resource histograms, team building exercises

Quality management	Quality metrics, checklists, quality control charts, Pareto diagrams, fishbone diagrams, maturity models, statistical methods

Risk management	Risk management plans, risk registers, probability/impact matrices, risk rankings
Communication management	Communications management plans, Kickoff meetings, conflict management, communications media selection, status and progress reports, virtual communications, templates, project Web sites
Procurement management	Make-or-buy analyses, contracts, requests for proposals or quotes, source selections, supplier evaluation matrices

Table 1.1 : Project Management Tools and Techniques

Project Success Factors:

The successful design, development, and implementation of information technology (IT) projects is a very difficult and complex process. However, although developing IT projects can be difficult, the reality is that a relatively small number of factors control the success or failure of every IT project, regardless of its size or complexity. The problem is not that the factors are unknown; it is that they seldom form an integral part of the IT development process.

Some of the factors that influence projects and may help them succeed are

- Executive Support
- User involvement
- Experienced project managers
- Limited scope
- Clear basic requirements
- Formal methodology
- Reliable estimates

THE ROLE OF PROJECT MANAGER

The project manager is the driving force in the management control loop. 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 representatives, is essential in ensuring that the key issues of cost, time, quality, and above all, client satisfaction, can be realized.

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

When they are appointed, project managers should be given terms of reference that define their:

Objectives;

Responsibilities;

Limits of authority.

Responsibilities of a Project Manager:

The objective of every project manager is to deliver the product on time, within budget and with the required quality. Although the precise responsibilities of a project manager will vary from company to company and from project to project, they should always include planning and forecasting. Three additional areas of management responsibility are:

·interpersonal responsibilities, which include:

- leading the project team;
- liaising with initiators, senior management and suppliers;
- being the **'**figurehead**'**, i.e. setting the example to the project team and representing the project on formal occasions.

informational responsibilities, which include:

- monitoring the performance of staff and the implementation of the project plan;
- disseminating information about tasks to the project team;
- disseminating information about project status to initiators and senior management;
- acting as the spokesman for the project team.

decisional responsibilities, which include:

- allocating resources according to the project plan, and adjusting those allocations when circumstances dictate (i.e. the project manager has responsibility for the budget);
- negotiating with the initiator about the optimum interpretation of contractual obligations, with the company management for resources, and with project staff about their tasks;
- handling disturbances to the smooth progress of the project such as equipment failures and personnel problems.

PROJECT LIFE CYCLE

The Project Life Cycle refers to a logical sequence of activities to accomplish the project's goals or objectives. Regardless of scope or complexity, any project goes through a series of stages during its life. There is first an Initiation or Starting phase, in which the outputs and critical success factors are defined, followed by a Planning phase, characterized by breaking down the project into smaller parts/tasks, an Execution phase, in which the project plan is executed, and lastly a Closure or Exit phase, that marks the completion of the project. Project activities must be grouped into phases because by doing so, the project manager and the core team can efficiently plan and organize resources for each activity, and also objectively measure achievement of goals and justify their decisions to move ahead, correct, or terminate. It is of great importance to organize project phases into industry-specific project cycles. Why? Not only because each industry sector involves specific requirements, tasks, and procedures when it comes to projects, but also because different industry sectors have different needs for life cycle management methodology. And paying close attention to such details is the difference between doing things well and excelling as project managers.

Diverse project management tools and methodologies prevail in the different project cycle phases. Let's take a closer look at what's important in each one of these stages:

Project Initiation:

The initiation stage determines the nature and scope of the development. If this stage is not performed well, it is unlikely that the project will be successful in meeting the business's needs. The key project controls needed here are an understanding of the business environment and making sure that all necessary controls are incorporated into the project. Any deficiencies should be reported and a recommendation should be made to fix them.

The initiation stage should include a plan that encompasses the following areas:

Analyzing the business needs/requirements in measurable goals.

Reviewing of the current operations.

Conceptual design of the operation of the final product.

Equipment and contracting requirements including an assessment of long lead time items.

Financial analysis of the costs and benefits including a budget.

Stakeholder analysis, including users, and support personnel for the project.

Project charter including costs, tasks, deliverables, and schedule.

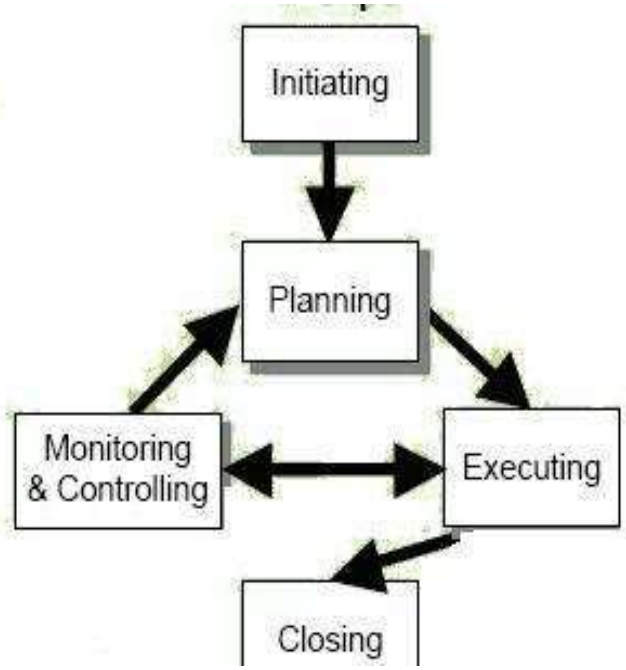


Figure 1.5 : Project Life Cycle

Planning & Design:

After the initiation stage, the system is designed. Occasionally, a small prototype of the final product is built and tested. Testing is generally performed by a combination of testers and end users, and can occur after the prototype is built or concurrently. Controls should be in place that ensures that the final product will meet the specifications of the project charter. The results of the design stage should include a product design that:

- Satisfies the project sponsor (the person who is providing the project budget), end user, and business requirements.

- Functions as it was intended.

- Can be produced within acceptable quality standards.

- Can be produced within time and budget constraints.

Execution & Controlling:

Monitoring and Controlling consists of those processes performed to observe project execution so that potential problems can be identified in a timely manner and corrective action can be taken, when necessary, to control the execution of the project. The key benefit is that project performance is observed and measured regularly to identify variances from the project management plan.

Monitoring and Controlling includes:

Measuring the ongoing project activities (*where we are*);

Monitoring the project variables (cost, effort, scope, etc.) against the project management plan and the project performance baseline (*where we should be*);

Identify corrective actions to address issues and risks properly (*How can we get on track again*);

Influencing the factors that could circumvent integrated change control so only approved changes are implemented

In multi-phase projects, the Monitoring and Controlling process also provides feedback between project phases, in order to implement corrective or preventive actions to bring the project into compliance with the project management plan.

Project Maintenance is an ongoing process, and it includes:

Continuing support of end users
Correction of errors
Updates of the software over time

In this stage, auditors should pay attention to how effectively and quickly user problems are resolved.

Over the course of any IT project, the work scope may change. Change is normal and expected part of the process. Changes can be the result of necessary design modifications, differing site conditions, material availability, client-requested changes, value engineering and impacts from third parties, to name a few. Beyond executing the change in the field, the change normally needs to be documented to show what was actually developed. This is referred to as Change Management. Hence, the owner usually requires a final record to show all changes or, more specifically, any change that modifies the tangible portions of the

finished work. The record is made on the contract documents – usually, but not necessarily limited to, the design drawings. The end product of this effort is what the industry terms as-built drawings, or more simply, “as built.”

When changes are introduced to the project, the viability of the project has to be re-assessed. It is important not to lose sight of the initial goals and targets of the projects. When the changes accumulate, the forecasted result may not justify the original proposed investment in the project.

Closure:

Closing includes the formal acceptance of the project and the ending thereof. Administrative activities include the archiving of the files and documenting lessons learned.

This phase consists of:

Project close: Finalize all activities across all of the process groups to formally close the project or a project phase.

Contract closure: Complete and settle each contract (including the resolution of any open items) and close each contract applicable to the project or project phase.

Sample Questions

1. Why is there a new or renewed interest in the field of project management?
2. What is a project, and what are its main attributes? How is a project different from what most people do in their day-to-day jobs? What is the triple constraint?
3. What is project management? Briefly describe the project management framework, providing examples of stakeholders, knowledge areas, tools and techniques, and project success factors.
4. Discuss the relationship between project, program, and portfolio Management and their contribution to enterprise success.
5. What are the roles of the project, program, and portfolio managers? What are suggested skills for project managers? What additional skills do program and portfolio managers need?

TECHNOLOGY CONTEXT

A SYSTEMS VIEW OF PROJECT MANAGEMENT

There are many aspects of project management that are important and worthy of comment. There are so many details that must be handled in order for a project to be successful. To be able to handle the day to day details while still keeping your eye of the strategic whole is a demanding task but one that can be learned and improved.

As the project is a temporary, one-time endeavor undertaken to solve a problem or take advantage of an opportunity, It usually has a customer or customers (either internal or external to the

organization that are doing the project), a budget or a set of scarce resources that must be managed and some kind of timeframe/constraint for completion or operation. Before one can undertake a project to solve a problem one must first understand the problem. Not only understand the details of the problem but also understand who has the problem and the context and environment that must be taken into consideration in addressing the problem.

A key practice in getting things clear is to look at the problem from the customers and users perspectives.

- What is important to the customer?

- How will the user actually be using the system.

- What does the world look like from their perspective?

- What do they value and what is the solution worth?

- Engineers tend to focus on features while customers are interested in benefits; how will this help them solve their problems.

One way to get this perspective is to spend time with the customers and users and enter into a dialog with them. If project managers run projects in isolation, these projects will never serve the needs of the organisation for which it is undertaken. Project managers thus should consider projects within the greater organizational context and take a holistic view of a project. Systems thinking describes this holistic view of carrying out projects.

A systems approach is an overall model for thinking about things as systems. Systems are sets of interacting components working within an environment to fulfill some purpose. System analysis is a problem-solving approach that requires defining the scope of the system, dividing it into its components, and then identifying and evaluating its problems, its opportunities constraints and needs. Once this is completed, the systems analyst then examines alternative solutions for improving the current situation, identifies an optimum, or at least satisfactory, solution or action plan, and examines that plan against the entire system. Systems management addresses the business, technological, and organizational issues associated with creating, maintaining, and making a change to a system.

Using a systems approach is critical to successful project management. Top management and project managers must follow

a systems philosophy to understand how projects relate to the whole organisation.

The Three Sphere model for Systems management:

The three-sphere model of systems management deals with the business, organizational and technological aspects and/or issues related to the project that should be defined and considered in order to select and manage projects effectively and successfully. In terms of addressing its advantage on the business side, a project should supplement or serve as an answer to the business goals; whereas, the technological sphere should state the proper hardware and software issues to be resolved. As for the organizational aspect, matters involving the stakeholders should be taken into full consideration. If the project manager would be able to point out as early as possible the aforementioned issues and integrate it to the project it would definitely aid in determining if an organization should invest and produce the project.

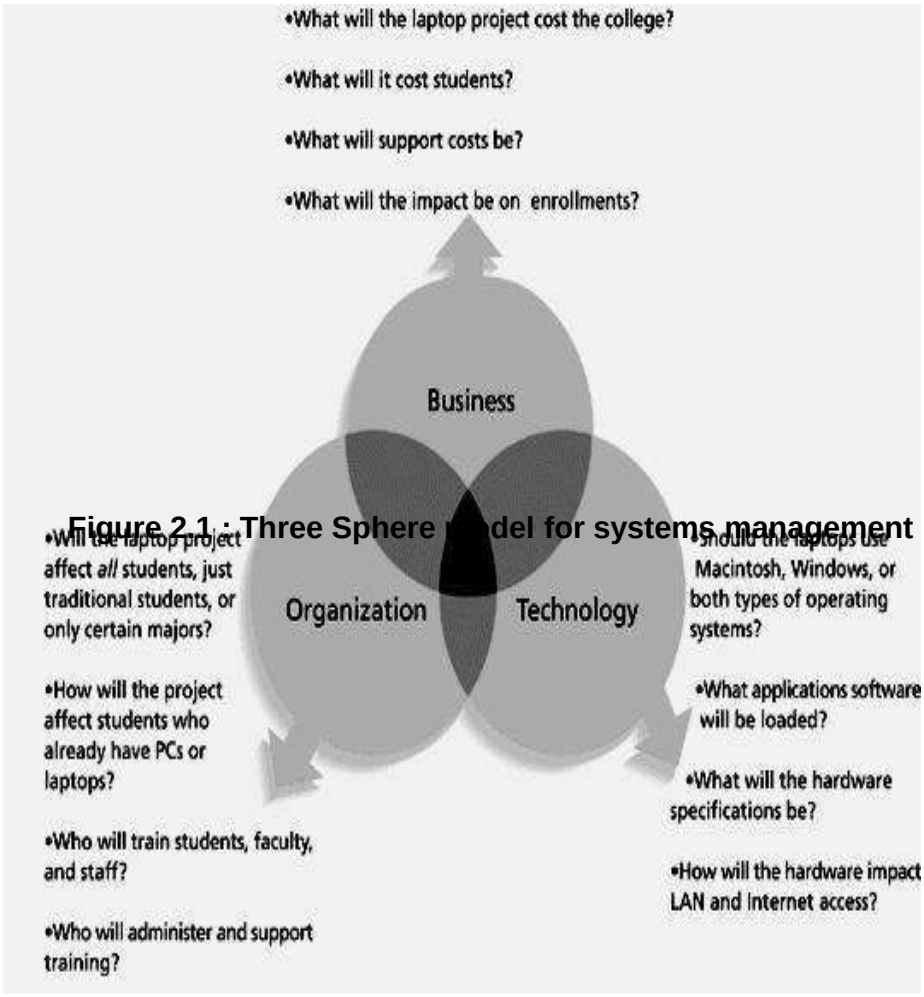


Figure 2.1 : Three Sphere model for systems management

A Case:

A programmer was given a task to convert a static website of a magazine into a dynamic PHP website; what prompts the management to engage into this project is the fact that the web has become more sophisticated and that there has been a major shift of "print" audience to the internet. You'll find below the business, organizational and technological issues of the said project.

Business issues:

1. Would the website be the medium in response to the impact of the internet in a publishing company?
2. Would the website supplement the magazine in terms of advertising?
3. What will the project cost the company?
4. What would be the impact of the website to the sales of the magazine?
5. What would be the cost of maintaining the whole system for the website?

Technological issues:

1. What operating system, server platform, scripting language and database should be used?
2. What will be the server and desktop specifications?
3. Does our current network setup allow employees to develop this project, or do we need an upgrade?
4. Do we have the right internet connection to support this project?

Organizational issues:

1. Do we have the existing manpower to develop the project?
2. What would be the impact of the website to the magazine's print division?
3. How will the website affect our print audience?

The most important issues are from the business and organization spheres, since these two primarily follows the business philosophy – it would definitely be pointless if a project fails to meet the endeavors either on the business or organizational

side – it's doomed to fail if that is the case. Among the three, I guess the technological issues are the easiest to resolve.

UNDERSTANDING ORGANISATIONS

Every project must have its own management structure define d at the start and dismantled at the end. The definition of the management roles, responsibilities, relationships and accountabilities and authorities provides the basis of the governance arrangements for the project. Note that it is unlikely that an existing line management structure will be sufficient or appropriate to use as a project management organisation, except perhaps where a small task is being run within a single business unit with no external impact.

A typical organisation structure is depicted in the figure below

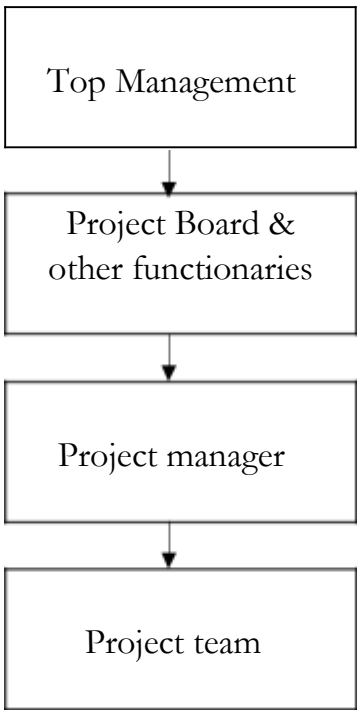


Figure 2.2 Organizational Structure

A well-designed organisation will involve the right people with the right skills and the right levels of authority so that, once approved, the project may proceed with minimal requirements to refer outside the project organisation other than to deal with

exception situations outside authority of the project's Senior Responsible Owner.

There is not a 'one-size fits all' model for the project organisation; you must design it to suit such things as a project's:

Criticality to the business
Size/complexity
Degree of impact within the parent body
Degree of impact on external bodies (OGDs, Private Sector)
Cost
Staff resources required
Types/levels of interested parties

Designing the structure and getting people to agree to take on roles takes time and may require many discussions/negotiations with management at appropriately senior levels.

The key roles:

Top management: (in certain circumstances/environments known as Project Sponsor(PS) or Programme Director).

The management is the project's owner and champion and is ultimately accountable for delivery of the project and so must:

provide leadership and direction to other members of the Project Board and to the Project Manager

ensure that all key stakeholders are committed to the project and adequately represented in the project's organisation structure

ensure that budget holders and resource owners are committed to the proj ect and that the necessary funds and other resources are made available when required

ensure that project governance arrangements of appropriate rigour are put in place

brief senior stakeholders on the current and forecast status of the project

receive, consider and act on regular frequent reports/briefings from the Project Manager

chair meetings of the Project Board

ensure that all members of the Project Board understand their roles the commitments they must make in order that the required outcomes/benefits from the project are achieved

ensure that the Project Manager is empowered to lead the project on a day to day basis

ensure that the Project Manager is aware of the limits of her/his authority and understands that issues outside those limits must be escalated to the PS at the earliest opportunity.

negotiate with senior stakeholders to broker solutions to project issues that are outside the level of authority of the Project Manager

As you can see, the PS is not just a figurehead, it is an active role as a key member of the project management team. If the project involves a number of organisations working together and/or has a cross cutting impact, it may require more than one person to be the decision-making authority. If this is the case, you may wish to set up a Project Board with the PS as Chair.

The Project Board:

The Project Board should include:

the Top Management representing the 'business' interests of the sponsoring organisation as a whole

senior representative(s) from areas that will be impacted by the outcome and must adopt changes ;

senior representative(s) from the organisation(s) that will design, build and implement the solution to meet the business need, (Senior Supplier role).

The Project Board must jointly:

create an environment where the project can succeed in delivering the changes necessary for the benefits to be realised

set the direction for the project and to approve key milestones

approve the Project Initiation Document

ensure the appropriate resources required by the projects within the project are made available in accordance with the latest agreed version of the Project Plan

take decisions as necessary throughout the life of the project

give the Project Manager the authority to lead the project on a day to day basis.

Members of the Project Board should decide how they will assure themselves that the integrity of those aspects of the project for which they are accountable is being maintained.

Project Manager:

The Project Manager will be responsible on behalf of the PS for day to day execution of the project plan and for dealing with issues that might affect achievement of the plan. The Project Manager must:

prepare the Project Initiation Document(PID)

submit the PID to the Project Board for approval

submit any revised versions of the Project Plan and Business Case to the Project Board for approval

monitor progress of the project and identify and take action to deal with any potential/actual exceptions that might jeopardise achievement of the project's objectives,

maintain a Risk Register/Log and actively manage risks using resources and approaches within limits of delegated authority

escalate to the Project Board recommendations for risk mitigations actions outside the scope of delegated authority limits

report progress to, and take advice from, the PS at regular intervals as agreed between PS and Project Manager during Project Initiation

manage stakeholder relationships and communications (in accordance with an agreed Communications Plan);

liaise with any nominated Project Assurance staff throughout the project.

STAKEHOLDER MANAGEMENT

The importance of stakeholder management is to support an organization in achieving its strategic objectives by interpreting and influencing both the external and internal environments and by creating positive relationships with stakeholders through the appropriate management of their expectations and agreed objectives. Stakeholder Management is a process and control that must be planned and guided by underlying Principles.

Stakeholder Management, within business or projects, prepares a strategy utilising information (or intelligence) gathered during the following common processes:

Stakeholder Identification - Interested parties either internal or external to organisation/project.

Stakeholder Analysis - Recognise and acknowledge stakeholder's needs, concerns, wants, authority, common relationships, interfaces and align this information within the Stakeholder Matrix.

Stakeholder Matrix - Positioning stakeholders according to the level of influence, impact or enhancement they may provide to the business or it's projects.

Stakeholder Engagement - Different to Stakeholder Management in that the engagement does not seek to develop the project/business requirements, solution or problem creation, or establishing roles and responsibilities. It is primarily focused at getting to know and understand each other, at the Executive level. Engagement is the opportunity to discuss and agree expectations of communication and, primarily, agree a set of Values and Principles that all stakeholders will abide by.

Communicating Information - Expectations are established and agreed for the manner in which communications are managed between stakeholders - who receives communications, when, how and to what level of detail. Protocols may be established including security and confidentiality classifications.)

Stakeholder Agreements: A collection of agreed decisions between stakeholders. This may be the lexicon of an organisation or project, or the Values of an initiative, the objectives, or the model of the organisation, etc. These should be signed by key stakeholder representatives.

Contemporary or modern business and project practice favours transparent, honest and open stakeholder management processes.

THE CONTEXT OF INFORMATION TECHNOLOGY PROJECTS

Software Projects:

Software development is a complex process involving such activities as domain analysis, requirements specification, communication with the customers and end-users, designing and producing different artifacts, adopting new paradigms and technologies, evaluating and testing software products, installing and maintaining the application at the end-user's site, providing customer support, organizing end-user's training, envisioning

potential upgrades and negotiating about them with the customers, and many more.

In order to keep everything under control, eliminate delays, always stay within the budget, and prevent project runaways, i.e. situations in which cost and time exceed what was planned, software project managers must exercise control and guidance over the development team throughout the project's lifecycle. In doing so, they apply a number of tools of both economic and managerial nature. The first category of tools includes budgeting, periodic budget monitoring, user chargeback mechanism, continuous cost/benefit analysis, and budget deviation analysis. The managerial toolbox includes both long-range and short-term planning, schedule monitoring, feasibility analysis, software quality assurance, organizing project steering committees, and the like.

All of these activities and tools help manage a number of important issues in the process of software development. Figure 1.1 illustrates some of the issues, but definitely not all of them.

Software Development Process:

One of the primary duties of the manager of a software development project is to ensure that all of the project activities follow a certain predefined *process*, i.e. that the activities are organized as a series of actions conducing to a desirable end . The activities are usually organized in distinct *phases*, and the process specifies what artifacts should be developed and delivered in each phase. For a software development team, conforming to a certain process means complying with an appropriate *order* of actions or operations. For the project manager, the process provides means for control and guidance of the individual team members and the team as a whole, as it offers criteria for tracing and evaluation of the project's deliverables and activities.

Figure 2.3: Certain important issues in Software Project Management

Software development process encompasses many different tasks, such as domain analysis and development planning, requirements specification, software design, implementation and testing, as well as software maintenance. Hence it is no surprise at all that a number of software development processes exist.

Generally, processes vary with the project's goals (such as time to market, minimum cost, higher quality and customer satisfaction), available resources (e.g., the company's size, the number, knowledge, and experience of people -- both engineers and support personnel -- and hardware resources), and application domain.

However, every software developer and manager should note that processes are *very* important. It is absolutely necessary to follow a certain predefined process in software development. It helps developers understand, evaluate, control, learn, communicate, improve, predict, and certify their work. Since processes vary with the project's size, goals, and resources, as well as the level at which they are applied (e.g., the organization level, the team level, or the individual level), it is always important to define, measure, analyze, assess, compare, document, and change different processes.

There are several well-known examples of software development processes. Each process relies on a certain *model* of software development. The first well established and well-documented software development process has followed the *waterfall model*. One of its variants is shown in Figure 1.2. The model assumes that the process of software development proceeds through several phases in a more-or-less linear manner. The phases indicated in Figure 1.2 are supposed to be relatively independent.

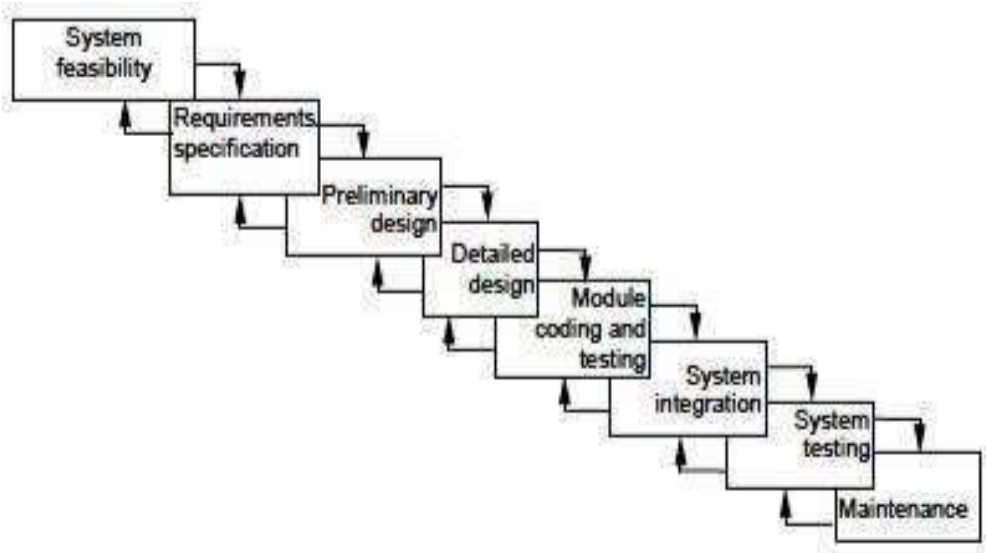


Figure 2.4 : Waterfall Model for Software Development

There is not much feedback and returning to previous phases other than the one directly preceding the phase in focus. In other words, once a certain phase is finished it is considered closed, and the work proceeds with the next phase. Many developers have criticized the waterfall model for its rigidity in that sense, and for its failure to comply with the reality of everchanging requirements and technology. However, the waterfall model is at least partially present in most of the other models as well, simply because of its natural order of phases in software development.

There have been many attempts to overcome the limitations of the waterfall model. Two common points in all such attempts are introduction of *iterations* in software development activities and *incremental* development. Iterative and incremental software development means going through the same activities more than once, throughout the product's lifecycle, each time producing new deliverables and/or improving the old ones. The main advantage of working in that way is that each individual developer works on a small ``work packet'' at any given moment, which is much easier to control.

A classical example of iterative and incremental models is the *spiral model* , sketched in Figure 1.3. In the spiral model, there are five core tasks: planning and design (largely corresponding to the classical analysis phase), approval (requirements specification), realization (design and implementation), revision (testing and modification), and evaluation (integration and system-level testing). The process iterates through these tasks, getting closer and closer to the end by adding increments (e.g., new functions, new design, new modules, new or improved testing procedures, new or improved

parts of the user interface, new integration and testing certificates, and so on) to the product in each iteration.

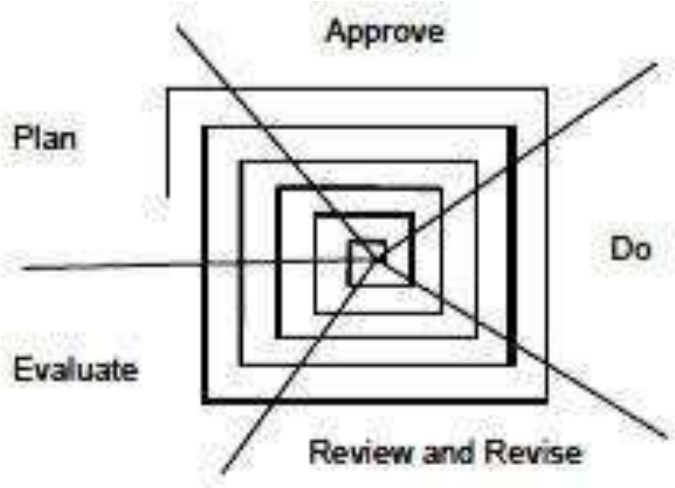


Figure 2.5 : Spiral Model for Software Development

The spiral model underlies many processes, such as DBWA (Design By Walking Around), and PADRE (Plan-Approve-Do-Review-Evaluate). The DBWA process combines the spiral model with multiple design views, flexible structuring of development teams, and dynamic changes in modes of working (e.g., working individually, working in pairs, or working in small teams), in order to improve the process efficiency and parallelism. The PADRE process uses the spiral model at multiple levels - the project level, the phase level, and the individual software module level - thus creating the ``spiral in a spiral in a spiral'' effect.

Requirements Engineering:

Requirements engineering is the discipline of gathering, analyzing, and formally specifying the user's needs, in order to use them as analysis components when developing a software system . Requirements *must* be oriented towards the user's real needs, not towards the development team and the project managers.

Almost all software development processes one way or another stress requirements analysis and specification as one of their core workflows. The reasons are simple. It is necessary to manage requirements as well as possible because a small change to requirements can profoundly affect the project's cost and schedule, since their definition underlies all design and implementation . Unfortunately, in most practical projects it is not possible to freeze the requirements at the beginning of the project and not to change them. Requirements develop over time, and their development is a learning process, rather than a gathering one. The

intended result of this process is a structured but evolving set of agreed, well understood, and carefully documented requirements . This implies the need for requirements *traceability*, i.e. the ability to describe and follow the life of a requirement, in both a forward and backward direction, ideally through the whole system's life cycle.

The importance of constantly involving the users in the process of requirements analysis and specifications cannot be overemphasized. Only the users know their domain properly, and for that reason they should certainly participate in defining the system's functions, designing them, and evaluating their implementation and testing. The users should also participate in creating, verifying, and updating the requirements specification

document for the project. The users should share with the developers the responsibility for the requirements' completeness and consistency. It is the project managers' duty to establish and maintain good relations with the users throughout the development process, as well as to consult them whenever the project gets stuck due to the development team's lack of domain understanding.

It is essential to make as explicit as possible all the requirements that reflect the user's work and the tasks that the software system under development is supposed to automate. Any situation in which users can find themselves when doing their job is the context that must be taken into account through requirements engineering. It is equally important not to concentrate on a single user's task, but to cover communication between users when the task requires collaboration.

There is a wide spectrum of techniques for requirements engineering. Whatever technique is applied, it is always desirable to involve the user to increase the correctness of the requirements specification. Some of the techniques are:

Structured interviews and questionnaires that the user fills in (inquiry based requirements gathering); diagram-based requirements analysis (using multiple diagrams to sketch relevant parts of the user's.

Work process and describe the requirements graphically).

Using metaphors of the user's work process (e.g., the office metaphor, or the agent/agency metaphor);

Scenario analysis (scenario is a typical sequence of activities characterizing the user's work process, hence it reflects what the user will do with the system and helps define the test procedures).

Using special-purpose software tools for requirements gathering (some of them can be simulation-based)

Requirements completeness and consistency checks (some of them can be automated, others must be performed manually).

Using special-purpose requirements-specification languages in order to describe requirements more formally and hence provide more automated requirements tracing.

Prototype system development, in order to make the requirements clear and to establish better mutual understanding with the users.

PROJECT SCHEDULING

DEVELOPING THE PROJECT SCHEDULE

Can you imagine starting a long car trip to an unfamiliar destination without a map or navigation system? You're pretty sure you have to make some turns here and there, but you have no idea when or where, or how long it will take to get there. You may arrive eventually, but you run the risk of getting lost, and feeling frustrated, along the way.

Essentially, driving without any idea of how you're going to get there is the same as working on a project without a schedule. No matter the size or scope of your project, the schedule is a key part of project management. The schedule tells you when each activity should be done, what has already been completed, and the sequence in which things need to be finished.

Luckily, drivers have fairly accurate tools they can use. Scheduling, on the other hand, is not an exact process. It's part estimation, part prediction, and part 'educated guessing.'

Because of the uncertainty involved, the schedule is reviewed regularly, and it is often revised while the project is in progress. It continues to develop as the project moves forward, changes arise, risks come and go, and new risks are identified. The schedule essentially transforms the project from a vision to a time-based plan.

Schedules also help you do the following:

They provide a basis for you to monitor and control project activities.

They help you determine how best to allocate resources so you can achieve the project goal.

They help you assess how time delays will impact the project.

You can figure out where excess resources are available to allocate to other projects.

They provide a basis to help you track project progress.

Project managers have a variety of tools to develop a project schedule - from the relatively simple process of action planning for small projects, to use of Gantt Charts and Network Analysis for large

projects. Here, we outline the key tools you will need for schedule development.

Schedule Inputs:

You need several types of inputs to create a project schedule:

Personal and project calendars - Understanding working days, shifts, and resource availability is critical to completing a project schedule.
Description of project scope - From this, you can determine key start and end dates, major assumptions behind the plan, and key constraints and restrictions. You can also include stakeholder expectations, which will often determine project milestones.

Project risks - You need to understand these to make sure there's enough extra time to deal with identified risks - and with unidentified risks (risks are identified with thorough Risk Analysis).

Lists of activities and resource requirements - Again, it's important to determine if there are other constraints to consider when developing the schedule. Understanding the resource capabilities and experience you have available - as well as company holidays and staff vacations - will affect the schedule.

A project manager should be aware of deadlines and resource availability issues that may make the schedule less flexible.

Scheduling Tools:

Here are some tools and techniques for combining these inputs to develop the schedule:

Schedule Network Analysis - This is a graphic representation of the project's activities, the time it takes to complete them, and the sequence in which they must be done. Project management software is typically used to create these analyses - Gantt charts and PERT Charts are common formats.

Critical Path Analysis - This is the process of looking at all of the activities that must be completed, and calculating the 'best line' - or critical path - to take so that you'll complete the project in the minimum amount of time. The method calculates the earliest and latest possible start and finish times for project activities, and it estimates the dependencies

among them to create a schedule of critical activities and dates.

Schedule Compression - This tool helps shorten the total duration of a project by decreasing the time allotted for certain activities. It's done so that you can meet time constraints, and still keep the original scope of the project. You can use two methods here:

Crashing - This is where you assign more resources to an activity, thus decreasing the time it takes to complete it. This is based on the assumption that the time you save will offset the added resource costs.

Fast-Tracking - This involves rearranging activities to allow more parallel work. This means that things you would normally do one after another are now done at the same time. However, do bear in mind that this approach increases the risk that you'll miss things, or fail to address changes.

PROJECT MANAGEMENT SOFTWARE TOOLS

There are many project scheduling software products which can do much of the tedious work of calculating the schedule automatically, and plenty of books and tutorials dedicated to teaching people how to use them. However, before a project manager can use these tools, he should understand the concepts behind the work breakdown structure (WBS), dependencies, resource allocation, critical paths, Gantt charts and earned value. These are the real keys to planning a successful project.

Allocate Resources to the Tasks:

The first step in building the project schedule is to identify the resources required to perform each of the tasks required to complete the project. A resource is any person, item, tool, or service that is needed by the project that is either scarce or has limited availability.

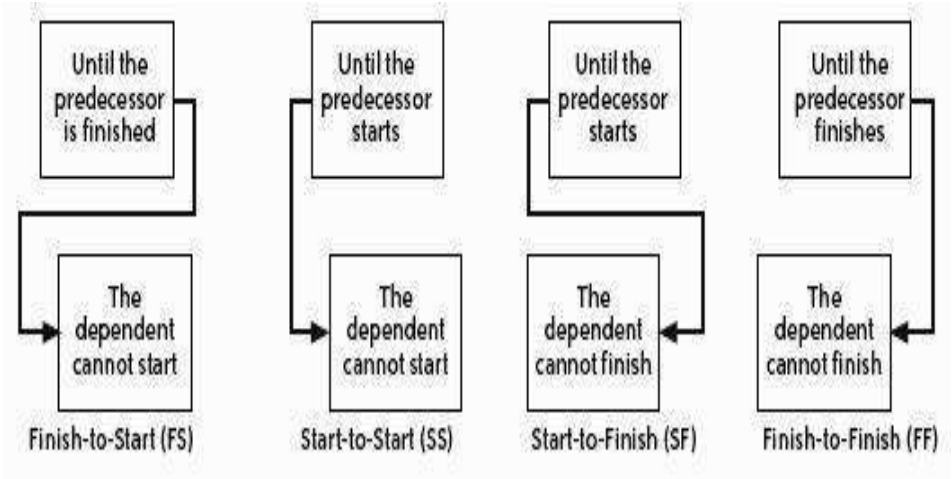
Many project managers use the terms “resource” and “person” interchangeably, but people are only one kind of resource. The project could include computer resources (like shared computer room, mainframe, or server time), locations (training rooms, temporary office space), services (like time from contractors, trainers, or a support team), and special equipment that will be temporarily acquired for the project. Most project schedules only plan for human resources—the other kinds of resources are listed in the resource list, which is part of the project plan.

One or more resources must be allocated to each task. To do this, the project manager must first assign the task to people who will perform it. For each task, the project manager must identify one or more people on the resource list capable of doing that task

and assign it to them. Once a task is assigned, the team member who is performing it is not available for other tasks until the assigned task is completed. While some tasks can be assigned to any team member, most can be performed only by certain people. If those people are not available, the task must wait.

Identify Dependencies:

Once resources are allocated, the next step in creating a project schedule is to identify dependencies between tasks. A task has a dependency if it involves an activity, resource, or work product that is subsequently required by another task. Dependencies come in many forms: a test plan can't be executed until a build of the software is delivered; code might depend on classes or modules built in earlier stages; a user interface can't be built until the design is reviewed. If Wideband Delphi is used to generate estimates, many of these dependencies will already be represented in the assumptions. It is the project manager's responsibility to work with everyone on the engineering team to identify these dependencies. The project manager should start by taking the WBS and adding dependency information to it: each task in the WBS is given a number, and the number of any task that it is dependent on should be listed next to it as a predecessor. The following figure shows the four ways in which one task can be dependent on another.



Task Dependency Create the Schedule:

Once the resources and dependencies are assigned, the software will arrange the tasks to reflect the dependencies. The software also allows the project manager to enter effort and duration information for each task; with this information, it can calculate a final date and build the schedule.

The most common form for the schedule to take is a Gantt chart. The following figure shows an example:

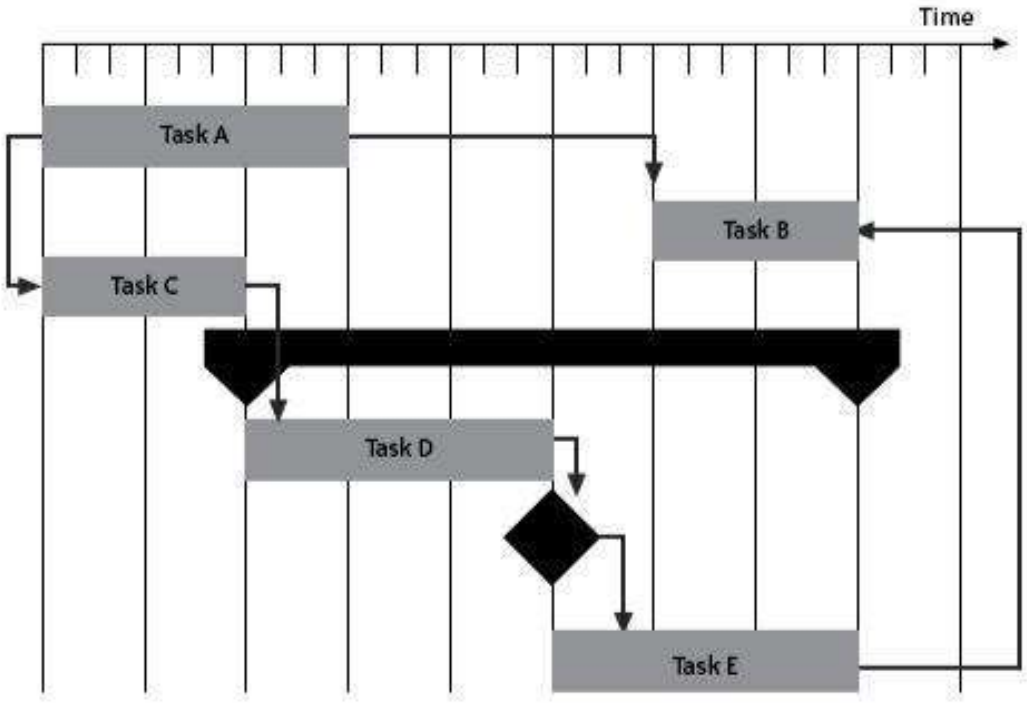
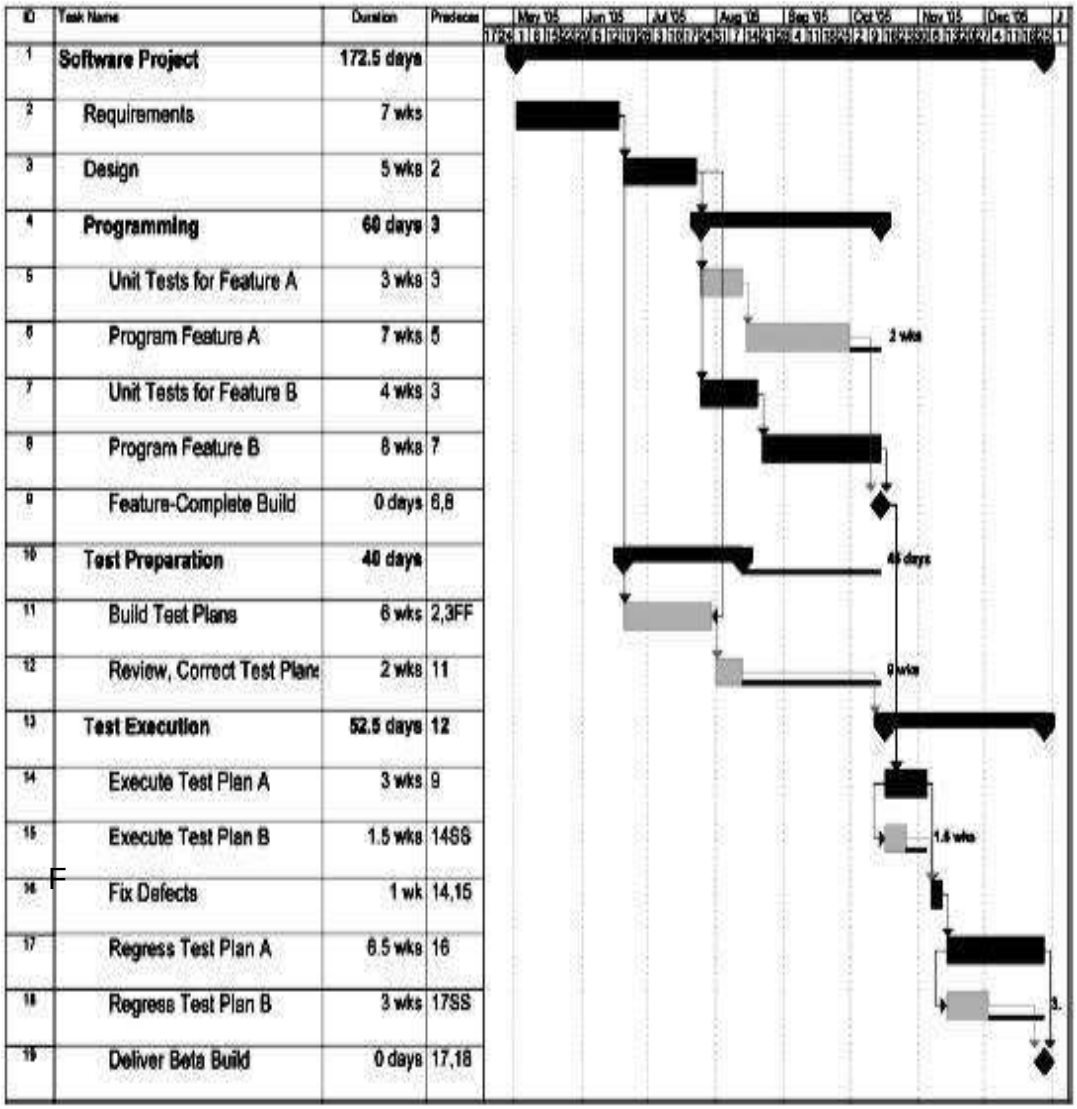


Figure 3.2: Gantt Chart

Each task is represented by a bar, and the dependencies between tasks are represented by arrows. Each arrow either points to the start or the end of the task, depending on the type of predecessor. The black diamond between tasks D and E is a milestone, or a task with no duration. Milestones are used to show important events in the schedule. The black bar above tasks D and E is a summary task, which shows that these tasks are two subtasks of the same parent task. Summary tasks can contain other summary tasks as subtasks. For example, if the team used an extra Wideband Delphi session to decompose a task in the original WBS into subtasks, the original task should be shown as a summary task with the results of the second estimation session as its subtasks.

The following figure shows an example of a Gantt chart created in Microsoft Projects :



ID	Task Name	Duration	Predecessors
1	**Software Project**	172.5 days	
2	Requirements	7 wks	
3	Design	5 wks	2
4	**Programming**	60 days	3
5	Unit Tests for Feature A	3 wks	3
6	Program Feature A	7 wks	5
7	Unit Tests for Feature B	4 wks	3
8	Program Feature B	8 wks	7
9	Feature-Complete Build	0 days	6,8
10	**Test Preparation**	40 days	
11	Build Test Plans	6 wks	2,3FF
12	Review, Correct Test Plans	2 wks	11
13	**Test Execution**	52.5 days	12
14	Execute Test Plan A	3 wks	9
15	Execute Test Plan B	1.5 wks	14SS
16	Fix Defects	1 wk	14,15
17	Regress Test Plan A	6.5 wks	16
18	Regress Test Plan B	3 wks	17SS
19	Deliver Beta Build	0 days	17,18

Gantt Chart drawn using Microsoft Project.

RISK PLAN

A *risk plan* is a list of all risks that threaten the project, along with a plan to mitigate some or all of those risks. Some people say that uncertainty is the enemy of planning. If there were no uncertainty, then every project plan would be accurate and every project would go off without a hitch. Unfortunately, real life intervenes, usually at the most inconvenient times. The risk plan is an insurance policy against uncertainty.

Once the project team has generated a final set of risks, they have enough information to estimate two things: a rough estimate of the probability that the risk will occur, and the potential impact of that risk on the project if it does eventually materialize. The risks

must then be prioritized in two ways: in order of probability, and in order of impact. Both the probability and impact are measured using a relative scale by assigning each a number between 1 and 5.

These numbers are arbitrary; they are simply used to compare the probability or impact of one risk with another, and do not carry any specific meaning. The numbers for probability and impact are assigned to each risk; a priority can then be calculated by multiplying these numbers together. It is equally effective to assign a percentage as a probability (i.e. a risk is 80% likely to occur) and a real duration for impact (i.e. it will cost 32 man-hours if the risk occurs). However, many teams have trouble estimating these numbers, and find it easier to just assign an arbitrary value for comparison.

Many people have difficulty prioritizing, but there is a simple technique that makes it much easier. While it's difficult to rank all of the risks in the list at once, it is usually not hard to pick out the one that's most likely to occur. Assign that one a probability of 5. Then select the one that's least likely to occur and assign that one a probability of 1. With those chosen, it's much easier to rank the others relative to them. It might help to find another 5 and another 1, or if those don't exist, find a 4 and a 2. The rest of the probabilities should start to fall in place. Once that's done, the same can be done for the impact.

After the probability and impact of each risk have been estimated, the team can calculate the priority of each risk by multiplying its probability by its impact. This ensures that the highest priority is assigned to those risks that have both a high probability and impact, followed by either high-probability risks with a low impact or low-probability risks with a high impact. This is generally the order in which a good project manager will want to try to deal with them: it allows the most serious risks to rise to the top of the list.

This can be very easily done using tools like Microsoft Project or even by using any spreadsheet package that provides some basic statistical functions.

3.3 DEVELOPING THE PROJECT BUDGET.

If scheduling is an art then costing could be considered a black art. Some projects are relatively straightforward to cost but most are not. Even simple figures like the cost per man/hour of labour can be difficult to calculate.

Accounting, costing and budgeting are extensive topics in themselves. Some fundamental principles to keep in mind are derived from accounting practices:

• The concept of 'prudence' – you should be pessimistic in your accounts (“anticipate no profit and provide for all possible losses”).Provide yourself with a margin for error and not just show the best possible financial position. It’s the old maxim: promise low-deliver / high once again

• The 'accruals' concept- revenue and costs are accrued or matched with one another and are attributed to the same point in the schedule. For example if the costs of hardware are in your budget at the point where you pay the invoice, then ALL the costs for hardware should be “accrued” when the invoice is received.

• The ‘consistency’ concept. This is similar to accruals but it emphasises consistency over different periods. If you change the basis on which you count certain costs you either need to revise all previous finance accounts in line with this or annotate the change appropriately so people can make comparisons on a like-for-like basis.

Note that the principles are listed in order of precedence. If the principle of consistency comes into conflict with the principle of prudence, the principle of prudence is given priority.

Costing:

At a basic level the process of costing is reasonably simple. You draw up a list of all your possible expenditure and put a numerical value against each item; the total therefore represents the tangible cost of your project. You may also however need to consider “intangible” items.

Tangible costs:

• **Capital Expenditure –** any large asset of the project which is purchased outright. This usually includes plant, hardware, software and sometimes buildings although these can be accounted for in a number of ways.

• **Lease costs –** some assets are not purchased outright but are leased to spread the cost over the life of the project. These should be accounted for separately to capital expenditure since the project or company does not own these assets.

• **Staff costs –** all costs for staff must be accounted for and this includes (but is not limited to): salary and pension (superannuation)

costs; insurance costs; recruitment costs; anything which can be tied directly to employing, training and retaining staff.

• **Professional services –**all large-scale projects require the input of one or more professional groups such as lawyers or accountants. These are normally accounted for separately since a close watch needs to be kept upon expenditure in this area. Without scrutiny the costs of a consultant engineer, accountant or lawyer can quickly dwarf other costs.

• **Supplies and consumables –** regular expenditure on supplies is often best covered by a single item in your budget under which these figures are accrued. They are related to overhead below.

• **One-off costs –** one-off costs apply to expenditure which is not related to any of the above categories but occurs on an irregular basis. Staff training might be an example. While it might be appropriate to list this under staff costs you might wish to track it independently as an irregular cost. The choice is yours but the principles of prudence and consistency apply.

• **Overheads –** sometime called indirect costs, these are costs which are not directly attributable to any of the above categories but never-the-less impact upon your budget. For example it may not be appropriate to reflect the phone bill for your project in staff costs, yet this still has to be paid and accounted for. Costing for overheads is usually done as a rough percentage of one of the other factors such as “staff costs”.

Intangible costs

It has become fashionable to account for “intangible” assets on the balance sheets of companies and possibly also projects. The argument goes like this: some contributions to a project are extremely valuable but cannot necessarily have a tangible value associated with them. Should you then account for them in the budget or costing? The “prudence” principle says yes but practicality says “no”. If you are delving this murky area of accountancy you should seek professional help and advice.

Typical things you might place in the budget under intangibles are “goodwill” and “intellectual property”. Personnel-related figures are a frequent source of intangible assets and so you might find things like “management team”, “relationships” and “contacts” on an intangibles balance sheet.

Budgeting:

Once you have costed your project you can then prepare an appropriate budget to secure the requisite funds and plan your cash

flow over the life of the project. An accurate cost model will of course entail a fairly detailed design or at the very least requirement specification so that you can determine your scope of work. This is normally completed well into the design phase of the project.

You must be extremely careful with initial estimates and always follow the “promise low / deliver high” commandment.

Costing and budgeting follow the iterative life cycle as do other tasks within the project. As you refine your design, so you will need to refine the costing which is based upon it.

As in scheduling, you need to build in adequate contingency (reserves) to account for unexpected expenditure. For example, if due to a failure in the critical path a task is delayed and a milestone (like software purchase) falls due in the month after it was scheduled. This can wreck your carefully planned cash flow. But if you have carefully budgeted your project then variations should be relatively easy to spot and cope with as they arise.

Just as in scheduling you should have regular budget reviews which examine the state of your finances and your expenditure to date and adjust the planned budget accordingly.

Regardless of circumstance, a number of basic philosophies can help your budgeting immensely by protecting it from subjective review. By understanding concepts, and making sure that everyone involved understands them, you’ll be on the right track to an accurate projection:

Project costs and project budgets are two different things.

Always start by identifying project costs.

Project costs are not defined solely in monetary amounts. Include actual amounts, with shipping and taxes, for software or hardware purchases that must be made. If you’re pro-rating the costs of using pre-existing hardware and software tools, include it in number of hours. Likewise, developer effort costs are recorded in hours, not dollars.

Once you’ve laid out your costs, identify your risks and assign a percentage reflecting how much each risk factor may affect the project as a whole, or a portion of the project. Each development team should have a risk value assigned to it, to cover reasonable costs such as hiring the occasional contractor to get a timeline under control, unforeseen overtime, and so on.

Your budget, then, is the total of the costs, as transcribed into a monetary figure, plus the total risk percentage of that

cost. Define conversion values that you use to represent equipment pro-rating and development times.

Your budget is not an invoice. Once you've determined the hard figures involved, leave it up to your company's business representatives to make adjustments for profits. Make sure they understand your figures reflect actual costs.

A budget should always be labeled as an estimate, until it is finalized and approved. This helps to manage expectations and prevent miscommunications from being written in stone.

A single person does not create a budget. At the very least, all of the following should be consulted: lead developer, project manager, and a business-side driver.

MONITORING AND CONTROLLING THE PROJECT

To appreciate how project control works you must first understand that, despite all the effort devoted to developing and gaining commitment to a plan, there is little chance that the resulting project will run precisely according to that plan.

This doesn't mean that you will fail to achieve the objectives of the plan – on the contrary, you must have a very high level of confidence that you can achieve those objectives and deliver the full scope, fit for purpose, on time and to budget.

The plan describes what you would like to do but it models just one of the infinite number of routes from where you are now to where you want to be. In practice your project will follow a different route to the one shown in your plan, you don't know which one, but you will need control to make sure it is a route that takes you to where you need to be, when you need to be there, and at a cost you can afford.

The power of the plan is that it gives you a baseline against which you can compare actual achievement, cost and time and determine the amount of deviation from plan and hence take corrective action if required.

The essential requirement for control is to have a plan against which progress can be monitored to provide the basis for stimulating management action if the plan is not being followed. Control then becomes a regular, frequent iteration of: Creating the right environment for control.

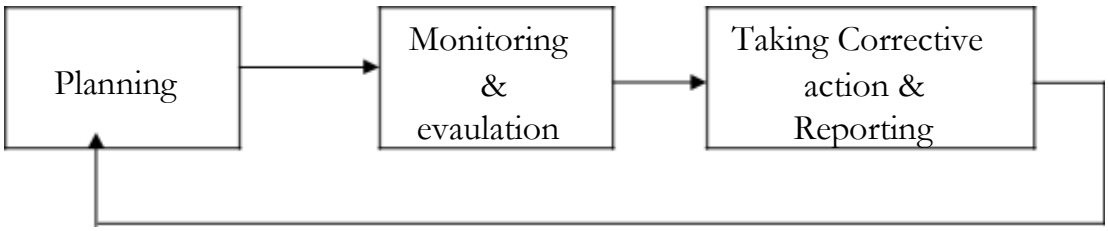


Figure 3.4 : Project Control

The basic requirements for control are:

a plan that is:

- realistic
- credible
- detailed enough to be executed
- acceptable to those who must execute it (Project Manager and Project Teams)
- approved by those who are accountable for its achievement (the SRO/ Project Board);

a process for monitoring and managing progress and resource usage;

a project management organisation of appropriately skilled people with sufficient authority and time to plan, monitor, report, take decisions and deal with exceptions;

a process to make minor corrections and adjustments to deal with minor deviations and omissions from the plan;

the commitment of those who will provide the resources indicated in the plan (SRO, Project Board, Stakeholders and resource 'owners' in the parent organisation and its related agencies);

explicit authority to proceed granted by those who are accountable for the project.

In all but the smallest or shortest projects you should think about how to break your project into manageable 'chunks' called stages. Every project will have a minimum of two stages – the first being Project Initiation. A large project may have a number of stages, each of which has its own stage plan. When designing your project's stage structure look for points where the Project manager should:

review achievements to date and assess project viability

take key decisions outside the level of authority of the Project Manager

approve a more detailed plan for the next phase of work
commit resources in accordance with the project or stage plan

assess the impact of some significant external event that will influence the project (eg: legislation, decision point in other project, review of business operation).

The Project Manager will also be able to identify stage boundaries by thinking about how far ahead is it sensible to plan in the fine detail needed for day to day control. In practice, the detailed plan for a stage will be produced towards the end of the preceding stage, when the information needed for planning is available.

Checkpoints:

Checkpoint reports are produced by team managers / leaders for the Project Manager who needs to have early warning of deviations from plan and other problems affecting the project team. Checkpoints provide regular, frequent comparison of actual progress, resource usage and forecasts against plans. They provide information for the Project Manager to apply control, eg by correcting small deviations from the plan. The basic purpose of a checkpoint is to answer the questions:

'What is going according to plan?'
'What is not going to plan?'
'What is likely not to go to plan?'

Checkpoints are essential controls – missed checkpoints are usually an early sign of a failing project. The information gathered at checkpoints should be documented in Checkpoint Reports and used in the preparation of Highlight Reports.

Checkpoint design:

There are many different ways of conducting Checkpoints - they might be, but do not have to be, achieved through written reports and meetings. Each project must use an approach that balances the need for communication and control against too much management interference in work in progress. Checkpoint design will cover:

Frequency of reporting
Timing (eg: time and day of week)
Information required from team members (oral reports, timesheets, written reports)
Method of conducting checkpoint (eg informal chats, formal meetings, phone, fax, email)

Participation (Project Manager? Project Assurance? Team Members? Suppliers?)
Content of a report to be used to communicate the findings of the Checkpoint.

The Project Manager should set Checkpoint frequency depending on the intensity of activity. Checkpoint frequencies ranging from fortnightly (eg during procurement phases) down to daily (eg during implementation and training) are possible within the same project.

Handling significant deviations from plan:

Project Board members are usually senior managers with limited time to devote management of the project. In order to achieve 'management by exception' the Project Manager should be given authority to deal with the inevitable small deviations from plan. For larger deviations, such as those resulting from requests for change, poor estimation, delays in deliveries by external agencies. The Project Manager will require an agreed exception handling process. This will involve:

Setting delegated limits (eg. cost and time 'Tolerances'): The Project Board should set limits to the allowable deviations from planned cost and schedule so that the Project Manager knows how much delegated authority is available to manage deviations from plan;

Exception reporting: The Project Manager may use an exceptional Highlight Reports to notify any forecast (or actual) deviations from plan beyond delegated limits. Positive sorts of exception should also be reported in this way eg: finishing work early or using less resource than planned.

Exception planning and decision making: The management may wish the Project Manager to create a new plan to replace the current one if it is no longer viable. This plan would b e submitted for a decision to proceed.

Monitoring System Performance:

A potential problem when software systems are involved is the potential of the systems not being able to handle increased volumes of data in the future. To take care of this, performance monitoring should be a part of all softwares that are likely to grow in size, identifying potential future bottlenecks in the system, including lack of disk space, lack or processing power, approaching transaction limits, long before they become a problem, so corrective action can be taken.

This process is very complex because softwares will grow in size due to systems being installed incrementally (e.g., they may be installed at a pilot location first) and due to future increases in number of customers over time. It is also complex because new technology may become available that handles greater capacity but that will incur additional costs to the organization to implement. It is proposed that information required for this planning be kept in a Performance and Adaptability Plan document that identifies future projections of increases in number of customers handled by the software, bottlenecks identified so far, and contingency plans for resolving anticipated future performance problems. The Performance and Adaptability Plan document would be used by business planners who would project increases in numbers of customers, performance monitors who identify bottlenecks in systems, and capacity planners who would identify requirements for changes to hardware and or system software.

THE PROJECT COMMUNICATION PLAN

Good communications among all stakeholders is key for the success of a project. It's important to ensure your project team develops a communication plan so that lack of communication does not derail your goals.

Even though you may have identified and analyzed your stakeholders and determined the most effective communications vehicles – without a well developed and implemented communication plan, you may have a recipe for disaster. So how do you develop a communication plan to ensure your project's success?

Following are the two types of communication plans to support and enhance communications throughout your project. As discussed in previous installments, the first step in building your plan is to identify your project stakeholders and determine the best communications vehicle. Next, you build your plan.

Two Types of Communications Plans for Your Project:

For all sized projects, a well-structured communications plan is a must from the beginning. Projects offer multiple opportunities for communications to your key stakeholders, and we recommend exploring two types of communication plans for your project to exploit these opportunities.

1. Regular or Ongoing Communication Plan
2. One-time or Event-driven Communication Plan

Building Your Plan:

Regular or Ongoing Communications:

Regular, or ongoing, communications include those opportunities you have to communicate to your project team members, sponsors, steering committee members, and other key stakeholders on a regular basis. These types of communication could include your regular status reports, scheduled project team meetings, monthly updates with the steering committee, or regularly scheduled campus updates on a project. Use your stakeholder analysis to develop these routine and ongoing communications for the project.

Review this plan at regular intervals (quarterly) to ensure that you are adequately communicating to those stakeholders who are closest to the project. The chart on the next page provides an example of the types of communications to consider for your regular and ongoing communications. Don't forget to include your regular

meetings and even one-on-ones that you may have with your sponsor.

Communications	Purpose	Audience	Author	Communication vehicle location	Frequency
Monthly status reports to management	To keep senior leadership informed about the projects progress	Steering committee Executive committee	Project Manager	- E-mails - Website postings	Monthly
Weekly schedule	Monitor the progress and report.	Project management team	Project Manager	-E-mails - postings on website - meetings	Weekly
Project Team calendar	Keep project participants aware of the key project deadlines to help them manage their schedule	Project participants Steering committee	Project coordinator	Postings in the respective members folder	As and when needed.

Figure 3.5 : Sample communication plan

One-time or Event-driven Communications:

During the life of any project, opportunities arise for one-time or event-driven communications. Work with your project team to identify those opportunities, like the example timeline. This plan could also include critical issues sessions, vendor meetings, training schedules, and roll-out schedules.

To gain the most advantage from the communications opportunities for your project, review this portion of your communication plan every month with your project team. Review the past month, and then look forward at least six months to ensure that as your project plan changes, you are able to capitalize on every communication opportunity.

When developing your communications plan keep in mind that the key is to always have the receiver as the focal point—not the sender. Make your communications deliberate and focused. By making sure that your plan is clear and thoroughly outlined, you can help reduce the number of problems and surprises that pop-up and have a project as successful as a perfect soufflé.

PROJECT METRICS

Metrics are a set of quantifiable parameters which are used to measure the effectiveness of a project or undertaking. Values are obtained for the parameters for multiple instances of the same entity and they are compared and interpreted as to the change in the effectiveness. For example, if there are multiple versions of a product, one metric could be the user satisfaction level (say 1 to 5, 1 being least happy and 5 being very happy)with the user interface for each of the versions. The effectiveness of the changes in the user interface can be measured by the satisfaction level of the users with each of the versions.

Project metrics are in-process or project execution measures that are collected, analysed and used to drive project process improvement.

Reasons for Project Metrics:

Project metrics require time and effort and so that work is done for usually one of these reasons:

To provide clear and tangible project status information about project schedule and cost

To identify areas for project process improvement

To demonstrate the results of process improvement efforts

To collect a database of project metrics to analyse trend information or provide historic comparators and perhaps used for parametric estimates

To collect project metrics without a clear plan of future action to use those metrics is simply wasting time and effort. In short, only collect project metrics that will be used to drive project process improvements.

Key Project Metrics:

Senior management will often wish to see regular reports of project progress against time and cost measures. Some project management methodologies go into some detail with these metrics including planned versus forecast, cost variance, schedule variance and earned value. However, more generally, key project management metrics include:

Schedule - delivery date and slippage in days from original delivery date

Cost - actual budget versus original budget

Resource - effort, how much time people have used on the project

Scope - changes to project as measured through number and type of controlled changes made

Quality - quality defects and documentation

Software - a specialised subject with many potential measures such as lines of code, code complexity and function point

Defects - number and type of problems or issues recorded for the technology project during its test stage and warranty period or a defined time period

Other metrics associated with normal operation such as availability, performance or support call resolution properly belong with service metrics rather than project metrics.

Project metrics selected should reflect the voice of the customer (customer needs), as well as ensure that the internal metrics selected by the organization are achieved. Metrics selected should be simple and straightforward and meaningful. Metrics selected should create a common language among diverse team members.

When drafting metrics for a particular project one should consider how the metrics are connected and related to key

business metrics. Typically there is no one metric that fits all the requirements for a particular situation.

Developing Project Metrics:

The most common approach used by teams is to understand the problem statement, brainstorm metrics, and finally decide what metrics can help them achieve better performance. The team then reviews these metrics with executive management to ensure that they are in synergy with the overall strategy of the business, and an iterative approach may be utilized.

Care should be exercised in determining what is measured. Metrics should be based on what, in fact, needs to be measured to improve the process, rather than what fits the current measurement system. Metrics need to be scrutinized from the value they add in understanding a process.

REPORTING PERFORMANCE & PROGRESS

Performance reporting involves collecting, processing and communicating information to key stakeholders, regarding the performance of the project. Performance reporting can be conducted using various tools and techniques, most of which have been already described in the previous paragraphs. The most widely used techniques for performance reporting are:

Performance review meetings that take place to assess the project's progress or/and status

Variance analysis which is about comparing actual project results (in terms of schedule, resources, cost, scope, quality and risk) against planned or expected ones.

Earned Value Analysis (EVA) used to assess project performance in terms of time (schedule) and cost (or resources).

Financial and Output Performance Indicators used to measure financial and physical progress of the project

Information of project's performance is usually communicated via **Progress Reports** and **Project Status Reports** which are described in the paragraphs below.

The Progress Report is a document prepared by the Project Team members (in case of in-house production) or by the Management Team of the Contractor (in case that the implementation of the project is totally outsourced) to provide

regular feedback to the Project Manager regarding the progress of the project. Progress reports should be submitted on a regular basis to enable the Project Manager to update the Activities Schedule, identify any schedule problems or potential problems and act proactively for their resolution. Progress Reports are usually asked to be submitted every two weeks or every month, when the project is implemented with own resources. However, in case that the project is implemented by a Contractor, the progress reports are usually asked every three or six months. Generally, a Progress Report should include the following information:

- Reporting period to which it refers
- Project Title
- Project Manager's name
- Authors of the report
- Date of submission
- Project synopsis (i.e. project goals and objectives, expected results, project activities, duration, etc.)

Project progress in the reporting period (i.e. activities/ tasks executed, actual work accomplished, deliverables submitted, deviations for baseline schedule, estimation of the effort required to complete activities/ tasks)

Work programme for the following reporting period (i.e. activities/ tasks to be executed, deliverables to be submitted, schedule estimates for key milestones, etc.)

Updated/ revised Activities Schedule showing the percentage of work completed so far and the estimated start or finish dates for activities/ tasks.

It should be noted that in case of small projects with only few team members, the Progress Report can be substituted by personal judgment and observations of the Project Manager or by day-to-day discussions with the team members on the progress of the deliverables. On the contrary, in case of large and complex projects, where progress reporting is an important aspect of communication management, the Progress Reports should be formally submitted to the Project Manager by the Team Manager(s) (or by the Contractor), who have to prepare them by collecting the relative progress information from individual team members.

Project Status Report:

The **Project Status Report** is a document prepared by the Project Manager - using the information provided by the Progress Reports - to present the status of the project to key stakeholders, including the Project Steering Committee, the Project Owner and

the Funding Agency. Depending on the duration and size of the project, as well as on specific communication requirements of the Project Owner or/and the Funding Agency, the Status Report can be prepared monthly, quarterly or biannually. Usually, Status Reports are prepared with the same or less frequency than Progress Reports since they require input from them.

The aim of the Project Status Report is to:

-Provide an overview of project's progress up to date

- Ensure that the key stakeholders are regularly informed on the progress of the project
- Inform the key stakeholders about issues that require immediate action or resolution

Normally the Status Report becomes the point of discussion for the Status Meeting, which is a regularly scheduled event, where the Project Manager presents the status of the project to the Steering Committee (and maybe to the Project Owner or /and the Funding Agency). In these meetings the Project Manager can invite members of the Project Team who have expertise in a certain area of the discussion. It is, however recommended that the Project Manager invites periodically the Project Team to review the status of the project, discuss their accomplishments and communicate any issues or concerns in an open, honest and constructive forum. On large projects where gathering the entire team is not always possible, the Project Team members can be represented in the meeting by the respective Team Manager(s), who can communicate the status of their team work since they have a better insight into the day-to-day activities of their team members.

PROJECT RISK MANAGEMENT

INTRODUCTION

Managing risk is an integral part of good management and is something many managers do already in one form or another.

Project risk is an uncertain event or condition that, if it occurs, has a positive or a negative effect on at least one project objective. A risk may have one or more causes and, if it occurs, one or more impacts. Risk management is the systematic process of planning for, identifying, analyzing, responding to, and monitoring project risks. It involves processes, tools, and techniques that will help the project manager maximize the probability and results of positive events and minimize the probability and consequences of adverse events as indicated and appropriate within the context of risk to the overall project objectives of cost, time, scope and quality. Project risk management is most effective when first performed early in the life of the project and is a continuing responsibility throughout the project's life cycle.

THE IMPORTANCE OF PROJECT RISK MANAGEMENT

The project risk management process helps project sponsors and project teams make informed decisions regarding alternative approaches to achieving their objectives and the relative risk involved in each, in order to increase the likelihood of success in meeting or exceeding the most important objectives (e.g. time) sometimes at the expense of other objectives (e.g. cost).

Risk Management provides a structured way of identifying and analyzing potential risks, and devising and implementing responses appropriate to their impact. These responses generally draw on strategies of risk prevention, risk transfer, impact mitigation or risk acceptance. Within a single project or proposal each of these strategies may have application for different individual risks.

Risk management encourages the project team to take appropriate measures to:

1. Minimize adverse impacts to project scope, cost, and schedule (and quality, as a result).
2. Maximize opportunities to improve the project's objectives with lower cost, shorter schedules, enhanced scope and higher quality.
3. Minimize management by crisis.

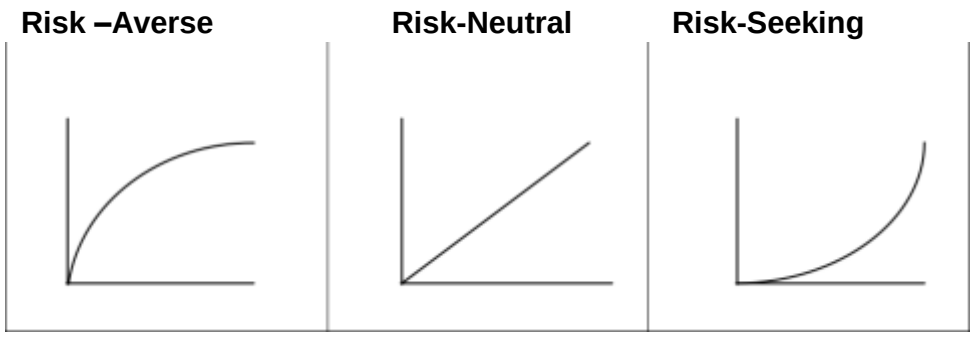
Project risk management is the art and science of identifying, analyzing and responding to risk throughout the life of a project and in the best interest of meeting the project objectives. A frequently overlooked aspect of project management, risk management can often result in significant improvements in the ultimate success of projects .Risk management can have a positive impact on selecting projects, determining scope of projects and developing realistic schedules and cost estimates. It helps project stakeholders understand the nature of the project, involves team members in defining the strengths and weakness , and helps to integrate the other project management knowledge areas.

Before you can improve project risk management, you must understand what risk is .A basic dictionary definition says that risk is "the possibility of loss or injury". This definition highlights the negativity often associated with risk and suggests that uncertainty is involved. Project risk management involves understanding potential problems that might occur on the project and how they might impede project success. The *PMBOK Guide 2004* refers to this type of risk as a negative risk. However, there are also positive risks, which can result in good things happening on a project. A general definition of a project risk , therefore , is an uncertainty that can have a negative or positive effect on meeting project objectives.

Some organizations or people have a neutral tolerance for risk, some have an aversion to risk, and others are risk seeking. These three preferences for risk are part of the utility theory of risk.

Risk utility or risk tolerance is the amount of satisfaction or pleasure received from a potential payoff. The following figure shows the basic difference between risk averse, risk neutral, and risk seeking preferences. The y-axis represents utility, or the amount of pleasure received from taking a risk. The x-axis shows the amount of potential payoff, opportunity, or dollar value of the opportunity at stake.

Utility rises at a decreasing rate for a risk averse person. That is when more payoff or money is at stake ,a person or organization that is risk averse gains less satisfaction from risk, or has lower tolerance for the risk. Those who are risk seeking have a higher tolerance for the risk, and their satisfaction increases when more payoff is at stake. A risk seeking person prefers outcomes that are more uncertain and is often willing to pay penalty to take risk. A risk neutral person achieves balance between risk and payoff..



Risk utility function and risk preference

The goal of project risk management can be viewed as minimizing potential negative risks while maximizing potential positive risks. The term known risks is some times used to describe risks that the project team has identified and analyzed .

4.2.1 Processes and outputs:

This matrix shows the six main processes and all of the deliverables associated with project risk management

Process	Output(deliverables)
Risk management planning	Risk management plan(RMP)
Risk identification	Risk Register (Register)
Qualitative risk analysis	Risk Register (updates) Prioritized list of risks classified as high, moderate, or low
Quantitative risk analysis	Quantitative Risk Analysis Reports Numerical analysis of the project's likelihood of achieving its overall objectives (Risk Register updates)
Risk response planning	1- Risk Register (updates) 2- Project Management Plan (updates) 3- Project Risk Management Plan (updates) 4- Risk-related contractual agreements The outcome may result in one or more of the following: residual risks, secondary risks, change control, contingency reserve (amounts of time or budget needed).
Risk monitoring and control	Risk Register (updates) The outcome may result in workaround plans, corrective actions, programming change request (PCR), and updates to risk identification checklists for future projects

RISK MANAGEMENT PLANNING

Risk management planning is the process of deciding how to approach and plan for risk management activities for a project, and the main output of this process is a risk management plan A risk management plan documents the procedure for managing risk throughout the project.

The project team should hold several planning meeting early in the project's life cycle to help develop the risk management plan. The project team should review the project documents as well as corporate risk management policies, risk categories, lessons learned reports from past projects and templates for creating risk management plan.

Careful and explicit planning enhances the possibility of success of the other risk management processes. Risk Management Planning is the process of deciding how to approach
and conduct the risk management activities for a project. Planning of risk management processes is important to ensure that the level, type, and visibility of risk management are commensurate with both the risk and importance of the project to the organization, to provide sufficient resources and time for risk management activities, and to establish an agreed-upon basis for evaluating risks. The Risk Management Planning process should be completed early during project planning, since it is crucial to successfully performing the other processes described in this handbook.

The result of Risk Management Planning is a Risk Management Plan. The risk management plan identifies and establishes the activities of risk management for the project in the project plan (RMP)

A risk management plan summarizes how risk management will be performed on a particular project. Like other specific knowledge area plans it becomes a subset of project management plan The following table lists the general topics that a risk management plan should address It is important to clarify roles and responsibilities, prepare budget and schedule estimates for risk-related work, and .identify risk categories for consideration. It is also important to describe how risk management will be done, including assessment of risk probabilities and impacts as well as creation of risk related documentation.

Methodology: How will risk management will be performed on this project?. What tools and data sources are available and applicable?
Roles and responsibilities: who are the individuals responsible for implementing specific tasks and providing deliverables related to risk management
Budget and schedule: What are the estimated costs and schedules for performing risk related activities?
Risk Categories: What are the main categories of risk that should be addressed on this project?. Is there a risk breakdown structure for the project
Risk Probability and Impact: How will the probabilities and impacts of risk items be assessed?. What scoring and interpretation methods will be used for the qualitative and quantitative analysis of risks?
Risk Documentation: What reporting formats and processes will used for risk management activities?

In addition to risk management plan many projects also include contingency plans, fallback plans, and contingency reserves. Contingency plans are predefined actions that the project team will take if an identified risk event occurs. For example ,if the project team knows that a new release of a software package may not be available in time for them to use it for their project, they might have a contingency plan to use the older version of the software.

Fallback plans are developed for risks that have a high impact on meeting project objectives and are put in to effect if attempts to reduce risks are not effective. For example , a new college graduate might have a main plan and several contingency plans on where to live after graduation, but if none of the plans work out a fallback plan might be to live at home for a while. Sometimes contingency plans and fallback plans are used interchangeably.

Contingency reserves or contingency allowances are provisions held by the project sponsor or organization to reduce the risk of cost or schedule overruns to an acceptable level. For example if a project appears to be off course because the the staff is inexperienced with some new technology and the team had not identified it as a risk ,the project sponsor may provide additional funds from contingency reserves to hire an outside consultant to train and advise the project staff in using the new technology.

4.4 COMMON SOURCES OF RISK IN INFORMATION TECHNOLOGY PROJECTS

Several studies show that IT projects share some common sources of risk. The Standish Group developed an IT success potential scoring sheet based on potential risks. Other broad categories of risk help identify potential risks.

Information Technology Success Potential Scoring Sheet

Success Criterion	**Relative Importance**
User Involvement	19
Executive Management support	16
Clear Statement of Requirements	15
Proper Planning	11
Realistic Expectations	10
Smaller Project Milestones	9
Competent Staff	8

Ownership	6
Clear Visions and Objectives	3
Hard-Working, Focused Staff	3
Total	100

The Standish Group provides specific questions for each success criterion to help decide the number of points to assign to a project. For example the five questions related to user involvement include the following
Do I have the right user(s)?
Did I involve the users early and often?
Do I have a quality relationship with user(s)?
Do I make involvement easy
Did I find out what the user(s) need(s)?

The number of questions corresponding to each success criterion determines the number of points each positive response is assigned. For example in the case of user involvement there are five questions . For each positive reply , you would get(19/5) 3.8 points . !9 represents the weight of the criterion and five represents the number of questions. Therefore ,you would assign a value to the user involvement criterion by adding 3.8 points to the score for each question you can answer positively.

4.4.1 Categories of Risk:

A broad categories of risks are described on the questionnaires developed by many organizations. Some of them are given below.

Market risk: If the information technology project is to produce a new product or service will it be useful to the organization or marketable to others?. Will user accept the product or service?. Will someone else make a better product or service faster, making the project a waste of time and money.

Financial risk: Can the organization afford to undertake the project?. How confident are the stakeholders in the financial projections?. Will the project meet NPV,ROI, and payback estimates?. If not van the organization afford to proceed the project?. Is this project the best way to use the organization's financial resources?

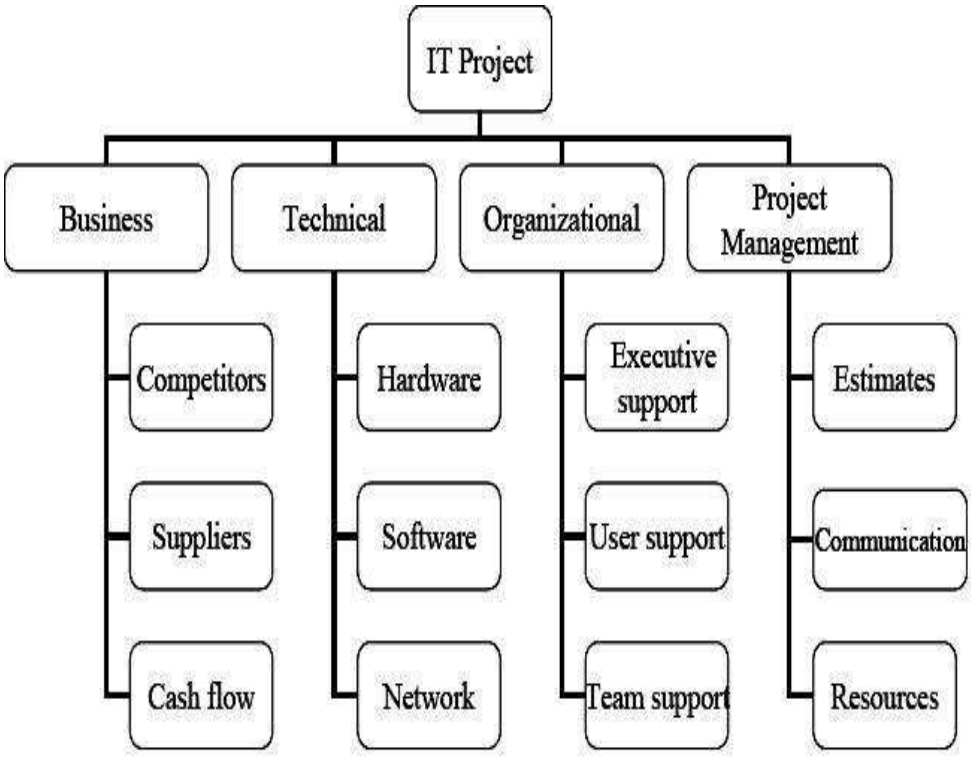
Technology risk: Is the project technically feasible?. Will it use mature, leading edge or bleeding edge technologies? When will decisions be made on which technology to use? Will H/w, S/w and network function properly?. You can also breakdown the technology risk into h/w, s/w, and network technology if required.

People risk: Does the organization have or can they find people with appropriate skills to complete the project successfully?. Do they have enough experience?. Does senior management support the project?. Is the organization familiar sponsor/customer for the project?. How good is the relationship with the sponsor/customer?

Structure/process risk: What is the degree of change the new project will introduce into user areas and business procedures? How many distinct user groups does the project need to satisfy? With how many other systems does the project need to interact? Does the organization have processes in place to complete the project successfully?

Risk Breakdown Structure:

A **risk breakdown structure** is a hierarchy of potential risk categories for a project. Similar to a work breakdown structure but used to identify and categorize risks. A sample shown below.



A risk break down structure is a useful tool that can help project managers consider potential risks in different categories. The highest level categories are business, technical, and organizational and project management. Competitors suppliers, and cash flow are categories that fall under business risks. Under technical risk are the categories h/w, s/w, and network.

A risk break down structure provides a simple, one page chart to help ensure a project team is considering important risk categories related to all information technology projects.

The following table shows the potential negative risk conditions that can exist within each knowledge area.

Potential Risk Conditions Associated With Each Knowledge Area

RISK IDENTIFICATION

Risk identification involves identifying potential project risks. Risk Identification produces a deliverable — the project Risk Register – where risks are identified that may affect the project's ability to achieve its objectives. Risk Identification documents which risks might affect the project and documents their characteristics. The Risk Register is subsequently amended with the results from qualitative risk analysis and risk response planning, and is reviewed and updated throughout the project.

Participants in risk identification activities can include the following, where appropriate: project manager, project team members, risk management team (if assigned), subject matter experts both from the project and from outside the project team, customers, end users, other project managers, stakeholders, and risk management experts. While these personnel are often key

participants for risk identification, all project personnel should be encouraged to identify risks.

Suggestions For Identifying Risks:

The assigned team members identify the potential risks (threats and opportunities), using

The risk breakdown structure, suitably tailored to the project.

The sample risk list

Their own knowledge of the project or similar projects.

Consultation with others who have significant knowledge of the project or its environment.

Consultation with others who have significant knowledge of similar projects.

There are several other tools and techniques also for identifying risks Five common information gathering techniques for risk identification include brainstorming ,Delphi technique ,interviewing ,root cause analysis, and SWOT analysis.

1. Brain Storming:

It is a technique by which a team attempt to generate ideas or find solutions for a specific by amassing ideas spontaneously and with out judgment . This approach can help the group create a comprehensive list of risks to address later in the qualitative and quantitative risk analysis process. An experienced facilitator should run the brainstorming session and introduce new categories of potential risks to keep the ideas flowing . After the ideas are collected ,the facilitator can group and categorize the ideas to make them more manageable

2. Delphi Technique:

The Delphi Technique is used to derive a consensus among a panel of experts who make predictions about future developments. It Provides independent and anonymous input regarding future events. Uses repeated rounds of questioning and written responses and avoids the biasing effects possible in oral methods, such as brainstorming.

3. Interviewing:

Interviewing is a fact-finding technique for collecting information in face-to-face, phone, e-mail, or instant messaging discussions. Interviewing people with similar project experience is an important tool for identifying potential risks.

4. SWOT Analysis:

SWOT analysis (strengths, weaknesses, opportunities,and threats) can also be used during risk identification.

Helps identify the broad negative risks that apply to a project.

Applying SWOT to specific potential projects can help identify the broad risks and opportunities that apply in that scenario Some other techniques for risk identification are

5. Use of checklists :

The list of risks that have been encountered in previous projects provide meaningful template for understanding risks in current projects.

It is important to analyze project assumptions to make sure that they are valid. Incomplete, inaccurate or inconsistent assumptions might lead to identifying more risks.

6. Diagramming Technique:

This method include using cause and effect diagrams or fishbone diagrams ,flow charts and influence diagrams .Fishbone diagrams help you trace problems back to their root cause. Process flow charts are diagrams that show how different parts of the system interrelate.

4.5.2 The Risk Register:

The main output of the risk identification process is a list of identified risks and other information needed to begin creating a risk register.

A risk register is:

A document that contains the results of various risk management processes and that is often displayed in a table or spreadsheet format.

A tool for documenting potential risk events and related information.

Risk Register Contents

An identification number for each risk event.

A rank for each risk event.

The name of each risk event.

A description of each risk event.

The category under which each risk event falls.

The root cause of each risk.

Triggers for each risk**;** triggers are indicators or symptoms of actual risk events.

Potential responses to each risk.

The risk owner or person who will own or take responsibility for each risk.

The probability and impact of each risk occurring.

The status of each risk.

Sample Risk Register

QUALITATIVE RISK ANALYSIS

Assess the likelihood and impact of identified risks to determine their magnitude and priority.

Risk quantification tools and techniques include:

Probability/impact matrixes

The Top Ten Risk Item Tracking

Expert judgment

Using Probability/Impact Matrix To Calculate Risk Factors:

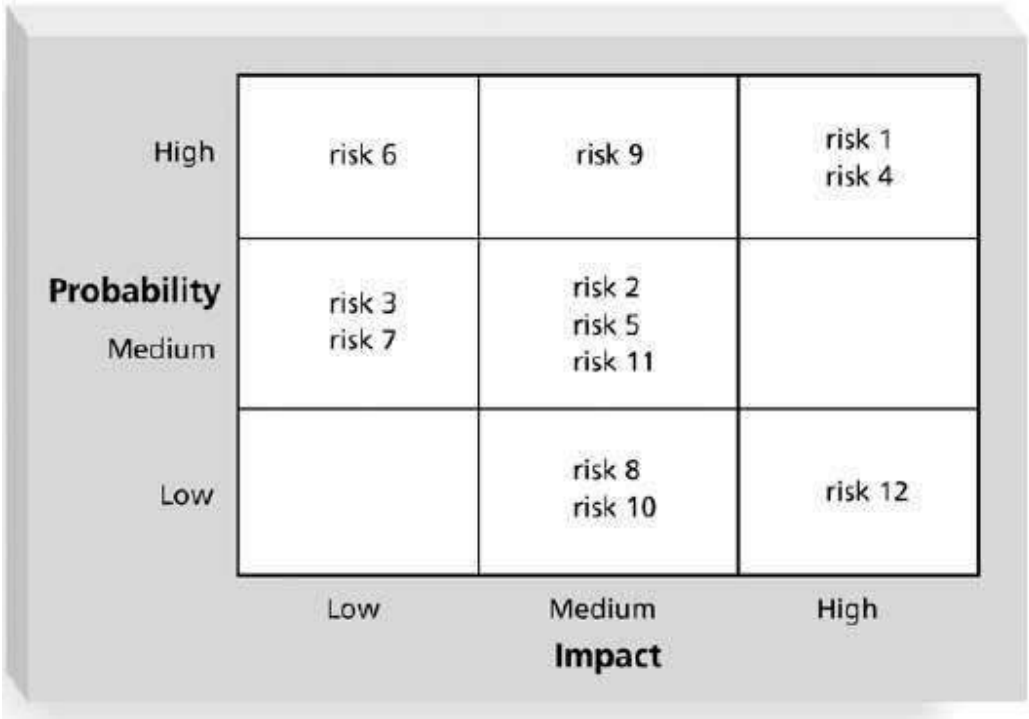
A probability/impact matrix or chart lists the relative probability of a risk occurring on one side of a matrix or axis on a chart and the relative impact of the risk occurring on the other.

List the risks and then label each one as high, medium, or low in terms of its probability of occurrence and its impact if it did occur.

It may be useful to create separate Probability/Impact Matrix or chart for negative risks and positive risks to make sure both types of risks are adequately addressed. Qualitative analysis is normally done quickly so that the project team has to decide what type of approach makes the most sense for their project. To quantify risk probability and consequence, the Defense Systems Management College developed a technique for calculating risk factors – the numbers that represent the overall risk of specific events ,based on their probability of occurring and consequences to the project if they do occur. The technique makes use of Probability/Impact Matrix that shows the probability of risks occurring and the impact or consequences of the risks.

Probability of a risk occurring can be estimated based on several factors as determined by the unique nature of each project . For example factors evaluated for potential H/W or S/W technology risks could include the technology not being mature, the technology being too complex, and an inadequate support base for developing the technology. The impact of a risk occurring could include factors such as availability of fallback solutions or the consequences of not meeting performance , cost and schedule estimates

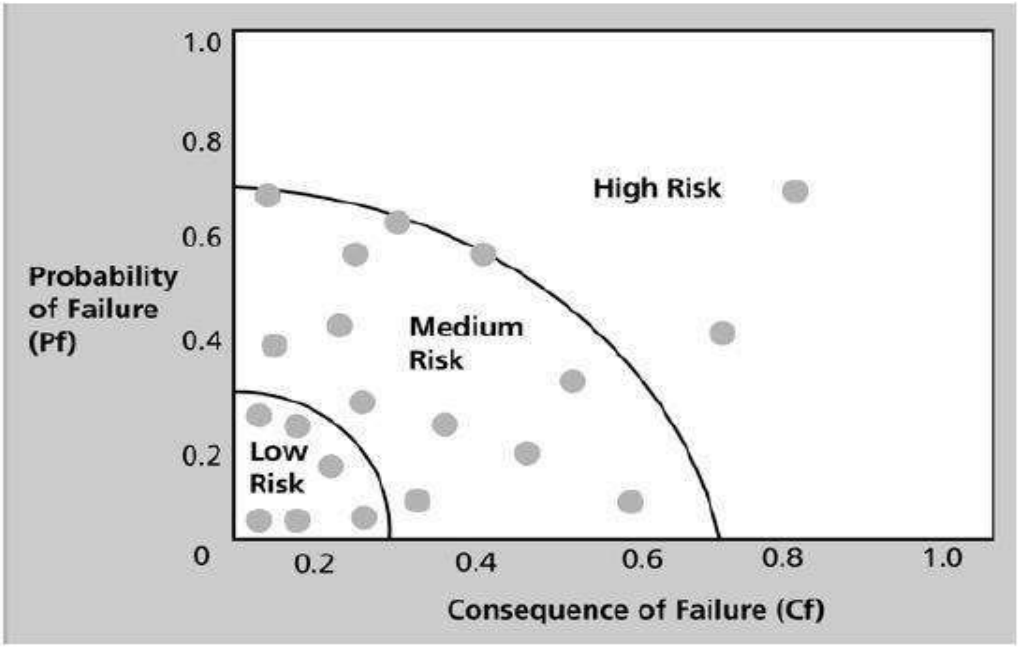
Sample Probability/Impact Matrix



The following figure gives an example of how the risk factors were used to graph the probability of failure and consequence of failure for proposed technologies. The figure classifies potential

technologies (dots on the charts) as high, medium, or low risk based on the probability of failure and consequence of failure. The researchers for this study highly recommended that the US Air Force invest in the low to medium risk technologies and suggested that it not pursue the high risk technologies. It can be seen that the rigor behind using Probability/Impact Matrix and risk factors provides a much stronger argument than simply stating the risk probabilities or consequences are high, medium, or low

Chart Showing High-, Medium-, and Low-Risk Technologies



Top Ten Risk Item Tracking:

Top Ten Risk Item Tracking is a qualitative risk analysis tool that helps to identify risks and maintain an awareness of risks throughout the life of a project. Establish a periodic review of the top ten project risk items.

The review begins with a summary of the status of top ten sources of risk on the project. The summary includes each item's current ranking previous ranking, number of times it appears on the list over a period of time, and a summary of progress made in resolving the risk item since the previous review.

List the current ranking, previous ranking, number of times the risk appears on the list over a period of time, and a summary of progress made in resolving the risk item.

The following figure provides an example of Top Ten Risk Item Tracking chart that could be used at a management review meeting for a project. This includes only the top five negative risk events. Each risk event is ranked based on the current month, previous month, and how many months it has been in the top ten. The last column briefly describes the progress for resolving each particular risk item

Example of Top Ten Risk Item Tracking

	Monthly Ranking			
Risk Item	**This Month**	**Last Month**	**Number of Months**	**Risk Resolution Progress**
Inadequate planning	1	2	4	Working on revising the entire project plan
Poor definition of scope	2	3	3	Holding meetings with project customer and sponsor to clarify scope
Absence of leadership	3	1	2	Just assigned a new project manager to lead the project after old one quit
Poor cost estimates	4	4	3	Revising cost estimates
Poor time estimates	5	5	3	Revising schedule estimates

Expert Judgment:

Many organizations rely on the intuitive feelings and past experience of experts to help identify potential project risks. Experts can categorize risks as high, medium, or low with or without more sophisticated techniques.

The main output of qualitative risk analysis is updating the risk register .The ranking column of the risk register should be filled in along with numeric value or high, medium, low for the probability and impact of the risk event. Additional information is often added for risk events, such as identification of risks that need more attention in the near term or those that can be placed on a watch list. A watch list is a list of risks that are low priority , but are still

identified as potential risks. Qualitative analysis can also identify risks that should be evaluated on a quantitative basis.

QUANTITATIVE RISK ANALYSIS

Often follows qualitative risk analysis, but both can be done together.

Large, complex projects involving leading edge technologies often require extensive quantitative risk analysis. Main techniques include:

Decision tree analysis
Simulation
Sensitivity analysis

Quantitative risk analysis is a way of numerically estimating the probability that a project will meet its cost and time objectives. Quantitative analysis is based on a simultaneous evaluation of the impact of all identified and quantified risks. The result is a probability distribution of the project's cost and completion date based on the identified risks in the project.

Quantitative risk analysis involves statistical techniques, primarily Monte Carlo simulation that is most widely and easily used with specialized software.

Quantitative risk analysis starts with the model of the project, either its project schedule or its cost estimate depending on the objective. The degree of uncertainty in each schedule activity and each line-item cost element is represented by a probability distribution. The probability distribution is usually specified by determining the optimistic, the most likely and the pessimistic values for the activity or cost element – this is typically called the "3-point estimate." The three points are estimated during an interview with subject matter experts who usually focus on the schedule or cost elements one at a time. The risks that lead to the three points are recorded for the quantitative risk analysis report and for risk response planning. For each activity or cost element a probability distribution type is chosen that best represents the risks discussed in the interview. Typical distributions usually include the triangular, beta, normal and uniform.

Decision Trees and Expected monetary Value:

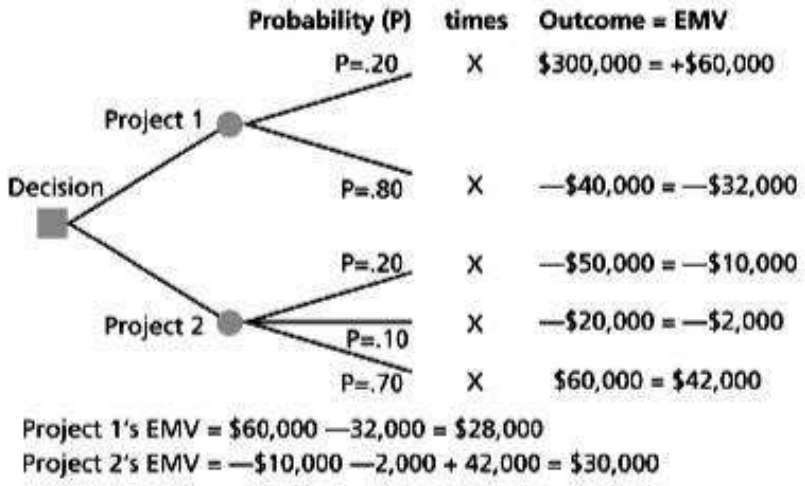
A decision tree is a diagramming analysis technique used to help select the best course of action in situations in which future outcomes are uncertain.

Estimated monetary value (EMV) is the product of a risk event probability and the risk event's monetary value.

You can draw a decision tree to help find the EMV.

To create a decision tree and to calculate expected monetary value specifically, you must estimate the probabilities, of certain events occurring. For example in the following figure there is a 20 percent probability(P=.20) that Cliff's firm will win the contract project1, which is estimated to be $300,000 in profits- the outcome of the top branch in the figure. There is an 80 percent probability that it will not win the contract for the project, and the outcome is estimated to be -$40,000 meaning that the firm has to invest $40,000 into project1with no reimbursement if it is not awarded the contract.

To calculate EMV for each project, multiply the probability by the outcome value for each potential outcome for each project . The EMV for project 1 is 0.2($300,000)+0.8(-40,000)=$60,000-$32000=28,000



Simulation:

A specialized Monte Carlo simulation software program runs (iterates) the project schedule or cost estimate many times, drawing duration or cost values for each iteration at random from the probability distribution derived from the 3-point estimates and probability distribution types selected for each element. The Monte Carlo software develops from the results of the simulation a probability distribution of possible completion dates and project costs. From this distribution it is possible to answer such questions as:

- How likely is the current plan to come in on schedule or on budget?
- How much contingency reserve of time or money is needed to provide the agency with a sufficient degree of certainty?

- Using sensitivity analysis, which activities or line-item cost elements contribute the most to the possibility of overrunning schedule or cost targets?

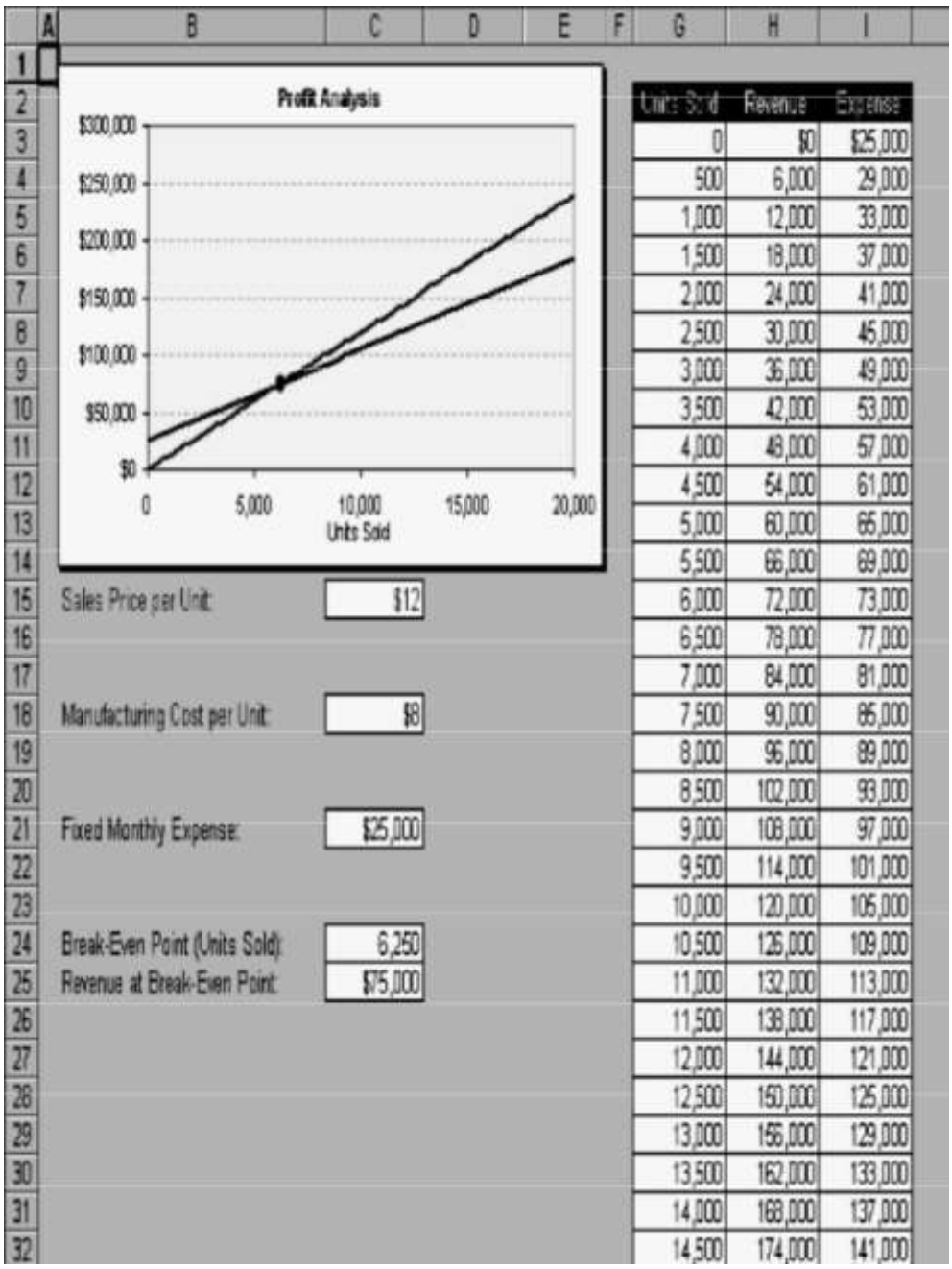
Sensitivity Analysis:

Sensitivity analysis is a technique used to show the effects of changing one or more variables on an outcome.

For example, many people use it to determine what the monthly payments for a loan will be given different interest rates or periods of the loan, or for determining break-even points based on different assumptions.

Spreadsheet software, such as Excel, is a common tool for performing sensitivity analysis.

The following figure shows an example Excel file created to quickly show the break-even point for a product based on various inputs-the sales price per unit, manufacturing cost per unit, and fixed monthly expenses. The current inputs result I a break-even point of 6,250 units sold. Users of this spreadsheet can change inputs and see the effects on the break-even point in chart format. Project teams often create similar models to determine the sensitivity of various project variables.



The main outputs of quantitative risk analysis are updates to the risk register, such as revised risk rankings or detailed information behind those rankings. The quantitative analysis also provides high level information in terms of the probabilities of achieving certain projects objectives. This information might cause the project manager to suggest changes in contingency reserves .

RISK RESPONSE PLANNING

Risk Response Planning is the process of developing options, and determining actions to enhance opportunities and reduce threats to the project's objectives. It focuses on the high-risk items evaluated in the qualitative and/or quantitative risk analysis. In Risk Response Planning parties are identified and assigned to take responsibility for each risk response. This process ensures that each risk requiring a response has an owner monitoring the responses, although a different party may be responsible for implementing the risk handling action itself.

The project manager and the PDT identify which strategy is best for each risk, and then design specific action(s) to implement that strategy.

Strategies for Negative Risks or Threats include:

Avoid: Risk avoidance involves changing the project plan to eliminate the risk or to protect the project objectives (time, cost, scope, quality) from its impact. The team might achieve this by changing scope, adding time, or adding resources (thus relaxing the so-called "triple constraint").

These changes may require a Programming Change Request (PCR). Some negative risks (threats) that arise early in the project can be avoided by clarifying requirements, obtaining information, improving communication, or acquiring expertise.

Transfer: Risk transference requires shifting the negative impact of a threat, along with ownership of the response, to a third party. An example would be the team transfers the financial impact of risk by contracting out some aspect of the work.

Transference reduces the risk only if the contractor is more capable of taking steps to reduce the risk and does so. Risk transference nearly always involves payment of a risk premium to the party taking on the risk.

Transference tools can be quite diverse and include, but are not limited to the use of: insurance, performance bonds, warranties, guarantees, incentive/disincentive clauses, A+B Contracts, etc.

Mitigate. Risk mitigation implies a reduction in the probability and/or impact of an adverse risk event to an acceptable threshold. Taking early action to reduce the probability and/or impact of a risk

is often more effective than trying to repair the damage after the risk has occurred.

Risk mitigation may take resources or time and hence may represent a tradeoff of one objective for another. However, it may

still be preferable to going forward with an unmitigated risk. Monitoring the deliverables closely, increasing the number of parallel activities in the schedule, early involvement of regulatory agencies in the project, early and continuous outreach to communities/advocacy groups, implementing value engineering, performing corridor studies, adopting less complex processes, conducting more tests, or choosing a more stable supplier are examples of mitigation actions.

General Risk Mitigation Strategies for Technical, Cost, and Schedule Risks

Technical Risks	Cost Risks	Schedule Risks
Emphasize team support and avoid stand-alone project structure	Increase the frequency of project monitoring	Increase the frequency of project monitoring
Increase project manager authority	Use WBS and CPM	Use WBS and CPM
Improve problem handling and communication	Improve communication, project goals understanding, and team support	Select the most experienced project manager
Increase the frequency of project monitoring	Increase project manager authority	
Use WBS and CPM		

Strategies for Positive Risks or Opportunities include:

Exploit. The organization wishes to ensure that the opportunity is realized. This strategy seeks to eliminate the uncertainty associated with a particular upside risk by making the opportunity definitely happen. Examples include securing talented resources that may become available for the project.

Share. Allocating ownership to a third party who is best able to capture the opportunity for the benefit of the project. Examples include: forming risk-sharing partnerships, teams, working with elected officials, special-purpose companies, joint ventures, etc.

Enhance. This strategy modifies the size of an opportunity by increasing probability and/or positive impacts, and by identifying and maximizing key drivers of these positive-impact risks. Seeking to facilitate or strengthen the cause of the opportunity, and proactively

targeting and reinforcing its trigger conditions, might increase probability. Impact drivers can also be targeted, seeking to increase the project's susceptibility to the opportunity.