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MANAGING SOFTWARE PROJECTS

MBA 4TH SEM.(18MBA403E)

UNIT-1

INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT

The job pattern of an IT company engaged in software development can be seen split in two parts:

- Software Creation
- Software Project Management

A project is well-defined task, which is a collection of several operations done in order to achieve a goal (for example, software development and delivery). A Project can be characterized as:

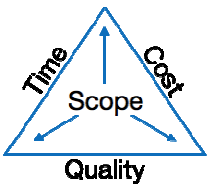
- Every project may has a unique and distinct goal.
- Project is not routine activity or day-to-day operations.
- Project comes with a start time and end time.
- Project ends when its goal is achieved hence it is a temporary phase in the lifetime of an organization.
- Project needs adequate resources in terms of time, manpower, finance, material and knowledge-bank.

Software Project

A Software Project is the complete procedure of software development from requirement gathering to testing and maintenance, carried out according to the execution methodologies, in a specified period of time to achieve intended software product.

Need of software project management

Software is said to be an intangible product. Software development is a kind of all new stream in world business and there's very little experience in building software products. Most software products are tailor made to fit client's requirements. The most important is that the underlying technology changes and advances so frequently and rapidly that experience of one product may not be applied to the other one. All such business and environmental constraints bring risk in software development hence it is essential to manage software projects efficiently.



The image above shows triple constraints for software projects. It is an essential part of software organization to deliver quality product, keeping the cost within client's budget constrain and deliver the project as per scheduled. There are several factors, both internal and external, which may impact this triple constrain triangle. Any of three factor can severely impact the other two.

Therefore, software project management is essential to incorporate user requirements along with budget and time constraints.

Software Project Manager

A software project manager is a person who undertakes the responsibility of executing the software project. Software project manager is thoroughly aware of all the phases of SDLC that the software would go through. Project manager may never directly involve in producing the end product but he controls and manages the activities involved in production.

A project manager closely monitors the development process, prepares and executes various plans, arranges necessary and adequate resources, maintains communication among all team members in order to address issues of cost, budget, resources, time, quality and customer satisfaction.

Let us see few responsibilities that a project manager shoulders -

Managing People

- Act as project leader
- Liaison with stakeholders
- Managing human resources
- Setting up reporting hierarchy etc.

Managing Project

- Defining and setting up project scope
- Managing project management activities
- Monitoring progress and performance
- Risk analysis at every phase
- Take necessary step to avoid or come out of problems
- Act as project spokesperson

Software Management Activities

Software project management comprises of a number of activities, which contains planning of project, deciding scope of software product, estimation of cost in various terms, scheduling of tasks and events, and resource management. Project management activities may include:

- **Project Planning**
- **Scope Management**
- **Project Estimation**

Project Planning

Software project planning is task, which is performed before the production of software actually starts. It is there for the software production but involves no concrete activity that has any direction connection with software production; rather it is a set of multiple processes, which facilitates software production. Project planning may include the following:

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Scope Management

It defines the scope of project; this includes all the activities, process need to be done in order to make a deliverable software product. Scope management is essential because it creates boundaries of the project by clearly defining what would be done in the project and what would not be done. This makes project to contain limited and quantifiable tasks, which can easily be documented and in turn avoids cost and time overrun.

During Project Scope management, it is necessary to -

- Define the scope
- Decide its verification and control
- Divide the project into various smaller parts for ease of management.
- Verify the scope
- Control the scope by incorporating changes to the scope

Project Estimation

For an effective management accurate estimation of various measures is a must. With correct estimation managers can manage and control the project more efficiently and effectively.

Project estimation may involve the following:

- **Software size estimation**

  Software size may be estimated either in terms of KLOC (Kilo Line of Code) or by calculating number of function points in the software. Lines of code depend upon coding practices and Function points vary according to the user or software requirement.

- **Effort estimation**

  The managers estimate efforts in terms of personnel requirement and man-hour required to produce the software. For effort estimation software size should be known. This can either be derived by managers' experience, organization's historical data or software size can be converted into efforts by using some standard formulae.

- **Time estimation**

  Once size and efforts are estimated, the time required to produce the software can be estimated. Efforts required is segregated into sub categories as per the requirement specifications and interdependency of various components of software. Software tasks are divided into smaller tasks, activities or events by Work Breakthrough Structure (WBS). The tasks are scheduled on day-to-day basis or in calendar months.

  The sum of time required to complete all tasks in hours or days is the total time invested to complete the project.

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- **Cost estimation**

  This might be considered as the most difficult of all because it depends on more elements than any of the previous ones. For estimating project cost, it is required to consider -

  - Size of software
  - Software quality
  - Hardware
  - Additional software or tools, licenses etc.
  - Skilled personnel with task-specific skills
  - Travel involved
  - Communication
  - Training and support

Project Estimation Techniques

We discussed various parameters involving project estimation such as size, effort, time and cost.

Project manager can estimate the listed factors using two broadly recognized techniques –

Decomposition Technique

This technique assumes the software as a product of various compositions.

There are two main models -

- **Line of Code** Estimation is done on behalf of number of line of codes in the software product.
- **Function Points** Estimation is done on behalf of number of function points in the software product.

Empirical Estimation Technique

This technique uses empirically derived formulae to make estimation.These formulae are based on LOC or FPs.

- **Putnam Model**

  This model is made by Lawrence H. Putnam, which is based on Norden's frequency distribution (Rayleigh curve). Putnam model maps time and efforts required with software size.

- **COCOMO**

  COCOMO stands for COnstructive COst MOdel, developed by Barry W. Boehm. It divides the software product into three categories of software: organic, semi-detached and embedded.

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Project Scheduling

Project Scheduling in a project refers to roadmap of all activities to be done with specified order and within time slot allotted to each activity. Project managers tend to define various tasks, and project milestones and arrange them keeping various factors in mind. They look for tasks lie in critical path in the schedule, which are necessary to complete in specific manner (because of task interdependency) and strictly within the time allocated. Arrangement of tasks which lies out of critical path are less likely to impact over all schedule of the project.

For scheduling a project, it is necessary to -

- Break down the project tasks into smaller, manageable form
- Find out various tasks and correlate them
- Estimate time frame required for each task
- Divide time into work-units
- Assign adequate number of work-units for each task
- Calculate total time required for the project from start to finish

Resource management

All elements used to develop a software product may be assumed as resource for that project. This may include human resource, productive tools and software libraries.

The resources are available in limited quantity and stay in the organization as a pool of assets. The shortage of resources hampers the development of project and it can lag behind the schedule. Allocating extra resources increases development cost in the end. It is therefore necessary to estimate and allocate adequate resources for the project.

Resource management includes -

- Defining proper organization project by creating a project team and allocating responsibilities to each team member
- Determining resources required at a particular stage and their availability
- Manage Resources by generating resource request when they are required and de-allocating them when they are no more needed.

Project Risk Management

Risk management involves all activities pertaining to identification, analyzing and making provision for predictable and non-predictable risks in the project. Risk may include the following:

- Experienced staff leaving the project and new staff coming in.
- Change in organizational management.
- Requirement change or misinterpreting requirement.
- Under-estimation of required time and resources.
- Technological changes, environmental changes, business competition.

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Risk Management Process

There are following activities involved in risk management process:

- **Identification -** Make note of all possible risks, which may occur in the project.
- **Categorize -** Categorize known risks into high, medium and low risk intensity as per their possible impact on the project.
- **Manage -** Analyze the probability of occurrence of risks at various phases. Make plan to avoid or face risks. Attempt to minimize their side-effects.
- **Monitor -** Closely monitor the potential risks and their early symptoms. Also monitor the effects of steps taken to mitigate or avoid them.

Project Execution & Monitoring

In this phase, the tasks described in project plans are executed according to their schedules.

Execution needs monitoring in order to check whether everything is going according to the plan. Monitoring is observing to check the probability of risk and taking measures to address the risk or report the status of various tasks.

These measures include -

- **Activity Monitoring -** All activities scheduled within some task can be monitored on day-to-day basis. When all activities in a task are completed, it is considered as complete.
- **Status Reports -** The reports contain status of activities and tasks completed within a given time frame, generally a week. Status can be marked as finished, pending or work-in-progress etc.
- **Milestones Checklist -** Every project is divided into multiple phases where major tasks are performed (milestones) based on the phases of SDLC. This milestone checklist is prepared once every few weeks and reports the status of milestones.

Project Communication Management

Effective communication plays vital role in the success of a project. It bridges gaps between client and the organization, among the team members as well as other stake holders in the project such as hardware suppliers.

Communication can be oral or written. Communication management process may have the following steps:

- **Planning** - This step includes the identifications of all the stakeholders in the project and the mode of communication among them. It also considers if any additional communication facilities are required.
- **Sharing** - After determining various aspects of planning, manager focuses on sharing correct information with the correct person on correct time. This keeps every one involved the project up to date with project progress and its status.
- **Feedback** - Project managers use various measures and feedback mechanism and create status and performance reports. This mechanism ensures that input from various stakeholders is coming to the project manager as their feedback.

- **Closure** - At the end of each major event, end of a phase of SDLC or end of the project itself, administrative closure is formally announced to update every stakeholder by sending email, by distributing a hardcopy of document or by other mean of effective communication.

After closure, the team moves to next phase or project.

Configuration Management

Configuration management is a process of tracking and controlling the changes in software in terms of the requirements, design, functions and development of the product.

IEEE defines it as "the process of identifying and defining the items in the system, controlling the change of these items throughout their life cycle, recording and reporting the status of items and change requests, and verifying the completeness and correctness of items".

Generally, once the SRS is finalized there is less chance of requirement of changes from user. If they occur, the changes are addressed only with prior approval of higher management, as there is a possibility of cost and time overrun.

Baseline

A phase of SDLC is assumed over if it baselined, i.e. baseline is a measurement that defines completeness of a phase. A phase is baselined when all activities pertaining to it are finished and well documented. If it was not the final phase, its output would be used in next immediate phase.

Configuration management is a discipline of organization administration, which takes care of occurrence of any change (process, requirement, technological, strategical etc.) after a phase is baselined. CM keeps check on any changes done in software.

Change Control

Change control is function of configuration management, which ensures that all changes made to software system are consistent and made as per organizational rules and regulations.

A change in the configuration of product goes through following steps -

- **Identification** - A change request arrives from either internal or external source. When change request is identified formally, it is properly documented.
- **Validation** - Validity of the change request is checked and its handling procedure is confirmed.
- **Analysis** - The impact of change request is analyzed in terms of schedule, cost and required efforts. Overall impact of the prospective change on system is analyzed.
- **Control** - If the prospective change either impacts too many entities in the system or it is unavoidable, it is mandatory to take approval of high authorities before change is incorporated into the system. It is decided if the change is worth incorporation or not. If it is not, change request is refused formally.
- **Execution** - If the previous phase determines to execute the change request, this phase take appropriate actions to execute the change, does a thorough revision if necessary.

- **Close request** - The change is verified for correct implementation and merging with the rest of the system. This newly incorporated change in the software is documented properly and the request is formally is closed.

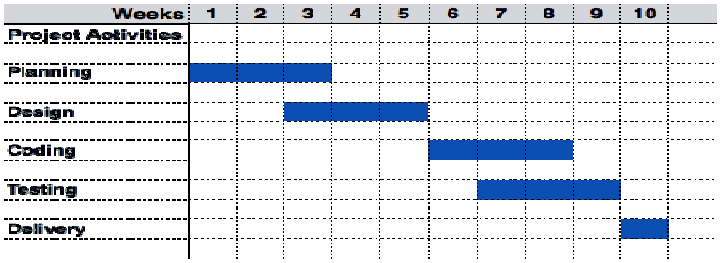
Project Management Tools

The risk and uncertainty rises multifold with respect to the size of the project, even when the project is developed according to set methodologies.

There are tools available, which aid for effective project management. A few are described -

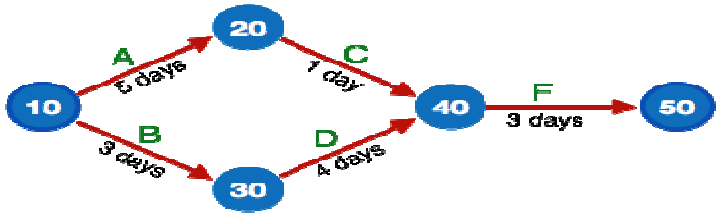
Gantt Chart

Gantt charts was devised by Henry Gantt (1917). It represents project schedule with respect to time periods. It is a horizontal bar chart with bars representing activities and time scheduled for the project activities.



PERT Chart

PERT (Program Evaluation & Review Technique) chart is a tool that depicts project as network diagram. It is capable of graphically representing main events of project in both parallel and consecutive way. Events, which occur one after another, show dependency of the later event over the previous one.



Events are shown as numbered nodes. They are connected by labeled arrows depicting sequence of tasks in the project.

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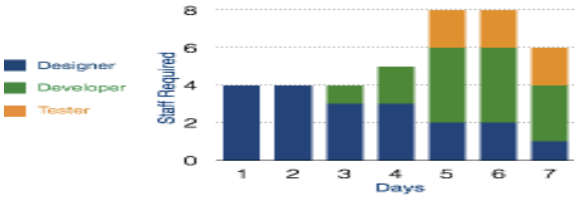
Resource Histogram

This is a graphical tool that contains bar or chart representing number of resources (usually skilled staff) required over time for a project event (or phase). Resource Histogram is an effective tool for staff planning and coordination.

Staff	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Designer	4	4	3	3	2	2	1
Developer	0	0	1	2	4	4	3
Tester	0	0	0	0	2	2	2
Total	4	4	4	5	8	8	6



Software Project Management Activities

Like typical project management, IT project management involves number of activities to plan, track, monitor and deliver project. Software project management also involves certain activities about software development and maintenance. Software project management can include following activities:

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- IT Project Planning & Tracking
- IT Project Resource Management
- IT Project Budget, Cost and Billing Management
- IT Project Bug/Issues Tracking
- IT Project Risk Management
- IT Project Change Request Management
- IT Project Document Management
- IT Project Communication Management
- IT Project Stakeholder Management
- IT Configuration Management
- IT Integration Management
- IT Procurement Management

In order to get a holistic view and better control over project project managers prefer to use project management software for IT teams.

some ways of categorizing software projects

It is important to distinguish between the main types of software project because what is appropriate in one context might not be so in another. For example, SSADM, the Structured Systems Analysis and Design Method, is suitable for developing information systems but not necessarily other types of system.

Embedded systems are also called real-time or industrial systems.

Information systems versus embedded systems

A distinction may be made between information systems and embedded systems. Very crudely, the difference is that in the former case the system interfaces with the organization, whereas in the latter case the system interfaces with a machine! A stock control system would be an information system that controls when the organization reorders stock. An embedded, or process control, system might control the air conditioning equipment in a building. Some systems may have elements of both so that the stock control system might also control an automated warehouse.

Would an operating system on a computer be an information system or an embedded system?

Service level agreements are becoming increasingly important as organizations contract out functions to external service suppliers.

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Objectives versus products

Projects may be distinguished by whether their aim is to produce a product or to meet certain objectives.

A project might be to create a product the details of which have been specified by the client. The client has the responsibility for justifying the product.

On the other hand, the project might be required to meet certain objectives. There might be several ways of achieving these objectives in contrast to the constraints of the product-driven project. One example of this is where a new information system is implemented to improve some service to users inside or outside an organization. The subject of an agreement would be the level of service rather than the characteristics of a particular information system.

Many software projects have two stages. The first stage is an objectives-driven project, which results in a recommended course of action and may even specify a new software application to meet identified requirements. The next stage is a project actually to create the software product.

Stakeholder Management

A project is successful when it achieves its objectives and meets or exceeds the expectations of the stakeholders. But who are the stakeholders? Stakeholders are individuals who either care about or have a vested interest in your project. They are the people who are actively involved with the work of the project or have something to either gain or lose as a result of the project. When you manage a project to add lanes to a highway, motorists are stakeholders who are positively affected. However, you negatively affect residents who live near the highway during your project (with construction noise) and after your project with far-reaching implications (increased traffic noise and pollution).

NOTE: Key stakeholders can make or break the success of a project. Even if all the deliverables are met and the objectives are satisfied, if your key stakeholders aren't happy, nobody's happy.

The project sponsor, generally an executive in the organization with the authority to assign resources and enforce decisions regarding the project, is a stakeholder. The customer, subcontractors, suppliers, and sometimes even the government are stakeholders. The project manager, project team members, and the managers from other departments in the organization are stakeholders as well. It's important to identify all the stakeholders in your project upfront. Leaving out important stakeholders or their department's function and not discovering the error until well into the project could be a project killer.

First, the number of stakeholders that project managers must deal with ensures that they will have a complex job guiding their project through the lifecycle. Problems with any of these members can derail the project.

Second, the diagram shows that project managers have to deal with people external to the organization as well as the internal environment, certainly more complex than what a manager in an internal environment faces. For example, suppliers who are late in delivering crucial parts may blow the project schedule. To compound the problem, project managers generally have little or no direct control over any of these individuals.

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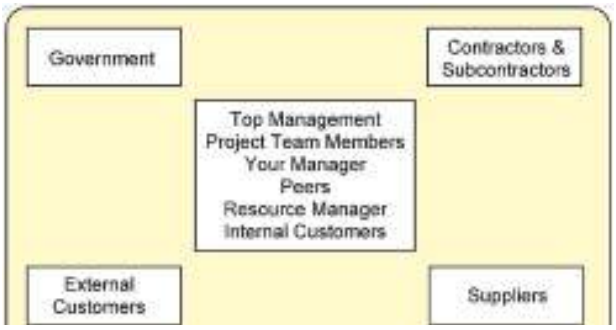

Figure : Project stakeholders. In a project, there are both internal and external stakeholders. Internal stakeholders may include top management, project team members, your manager, peers, resource manager, and internal customers. External stakeholders may include external customers, government, contractors and subcontractors, and suppliers.

Project Stakeholders

Top Management

Top management may include the president of the company, vice-presidents, directors, division managers, the corporate operating committee, and others. These people direct the strategy and development of the organization.

On the plus side, you are likely to have top management support, which means it will be easier to recruit the best staff to carry out the project, and acquire needed material and resources; also visibility can enhance a project manager's professional standing in the company.

On the minus side, failure can be quite dramatic and visible to all, and if the project is large and expensive (most are), the cost of failure will be more substantial than for a smaller, less visible project.

Some suggestions in dealing with top management are:

- Develop in-depth plans and major milestones that must be approved by top management during the planning and design phases of the project.
- Ask top management associated with your project for their information reporting needs and frequency.
- Develop a status reporting methodology to be distributed on a scheduled basis.
- Keep them informed of project risks and potential impacts at all times.

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The Project Team

The project team is made up of those people dedicated to the project or borrowed on a part-time basis. As project manager, you need to provide leadership, direction, and above all, the support to team members as they go about accomplishing their tasks. Working closely with the team to solve problems can help you learn from the team and build rapport. Showing your support for the project team and for each member will help you get their support and cooperation.

Here are some difficulties you may encounter in dealing with project team members:

- Because project team members are borrowed and they don't report to you, their priorities may be elsewhere.
- They may be juggling many projects as well as their full-time job and have difficulty meeting deadlines.
- Personality conflicts may arise. These may be caused by differences in social style or values or they may be the result of some bad experience when people worked together in the past.
- You may find out about missed deadlines when it is too late to recover.

Managing project team members requires interpersonal skills. Here are some suggestions that can help:

- Involve team members in project planning.
- Arrange to meet privately and informally with each team member at several points in the project, perhaps for lunch or coffee.
- Be available to hear team members' concerns at any time.
- Encourage team members to pitch in and help others when needed.
- Complete a project performance review for team members.

Your Manager

Typically the boss decides what the assignment is and who can work with the project manager on projects. Keeping your manager informed will help ensure that you get the necessary resources to complete your project.

If things go wrong on a project, it is nice to have an understanding and supportive boss to go to bat for you if necessary. By supporting your manager, you will find your manager will support you more often.

- Find out exactly how your performance will be measured.
- When unclear about directions, ask for clarification.
- Develop a reporting schedule that is acceptable to your boss.
- Communicate frequently.

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Peers

Peers are people who are at the same level in the organization as you and may or may not be on the project team. These people will also have a vested interest in the product. However, they will have neither the leadership responsibilities nor the accountability for the success or failure of the project that you have.

Your relationship with peers can be impeded by:

- Inadequate control over peers
- Political maneuvering or sabotage
- Personality conflicts or technical conflicts
- Envy because your peer may have wanted to lead the project
- Conflicting instructions from your manager and your peer's manager

Peer support is essential. Because most of us serve our self-interest first, use some investigating, selling, influencing, and politicking skills here. To ensure you have cooperation and support from your peers:

- Get the support of your project sponsor or top management to empower you as the project manager with as much authority as possible. It's important that the sponsor makes it clear to the other team members that their cooperation on project activities is expected.
- Confront your peer if you notice a behaviour that seems dysfunctional, such as bad-mouthing the project.
- Be explicit in asking for full support from your peers. Arrange for frequent review meetings.
- Establish goals and standards of performance for all team members.

Resource Managers

Because project managers are in the position of borrowing resources, other managers control their resources. So their relationships with people are especially important. If their relationship is good, they may be able to consistently acquire the best staff and the best equipment for their projects. If relationships aren't good, they may find themselves not able to get good people or equipment needed on the project.

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Internal Customers

Internal customers are individuals within the organization who are customers for projects that meet the needs of internal demands. The customer holds the power to accept or reject your work. Early in the relationship, the project manager will need to negotiate, clarify, and document project specifications and deliverables. After the project begins, the project manager must stay tuned in to the customer's concerns and issues and keep the customer informed.

Common stumbling blocks when dealing with internal customers include:

- A lack of clarity about precisely what the customer wants
- A lack of documentation for what is wanted
- A lack of knowledge of the customer's organization and operating characteristics
- Unrealistic deadlines, budgets, or specifications requested by the customer
- Hesitancy of the customer to sign off on the project or accept responsibility for decisions
- Changes in project scope

To meet the needs of the customer, client, or owner, be sure to do the following:

- Learn the client organization's buzzwords, culture, and business.
- Clarify all project requirements and specifications in a written agreement.
- Specify a change procedure.
- Establish the project manager as the focal point of communications in the project organization.

External customer

External customers are the customers when projects could be marketed to outside customers. In the case of Ford Motor Company, for example, the external customers would be the buyers of the automobiles. Also if you are managing a project at your company for Ford Motor Company, they will be your external customer.

Government

Project managers working in certain heavily regulated environments (e.g., pharmaceutical, banking, or military industries) will have to deal with government regulators and departments. These can include all or some levels of government from municipal, provincial, federal, to international.

Contractors, subcontractors, and suppliers

There are times when organizations don't have the expertise or resources available in-house, and work is farmed out to contractors or subcontractors. This can be a construction management foreman, network consultant, electrician, carpenter, architect, or anyone who is not an employee.

Managing contractors or suppliers requires many of the skills needed to manage full-time project team members.

Any number of problems can arise with contractors or subcontractors:

- Quality of the work
- Cost overruns
- Schedule slippage

Many projects depend on goods provided by outside suppliers. This is true for example of construction projects where lumber, nails, bricks, and mortar come from outside suppliers. If the supplied goods are delivered late or are in short supply or of poor quality or if the price is greater than originally quoted, the project may suffer.

Depending on the project, managing contractor and supplier relationships can consume more than half of the project manager's time. It is not purely intuitive; it involves a sophisticated skill set that includes managing conflicts, negotiating, and other interpersonal skills.

Politics of Projects

Many times, project stakeholders have conflicting interests. It's the project manager's responsibility to understand these conflicts and try to resolve them. It's also the project manger's responsibility to manage stakeholder expectations. Be certain to identify and meet with all key stakeholders early in the project to understand all their needs and constraints.

Project managers are somewhat like politicians. Typically, they are not inherently powerful or capable of imposing their will directly on coworkers, subcontractors, and suppliers. Like politicians, if they are to get their way, they have to exercise influence effectively over others. On projects, project managers have direct control over very few things; therefore their ability to influence others – to be a good politician – may be very important

Here are a few steps a good project politician should follow. However, a good rule is that when in doubt, stakeholder conflicts should always be resolved in favour of the customer.

Assess the environment

Identify all the relevant stakeholders. Because any of these stakeholders could derail the project, you need to consider their particular interest in the project.

- Once all relevant stakeholders are identified, try to determine where the power lies.
- In the vast cast of characters, who counts most?
- Whose actions will have the greatest impact?

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Identify goals

After determining who the stakeholders are, identify their goals.

- What is it that drives them?
- What is each after?
- Are there any hidden agendas or goals that are not openly articulated?
- What are the goals of the stakeholders who hold the power? These deserve special attention.

Define the problem

- The facts that constitute the problem should be isolated and closely examined.
- The question "What is the real situation?" should be raised over and over.

Culture of Stakeholders

When project stakeholders do not share a common culture, project management must adapt its organizations and work processes to cope with cultural differences. The following are three major aspects of cultural difference that can affect a project:

1. Communications
2. Negotiations
3. Decision making

Communication is perhaps the most visible manifestation of culture. Project managers encounter cultural differences in communication in language, context, and candor.

Language is clearly the greatest barrier to communication. When project stakeholders do not share the same language, communication slows down and is often filtered to share only information that is deemed critical.

The barrier to communication can influence project execution where quick and accurate exchange of ideas and information is critical.

The interpretation of information reflects the extent that context and candor influence cultural expressions of ideas and understanding of information. In some cultures, an affirmative answer to a question does not always mean yes. The cultural influence can create confusion on a project where project stakeholders represent more than one culture.

Example: Culture Affects Communication in Mumbai

A project management consultant from the United States was asked to evaluate the effectiveness of a U.S. project management team executing a project in Mumbai, India. The project team reported that the project was on schedule and within budget. After a project review meeting where each of

the engineering leads reported that the design of the project was on schedule, the consultant began informal discussions with individual engineers and began to discover that several critical aspects of the project were behind schedule. Without a mitigating strategy, the project would miss a critical window in the weather between monsoon seasons. The information on the project flowed through a cultural expectation to provide positive information. The project was eventually canceled by the U.S. corporation when the market and political risks increased.

Not all cultural differences are related to international projects. Corporate cultures and even regional differences can create cultural confusion on a project.

Example: Cultural Differences between American Regions

On a major project in South America that included project team leaders from seven different countries, the greatest cultural difference that affected the project communication was between two project leaders from the United States. Two team members, one from New Orleans and one from Brooklyn, had more difficulty communicating than team members from Lebanon and Australia.

Managing Stakeholders

Often there is more than one major stakeholder in the project. An increase in the number of stakeholders adds stress to the project and influences the project's complexity level. The business or emotional investment of the stakeholder in the project and the ability of the stakeholder to influence the project outcomes or execution approach will also influence the stakeholder complexity of the project. In addition to the number of stakeholders and their level of investment, the degree to which the project stakeholders agree or disagree influences the project's complexity.

A small commercial construction project will typically have several stakeholders. All the building permitting agencies, environmental agencies, and labour and safety agencies have an interest in the project and can influence the execution plan of the project. The neighbours will have an interest in the architectural appeal, the noise, and the purpose of the building.

Example: Tire Plant in India

A U.S. chemical company chartered a project team to design and build a plant to produce the raw materials for building truck tires designed for unpaved roads. The plant was to be built in India a few years after an accident that killed several Indians and involved a different U.S. chemical company. When the company announced the new project and began to break ground, the community backlash was so strong that the project was shut down. A highly involved stakeholder can significantly influence your project.

Example: Wind Turbine on a College Campus

A small college in South Carolina won a competitive grant to erect and operate a wind turbine on campus. The engineering department submitted the grant as a demonstration project for engineering students to expose students to wind technology. The campus facilities department found only one location for the wind turbine that would not disrupt the flow of traffic on campus. The engineering department found that location unacceptable for students who had to maintain the

wind turbine. The county construction permitting department had no policies for permitting a wind turbine and would not provide a building permit. The college had to go to the county council and get an exception to county rules. The marketing department wanted the wind turbine placed in a highly visible location to promote the innovative approach of the college.

Each of the college's stakeholders had a legitimate interest in the location of the wind turbine. The number of stakeholders on the project, multiplied by their passion for the subject and the lack of agreement on the location, increased the complexity of the project. Significant time and resources of a project will be dedicated to identifying, understanding, and managing client expectations.

Example: Stakeholders and a Bridge Project

The Department of Highways chartered a project to upgrade a number of bridges that crossed the interstate in one of the larger cities in South Carolina. The closing of these bridges severely impacted traffic congestion, including a large shopping mall. The contract included provisions for minimizing the impact on the traffic and communities near the construction areas. This provision allowed businesses or interested parties to review the project schedule and make suggestions that would lessen the impact of the construction. The project leadership invested significant time and resources in developing alignment among the various political stakeholders on the project approach and schedule.

Relationship Building Tips

Take the time to identify all stakeholders before starting a new project. Include those who are impacted by the project, as well as groups with the ability to impact the project. Then, begin the process of building strong relationships with each one using the following method.

- **Analyze stakeholders:** Conduct a stakeholder analysis, or an assessment of a project's key participants, and how the project will affect their problems and needs. Identify their individual characteristics and interests. Find out what motivates them, as well as what provokes them. Define roles and level of participation, and determine if there are conflicts of interest among groups of stakeholders.
- **Assess influence**: Measure the degree to which stakeholders can influence the project. The more influential a stakeholder is, the more a project manager will need their support. Think about the question, "What's in it for them?" when considering stakeholders. Knowing what each stakeholder needs or wants from the project will enable the project manager to gauge his or her level of support. And remember to balance support against influence. Is it more important to have strong support from a stakeholder with little influence, or lukewarm support from one with a high level of influence?
- **Understand their expectations**: Nail down stakeholders' specific expectations. Ask for clarification when needed to be sure they are completely understood.
- **Define "success"**: Every stakeholder may have a different idea of what project success looks like. Discovering this at the end of the project is a formula for failure. Gather definitions up front and include them in the objectives to help ensure that all stakeholders will be supportive of the final outcomes.

- **Keep stakeholders involved**: Don't just report to stakeholders. Ask for their input. Get to know them better by scheduling time for coffee, lunch, or quick meetings. Measure each stakeholder's capacity to participate and honour time constraints.
- **Keep stakeholders informed**: Send regular status updates. Daily may be too much; monthly is not enough. One update per week is usually about right. Hold project meetings as required, but don't let too much time pass between meetings. Be sure to answer stakeholders' questions and emails promptly. Regular communication is always appreciated – and may even soften the blow when you have bad news to share.

These are the basics of building strong stakeholder relationships. But as in any relationship, there are subtleties that every successful project manager understands – such as learning the differences between and relating well to different types stakeholders.

How to Relate to Different Types of Stakeholders

By conducting a stakeholder analysis, project managers can gather enough information on which to build strong relationships – regardless of the differences between them. For example, the needs and wants of a director of marketing will be different from those of a chief information officer. Therefore, the project manager's engagement with each will need to be different as well.

Stakeholders with financial concerns will need to know the potential return of the project's outcomes. Others will support projects if there is sound evidence of their value to improving operations, boosting market share, increasing production, or meeting other company objectives.

Keep each stakeholder's expectations and needs in mind throughout each conversation, report or email, no matter how casual or formal the communication may be. Remember that the company's interests are more important than any individual's – yours or a stakeholder's. When forced to choose between them, put the company's needs first.

No matter what their needs or wants, all stakeholders will respect the project manager who:

- Is always honest, even when telling them something they don't want to hear
- Takes ownership of the project
- Is predictable and reliable
- Stands by his or her decisions
- Takes accountability for mistakes

Supportive Stakeholders are Essential to Project Success

Achieving a project's objectives takes a focused, well-organized project manager who can engage with a committed team and gain the support of all stakeholders. Building strong, trusting relationships with interested parties from the start can make the difference between project success and failure.

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Tools to Help Stakeholder Management

There are many project decelerators, among them lack of stakeholder support. Whether the stakeholders support your project or not, if they are important to your project, you must secure their support. How do you do that?

First, you must identify who your stakeholders are. Just because they are important in the organization does not necessarily mean they are important to your project. Just because they think they are important does not mean they are. Just because they don't think they need to be involved does not mean they do not have to be. The typical suspects: your manager, your manager's manager, your client, your client's manager, any SME (subject matter expert) whose involvement you need, and the board reviewing and approving your project. Note that in some situations there are people who think they are stakeholders. From your perspective they may not be, but be careful how you handle them. They could be influential with those who have the power to impact your project. Do not dismiss them out of hand.

Second, you need to determine what power they have and what their intentions toward your project are. Do they have the power to have an impact on your project? Do they support or oppose you? What strategies do you follow with them?

Third, what's the relationship among stakeholders? Can you improve your project's chances by working with those who support you to improve the views of those who oppose you? Table 5.1 summarizes the options based on an assessment of your stakeholders' potential for cooperation and potential for threat.

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Managing Software Projects

MBA 4TH SEM.(18MBA403E)

UNIT-2

Project evaluation and programme management

- The business case for a project
- Project portfolios
- Project evaluation
  - Σ Cost benefit analysis
  - Σ Cash flow forecasting
- Programme management
- Benefits management

The business case

- Feasibility studies can also act as a 'business case'
- Provides a justification for starting the project
- Should show that the benefits of the project will exceed development, implementation and operational costs
- Needs to take account of business risks

Contents of a business case

1. Introduction/ background
2. The proposed project
3. The market
4. Organizational and operational infrastructure
5. The benefits
6. Outline implementation plan
7. Costs
8. The financial case
9. Risks
10. Management plan

- **Introduction/background:** describes a problem to be solved or an opportunity to be exploited
- **The proposed project:** a brief outline of the project scope

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- **The market:** the project could be to develop a new product (e.g. a new computer game). The likely demand for the product would need to be assessed.
- **Organizational and operational infrastructure:** How the organization would need to change. This would be important where a new information system application was being introduced.
- **Benefits** These should be express in financial terms where possible. In the end it is up to the client to assess these – as they are going to pay for the project.
- **Outline implementation plan:** how the project is going to be implemented. This should consider the disruption to an organization that a project might cause.
- **Costs:** the implementation plan will supply information to establish these
- **Financial analysis:** combines costs and benefit data toΣ establish value of project

Project portfolio management

The concerns of project portfolio management include:

- Evaluating proposals for projects
- Assessing the risk involved with projects
- Deciding how to share resources between projects
- Taking account of dependencies between projects
- Removing duplication between projects
- Checking for gaps

There are three elements to PPM:

1. **Project portfolio definition**
    - Create a central record of all projects within an organization
    - Must decide whether to have ALL projects in the repository or, say, only ICT projects
    - Note difference between new product development (NPD) projects and renewal projects e.g. for process improvement
2. **Project portfolio management**
   Actual costing and performance of projects can be recorded and assessed
3. **Project portfolio optimization**
   Information gathered above can be used achieve better balance of projects e.g. some that are risky but potentially very valuable balanced by less risky but less valuable projects
   You may want to allow some work to be done outside the portfolio e.g. quick fixes

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Cost benefit analysis (CBA)

This relates to an individual project. You need to:

-> Identify all the costs which could be:

Σ Development costs

Σ Set-up

Σ Operational costs

-> Identify the value of benefits

->Check benefits are greater than costs

Product/system life cycle cash flows

-> The timing of costs and income for a product of system needs to be estimated.

-> The development of the project will incur costs.

->When the system or product is released it will generate incomeΣ that gradually pays off costs

Cost Benefit Analysis

Cost-benefit analysis (CBA) is a technique used to compare the total costs of a programme/project with its benefits, using a common metric (most commonly monetary units). This enables the calculation of the net cost or benefit associated with the programme.

As a technique, it is used most often at the start of a programme or project when different options or courses of action are being appraised and compared, as an option for choosing the best approach. It can also be used, however, to evaluate the overall impact of a programme in quantifiable and monetised terms.

CBA adds up the total costs of a programme or activity and compares it against its total benefits. The technique assumes that a monetary value can be placed on all the costs and benefits of a programme, including tangible and intangible returns to other people and organisations in addition to those immediately impacted. As such, a major advantage of cost-benefit analysis lies in forcing people to explicitly and systematically consider the various factors which should influence strategic choice.

Decisions are made through CBA by comparing the net present value (NPV) of the programme or project's costs with the net present value of its benefits. Decisions are based on whether there is a net benefit or cost to the approach, i.e. total benefits less total costs. Costs and benefits that occur in the future have less weight attached to them in a cost-benefit analysis. To account for this, it is necessary to 'discount' or reduce the value of future costs or benefits to place them on a par with costs and benefits incurred today. The 'discount rate' will vary depending on the sector or industry,

but public sector activity generally uses a discount rate of 5-6%. The sum of the discounted benefits of an option minus the sum of the discounted costs, all discounted to the same base date, is the 'net present value' of the option.

Example-In 2005 the UK Government undertook a value for money analysis of Government investment in different types of childcare. The choice was between higher cost "integrated" childcare centres, providing a range of services to both children and parents, or lower cost "non-integrated" centres that provided basic childcare facilities.

The analysis included both a 'hard exercise' and a 'soft exercise'. The hard exercise identified, quantified and monetised direct costs and benefits. The soft exercise identified and described qualitatively non-magnetisable impacts, leading to option ranking.

Risk Evaluation

Risk evaluation is defined by the Business Dictionary as: "Determination of risk management priorities through establishment of qualitative and/or quantitative relationships between benefits and associated risks."

So how does that relate to managed service providers or IT administrators?

Anyone responsible for a company's data, server, network or software must perform a risk evaluation. A risk evaluation can help determine if those assets are at risk for a cyber attack, virus, data loss through natural disaster or any other threat.

The benefit of a risk evaluation is simple — it provides IT professionals with knowledge of where and how their business and reputation are at risk.

Performing a Risk Evaluation

A risk evaluation can be performed in five simple steps.

1. **Identify and prioritize assets**. Consider all the different types of data, software applications, servers and other assets that are managed. Determine which of these is the most sensitive or would be the most damaging to the company if compromised.

2. **Locate assets**. Find and list the source of those assets. Be it desktop office computers, mobile devices, internal servers or anything else, you'll want to trace each asset back to its source.

3. **Classify assets**. Categorize each asset as either public information, sensitive internal information, non-sensitive internal information, compartmentalized internal information and regulated information.

4. **Perform a threat modeling exercise**. Identify and rate all the threats faced by your top-rated assets. Microsoft's STRIDE method is a popular one.

5. **Finalize data and make a plan**. Once you have your evaluation, it's time to start tackling those risks, beginning with the most critical.

What is Programme Management?

What is a programme?

Successful programmes enable transformational changes for or within an organization. They exist to coordinate, direct and oversee implementation of a set of **interrelated projects** to deliver outcomes and their benefits, which are aligned to an organization's **strategic objectives**.

A programme may comprise projects across different areas of the business. For example, the launch of a new product or service may rely on projects running in the sales, marketing, distribution and IT departments, all of which are focused on delivering the outcome required by the programme. A programme can be a **standalone programme** or form part of **a portfolio**.

While a project is typically focused on delivering a specific output, a programme may deliver ongoing outcomes and business benefits. Programmes usually last between one and two years.

What is programme management?

Programme management is the overall management of the interrelated projects that make up the programme. It also involves linking in with the **business change** functions within the business areas affected to ensure that the changes are properly implemented. As with project management, planning work and tasks is a key part of programme management, but the work is more closely aligned to the organization's **ongoing strategy**, rather than specific deliverables.

Programme management often provides a layer of governance above specific projects and ensures that they are run effectively.

As in project management, the aims and desired benefits of a programme are identified in a **Business case**. The **Vision statement** sets out the desired future state following programme delivery and the programme **Blueprint** sets out what will have been achieved when the programme is completed and all the projects within it are no longer required.

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Key aspects of programme management

- **Governance** – defining the programme roles and responsibilities as well as the processes and metrics to assess its progress
- **Management** – planning the projects and the overall programme, ensuring that regular reviews are undertaken and that stakeholders are engaged
- **Financial management** – costs of managing the programme need to be tracked and controls need to be put in place
- **Infrastructure** – creating the right work environment to support the programme Planning – developing a programme plan based on the specific projects, resources, timescales and controls for the overall programme.

The Programme Office

The programme is supported by a **Programme Office (PO)** which monitors the progress of benefits realization against the plan, gathers information for benefits reviews, produces performance reports as defined by the programme manager and maintains benefits information under change controls and audit trails of change. The PO also provides or locates resources that can assist with the design of the programme blueprint, facilitates impact assessments of change on the blueprint and maintains configuration control of the blueprint. The Programme Office is also a **centre of excellence** and assists with the correct implementation of the programme's principles, governance themes and transformational flow.

The programme office may serve a single programme or several programmes, depending on the size or capabilities of an organization.

Programme management roles

A **Senior Responsible Owner (SRO)**, or programme sponsor, is responsible for ensuring the programme achieves the business case and delivers benefits to the organization and that there is commitment at senior level within the organization.

The **programme manager** manages the programme on a day-to-day basis and coordinates its projects.

Finally, **business change managers** are responsible for the programme realizing the stated benefits through effective transition of the programme capabilities into the desired business outcomes and benefits. This will also transition the programme into business as usual.

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Approaches to programme management

A **programme management framework** can offer a governance structure and provide process models, documentation templates and guidelines for adapting it to the specific programme. AXELOS' **Managing Successful Programmes (MSP®)** is an open framework that can be tailored, but a business may develop its own programme management approach. However, it is important that there is consistency between the methods for managing a programme and the projects it includes.

Programme manager responsibilities

The **programme manager** plans the programme and allocates resources across its projects. They are responsible for defining the governance, managing the budget and appointing the programme team. The programme manager manages the programme's risks and the dependencies between projects as well as overall progress, resolving any issues. The programme manager also needs to liaise with the business change managers affected by the programme. On larger programmes, a programme manager may be supported by a risk manager, benefits manager or communications manager and a programme office.

Programme manager skills

Programme managers need strong leadership, communication and interpersonal skills. They need to manage the programme team, so knowledge of programme and project management frameworks as well as procurement, budgeting and resource allocation procedures is beneficial. They should also be able to advise their project teams and to anticipate and solve any problems.

How to become a programme manager

AXELOS has a range of **programme management resources** including case studies and white papers focusing on using MSP and other complementary methods.

You can use our Career Path tool to see how the role of programme manager would enable you to advance your career and what skills you would need to succeed.

You can also learn more about programme management training with our **MSP certifications** and use our sample papers to test your programme management knowledge.

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The 6 Steps of Resource Allocation

Resource allocation is the process of assigning and scheduling resources to project tasks.

Resources are the life blood of project management. Resources are used to carry out the project, and are returned to their owners if not consumed by the project.

There are 6 steps to performing a proper resource allocation:

1. Divide the Project into Tasks
2. Assign the Resources
3. Determine resource attributes
4. Resource Leveling
5. Re-allocate as necessary
6. Track resource utilization

1.Divide the Project into Tasks

In project management, the project is divided into tasks and managed on a task, rather than a project, level. Resource allocation is an integral component of this process because each task is assigned the necessary resources, and the resources are managed by task.

During the project planning phase, the project's constituent tasks are determined and listed, like this:

ID	Task
100	Dig Holes
200	Build Fence

Each task is assigned a start and end date and a budget, like this:

ID	Task	Start	End	Budget
100	Dig Holes	July 1	July 10	$1,000
200	Build Fence	July 8	July 31	$9,000

This is called a work breakdown structure (WBS), and it is the minimum planning phase for a small project, according to all of the three main project management methodologies.

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Once the project is successfully divided into tasks, the resources can be assigned.

2.Assign the Resources

Each task requires resources in order to be successfully performed. As a minimum, most tasks require a human resource to carry out some actions. Usually, the person starts with some input materials which are used to produce an output.

Generally, there are five types of resources:

1. **Labor**

   Human resources are an integral part of most projects. The project team has needs that require active management, like:

   - A satisfying work environment that does not involve conflicts with other team members.
   - Making an important contribution to the project, and/or greater society.
   - Leaving the project with something more than they started with, for example additional knowledge or skills, or a strong resume/CV entry that results in a better chance at future work.

   Equipment

   Tools and equipment that are used to produce the product, but don't become part of it, must be identified and allocated to each task. This equipment must be paid a reasonable rate that takes into account the wear and tear experienced during the project. Specialty equipment often requires significant investment of time and money.

   Materials

   Materials that become a part of the final product must be allocated so that they can be procured at the right time and their availability is confirmed.

   Facilities

   Buildings and work areas are often a significant cost to the project. If they are not readily available, they also require space in the project schedule and budget to ensure they are ready for the project team.

   Miscellaneous

   Most projects require other resources that impact the budget or schedule. This can include project financing and insurance costs, performance bonding, administration, contingencies, risk premiums, transportation and delivery, or any other item necessary to perform the project.

The resources are assigned to each task, so that the table looks like this:

ID	Task	Start	End	Budget	Resources

100	Dig Holes	July 1	July 10	$1,000	Bob, shovel
200	Build Fence	July 8	July 31	$9,000	Bob, Bill, shovel, fence posts, fence material

For the human resources (project team), it is often helpful to communicate project roles using a RACI chart, pronounced "racy," which assigns each task to each team member according to one of the four responsibility levels:

- Responsible (R)
- Accountable (A)
- Consulted (C)
- Informed (I)

All project managers use RACI charts, even if they don't know it. Writing out the chart is a highly effective way to communicate project roles to project members and ensure there is no confusion.

3.Determine Resource Attributes

Each resource comes with attributes (project manager lingo) which must be sufficient to carry out the project work. These attributes include:

- **Grade**
  Grade refers to the technical specification level of the resource. In this case, the the length of the fenceposts, the depth of the holes, and the strength of the fence material are all characteristics of grade. In short, the resources must be adequate for the task.
- **Skill**
  Skill is the same as grade but specific to the human resources. Bill and Bob, in this case, must know how to pound the fence posts and be strong enough to drive the posts.
- **Quality**
  Quality and grade are not the same thing. Quality refers to the degree to which the resource meets specifications, that is, if poor quality fence material arrives at the site it is not acceptable and must be rejected, adding unexpected costs and schedule implications. This is different

from the grade of the fence material, which can be low. The fence may not need high grade fence material. Low grade is acceptable (in the right circumstances), whereas low quality is never acceptable.

- **Resource-specific attributes: Size, shape, length, speed, color, strength, etc.**
  Each resource has many specific attributes that define its function. for example, if the paint is supposed to be brown, but a green paint arrives on site, it is probably still high quality as well as grade, yet not sufficient for the project. The required attributes must be determined individually for each resource.
- **Availability**
  In project management lingo this is called a resource calendar. The resource calendar can range from a simple listing of employee vacation time to sophisticated material tracking software. But its purpose is to ensure the project resource is available when needed.

At this stage we drill down into the table for each resource. Hence, a new table of information is formed for each resource:

Resource	Attributes	Availability
Bob		Needs 1 week notice
Shovel	▪ Garden style ▪ Large	Immediately

4.Resource Leveling

Project schedules are usually created without the resources in mind. That is, the network diagram and gantt chart are manipulated to minimize the schedule duration based on the number of hours or days required to carry out each task, but the resources assigned to the task might be highly volatile, incurring sometimes major cost and schedule implications.

For example, if we need Bob for 2 hours one day and 18 hours the next, we might need to pay him overtime thereby driving the project over budget.

Resource leveling refers to the process of inspecting the resources to ensure their use is as “smooth” and level as possible. It is a common scenario that it is more advantageous to extend the project schedule to avoid large spikes and dips in resource usage.

In addition, the resources used to carry out those tasks must be procured (purchased), delivered, and prepared. During the project, they must be maintained and serviced. All of these tasks must be accounted for within the project schedule and budget.

5.Re-allocate as Necessary

Throughout the project, resource re-allocation tends to be a constant and inescapable function of the project manager.

Resources are scarce. They sometimes do not show up on time, are needed by other projects, or lose their usefulness over time. Many things can happen that require a shift of resources from one task to another, or a change in the project schedule or budget.

6.Track Utilization Rates

It is a surprisingly common occurrence that a resource arrives at a project and sits idle for a long period of time.

It is equally common that project managers have no idea that the resource is being paid for but not being used.

A simple solution is to track resource utilization rates. The utilization rate is simply the percentage of billable time:

Utilization Rate = Number of Billable Hours / Number of Total Hours

For example, if Bill worked 4 hours out of a possible 40 hours for the week, his utilization rate is 4 / 40 = 10%. Clearly this would suggest corrective action is warranted on the part of the project manager.

aids to programme management in management software project

What Are Project Management Tools?

If you're here, you're probably wondering, "what are project management tools?" Well, you're smart for coming to a project management software for answers to that question. Project management tools are aids to assist an individual or team to effectively organize work and manage projects and tasks. The term usually refers to project management software you can purchase online or even use for free.

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Project Management Tool Overview

Despite its name, project management tools are not just for project managers. Project management tools are made to be completely customizable so they can fit the needs of teams of different sizes and with different goals.

What Are Some Project Management Tool Features?

Project management tools are usually defined by the different features offered. They include, but are not limited to:

- **Planning/scheduling** - Project management tools allow you to plan and delegate work all in one place with tasks, subtasks, folders, templates, workflows, and calendars.
- **Collaboration -** Email is no longer the only form of communication. Use project management tools to assign tasks, add comments, organize dashboards, and for proofing & approvals.
- **Documentation** - Avoid missing files with file management features: editing, versioning, & storage of all files.
- **Evaluation** - Track and assess productivity and growth through resource management & reporting

What Are Program Management Tools?

A program management tool may be similar to a project management tool, some a few key differences. Before we talk about how the tools differ, let's discuss how program managers and project managers compare:

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- Projects typically have clear start and end dates, with short-term goals that lead to tangible outcomes or deliverables. Constraints such as cost, resources, budget, and time all factor into the feasibility of a project

- Programs are composed of several, interconnected projects that, when combined, achieve a larger, long-term business objective.

- This means program management tools will need advanced features to track projects at a higher-level in order to see how each project is interacting with each other. These tools can include: Flexible work views

- Cross-functional resource management

- Dashboards

- Reporting

- Gantt-Chart

- Timesheets

So, what is a project management tool? Simply put, it's software to help organize work and collaborate with colleagues on projects.

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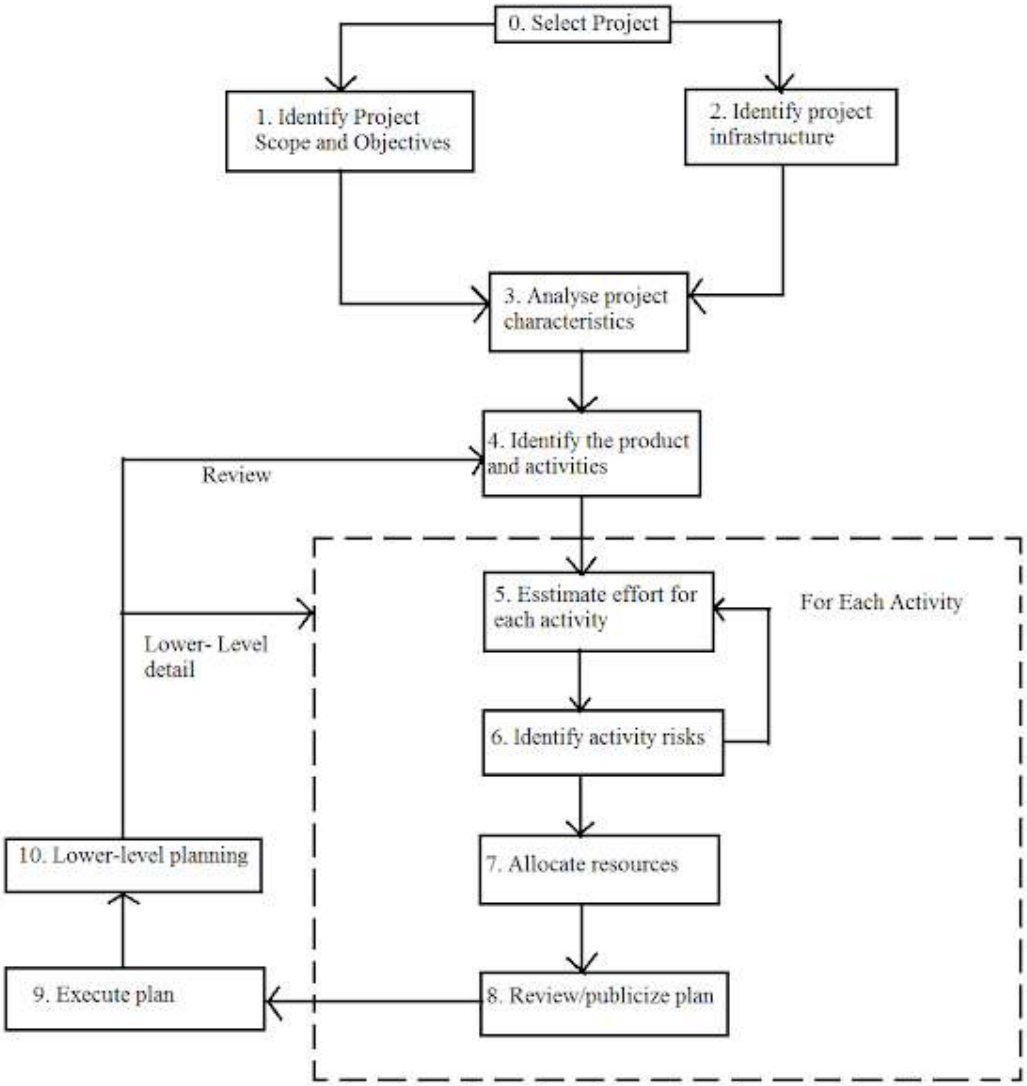
Step Wise Project Planning



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Planning is the most difficult process in project management. The framework described is called the Stepwise method to help to distinguish it from other methods.

Step 0: Select Project

Step 1: Identify project scope and objectives
Step 1.1 : Identify objectives and practical measures of the effectiveness in meeting those objectives
Step 1.2 : Establish a project authority
Step 1.3 : Stakeholder analysis - identify all stakeholders in the project and their interests.
Step 1.4 : Modify objectives in the light of stakeholder analysis.
Step 1.5 : Establish methods of communication with all parties.

Step 2 : Identify project infrastructure
Step 2.2 : Identify installation standard and procedures
Step 2.3 : Identify project team organization

Step 3 : Analyse project characteristics
Step 3.1 : Distinguish the project as either objectives- or product-driven.
Step 3.2 : Analyse other project characteristics
Step 3.3 : Identify high-level project risks
Step 3.4 : Take into account use requirements concerning implementation
Step 3.5 : Select development methodology and life-cycle approach
Step 3.6 : Review overall resource estimates

Step 4 : Identify project products and activities
Step 4.1 : Identify and describe project products
Step 4.2 : Document generic product flows
Step 4.3 : Recognize product instances
Step 4.4 : Produce ideal activity network
Step 4.5 : Modify the ideal to take into account need for stages and checkpoints

Step 5 : Estimate effort for each activity
Step 5.1 : Carry out bottom-up estimates
- distinguish carefully between effort and elapsed time

Step 5.2 : Revise plan to create ontrollable activities
- breakup very long activities into a series of smaller ones
- bundle up very short activities

Step 6 : Identify activity risks
Step 6.1 : Identify and quantify activity based risks
- damage if risk occurs
- likelihood if risk occuring

Step 6.2 : Plan risk reduction and contingency measures
- risk reduction : activity to stop risk occuring
- contingency : action if risk does occurs

Step 6.3 : Adjust overall plans and estimates to take account of risks

Step 7 : Allocate resources

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Step 7.1 : Identify and allocate resources
Step 7.2 : Revise plans and estimates to take into account resource constraints

Step 8 : Review/ Publicize plans
Step 8.1 : Review quality aspects of the project plan
Step 8.2 : Documentr plans and obtain agreement

Step 9 and 10 : Execute plan. Lower levels of planning

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Managing Software Projects

MBA 4TH SEM.(18MBA403E)

UNIT-3

Selection of an appropriate project approach

- **Outline of lecture**
- Building OR buying software
- Taking account of the characteristics of the project
- Process models
  - Waterfall
  - Prototyping and iterative approaches
  - Incremental delivery
- Agile approaches

Project Selection Methods

Introduction

One of the biggest decisions that any organization would have to make is related to the projects they would undertake. Once a proposal has been received, there are numerous factors that need to be considered before an organization decides to take it up.

The most viable option needs to be chosen, keeping in mind the goals and requirements of the organization. How is it then that you decide whether a project is viable? How do you decide if the project at hand is worth approving? This is where project selection methods come in use.

Choosing a project using the right method is therefore of utmost importance. This is what will ultimately define the way the project is to be carried out.

But the question then arises as to how you would go about finding the right methodology for your particular organization. At this instance, you would need careful guidance in the project selection criteria, as a small mistake could be detrimental to your project as a whole, and in the long run, the organization as well.

Selection Methods

There are various project selection methods practised by the modern business organizations. These methods have different features and characteristics. Therefore, each selection method is best for different organizations.

Although there are many differences between these project selection methods, usually the underlying concepts and principles are the same.

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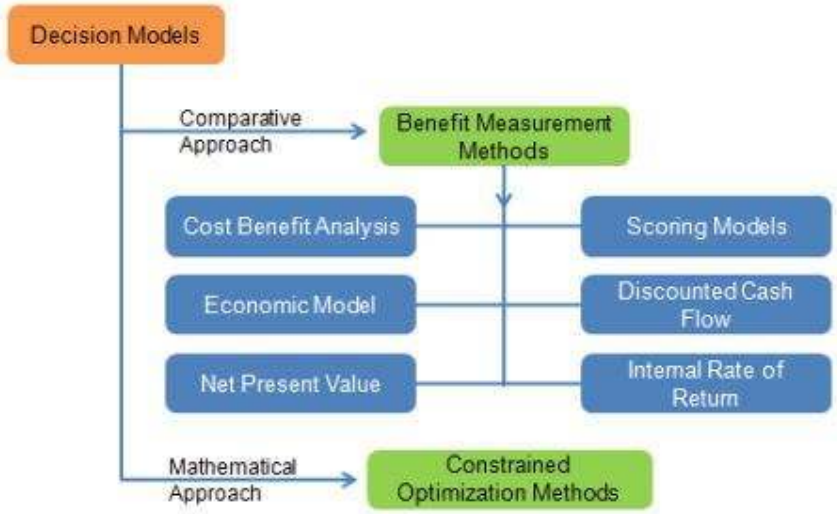
Following is an illustration of two of such methods (Benefit Measurement and Constrained Optimization methods):



As the value of one project would need to be compared against the other projects, you could use the benefit measurement methods. This could include various techniques, of which the following are the most common:

- You and your team could come up with certain criteria that you want your ideal project objectives to meet. You could then give each project scores based on how they rate in each of these criteria and then choose the project with the highest score.
- When it comes to the Discounted Cash flow method, the future value of a project is ascertained by considering the present value and the interest earned on the money. The higher the present value of the project, the better it would be for your organization.
- The rate of return received from the money is what is known as the IRR. Here again, you need to be looking for a high rate of return from the project.

The mathematical approach is commonly used for larger projects. The constrained optimization methods require several calculations in order to decide on whether or not a project should be rejected.

Cost-benefit analysis is used by several organizations to assist them to make their selections. Going by this method, you would have to consider all the positive aspects of the project which are the benefits and then deduct the negative aspects (or the costs) from the benefits. Based on the results you receive for different projects, you could choose which option would be the most viable and financially rewarding.

These benefits and costs need to be carefully considered and quantified in order to arrive at a proper conclusion. Questions that you may want to consider asking in the selection process are:

- Would this decision help me to increase organizational value in the long run?
- How long will the equipment last for?
- Would I be able to cut down on costs as I go along?

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In addition to these methods, you could also consider choosing based on opportunity cost - When choosing any project, you would need to keep in mind the profits that you would make if you decide to go ahead with the project.

Profit optimization is therefore the ultimate goal. You need to consider the difference between the profits of the project you are primarily interested in and the next best alternative.

Implementation of the Chosen Method

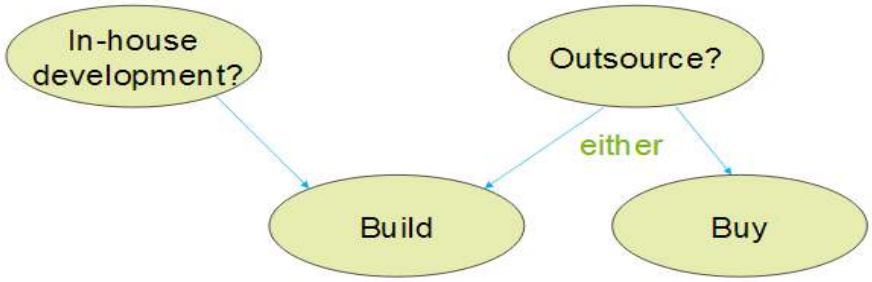
The methods mentioned above can be carried out in various combinations. It is best that you try out different methods, as in this way you would be able to make the best decision for your organization considering a wide range of factors rather than concentrating on just a few. Careful consideration would therefore need to be given to each project.

Selection of project approaches

- This lecture concerned with choosing the right approach to a particular project: variously called technical planning, project analysis, methods engineering and methods tailoring

- In-house: means that the developers and the users of the software are in the same organization.
  - often the methods to be used dictated by organizational standards
- Suppliers: : means that the developers and the users of the software are in the different organization.
  - need for tailoring as different customers have different needs

Build or buy?



In-House

- Time is needed to develop the software
- Would often require the recruitment of new technical staff to do the job
- Usually, the new staff won't be needed after the project is completed
- Sometimes due to the novelty of the project there may be lack of executives to lead the effort

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Outsourcing

Contracting the project out to an external IT development company (outsourcing):

- Time is needed to develop the software
- The conducting company will have technical and project expertise not
- readily available to the client
- The client would still do management effort to establish and manage the contracts .

Advantages of off-the-shelf (OTS) software

- Cheaper as supplier can spread development costs over a large number of customers
- Software already exists
  - Can be trialled by potential customer
  - No delay while software being developed
- Where there have been existing users, bugs are likely to have been found and eradicated

Disadvantages of off-the-shelf

- Customer will have same application as everyone else: no competitive advantage, but competitive advantage may come from the way application is used
- Customer may need to change the way they work in order to fit in with OTS application
- Customer does not own the code and cannot change it
- Danger of over-reliance on a single supplier

Steps of Project Analysis

- Identify project as either objective driven or product driven.
- Analyze other project characteristics by asking:–
  - Will we implement a data-oriented or a process oriented system?
  - Will the software to be produced be a general tool or application specific?
  - Are there specific tools available for implementing the particular type of application?
    - E.g.: – does it involve concurrent processing?
    - Is the system knowledge-based?
    - Will the system to be produced makes heavy use of computer graphics?
- Is the system to be created safety critical?
- Is the system designed to carry out predefined services or to be engaging and entertaining?
- What is the nature of the hardware/software environment in which the system will operate?
- Identify high-level project risks.
- The more uncertainty in the project the more the risk that the project will be unsuccessful.
- Recognizing the area of uncertainty allows taking steps towards reducing its uncertainty.
- Uncertainty can be associated with the products, processes, or resources of a project.
- Product uncertainty:
  - How well are the requirements understood.
  - The users themselves could be uncertain about what the system is to do.
- Process uncertainty:
  - For the project under consideration, the organization will use an approach or an application building-tool that it never used before.
- Resource uncertainty:

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- The main area of resource uncertainty is the availability of the staff with the right ability and experience.

General approach

- Look at risks and uncertainties e.g.
  - are requirement well understood?
  - are technologies to be used well understood?
- Look at the type of application being built e.g.
  - information system? embedded system?
  - criticality? differences between target and development environments?
- Clients' own requirements
  - need to use a particular method

Structure versus speed of delivery

Structured approach

- Also called 'heavyweight' approaches
- Step-by-step methods where each step and intermediate product is carefully defined
- Emphasis on getting quality right first time
- Example: use of UML (Unified Modelling Language)
- Future vision: Model-Driven Architecture (MDA). UML supplemented with Object Constraint Language, press the button and application code generated from the UML/OCL model

Agile methods

- Emphasis on speed of delivery rather than documentation
- RAD Rapid application development emphasized use of quickly developed prototypes
- JAD Joint application development. Requirements are identified and agreed in intensive workshops with users

Software Process Models

A software process model is a specified definition of a software process, which is presented from a particular perspective. Models, by their nature, are a simplification, so a software process model is an abstraction of the actual process, which is being described. Process models may contain activities, which are part of the software process, software product, and the roles of people involved in software engineering. Some examples of the types of software process models that may be produced are:

1. **A workflow model:** This shows the series of activities in the process along with their inputs, outputs and dependencies. The activities in this model perform human actions.
2. **2. A dataflow or activity model:** This represents the process as a set of activities, each of which carries out some data transformations. It shows how the input to the process, such as a specification is converted to an output such as a design. The activities here may be at a lower level than activities in a workflow model. They may perform transformations carried out by people or by computers.

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3. **3. A role/action model:** This means the roles of the people involved in the software process and the activities for which they are responsible.

There are several various general models or paradigms of software development:

1. **The waterfall approach:** This takes the above activities and produces them as separate process phases such as requirements specification, software design, implementation, testing, and so on. After each stage is defined, it is "signed off" and development goes onto the following stage.
2. **Evolutionary development:** This method interleaves the activities of specification, development, and validation. An initial system is rapidly developed from a very abstract specification.
3. **Formal transformation:** This method is based on producing a formal mathematical system specification and transforming this specification, using mathematical methods to a program. These transformations are 'correctness preserving.' This means that you can be sure that the developed programs meet its specification.
4. **System assembly from reusable components:** This method assumes the parts of the system already exist. The system development process target on integrating these parts rather than developing them from scratch.

1-Waterfall Model.

2-V-process Model.

3-Spiral Model.

4-Software prototyping.

5-Phased Development Model.
- 5-1-incremental development model.
- 5-2-iterative development model.

1-Waterfall Model.

- Classical model of system development.
- Called one-shot or once-through model.
- limited scope of iteration. Is this a strength or a limitation??
  - This is a strength for the WF-model.
  - Because it is suitable for some projects especially for large projects, we want to avoid reworking tasks that are thought to be completed.
  - Reworking tasks could result in late delivery.
- Suitable for systems with well defined requirements.
- Not suitable for systems of high uncertainty

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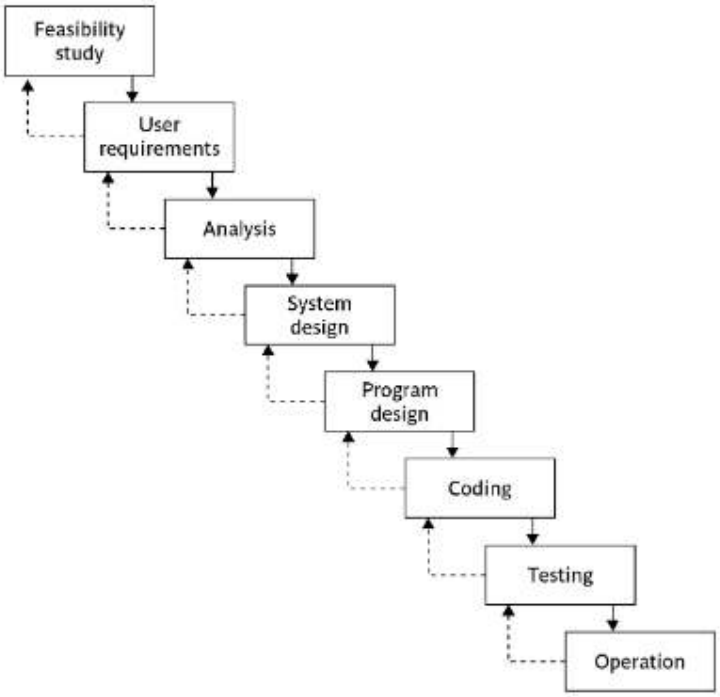
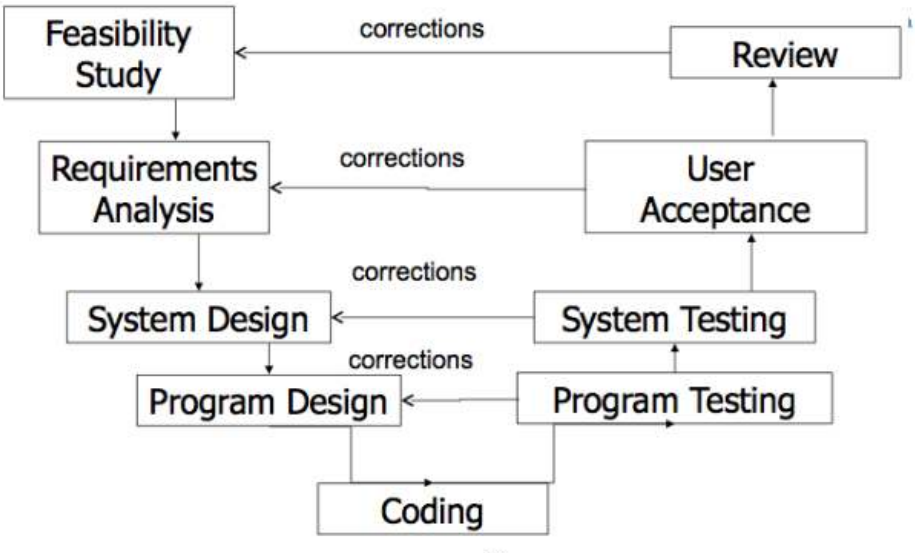


V-process Model

- An extension of the waterfall model.
- V-process model expands the activity box "testing" in the waterfall model.
- Each step has a matching validation process.
- Validation process can cause a Loop back to the corresponding stage and reworking the following steps in case of discrepancy.



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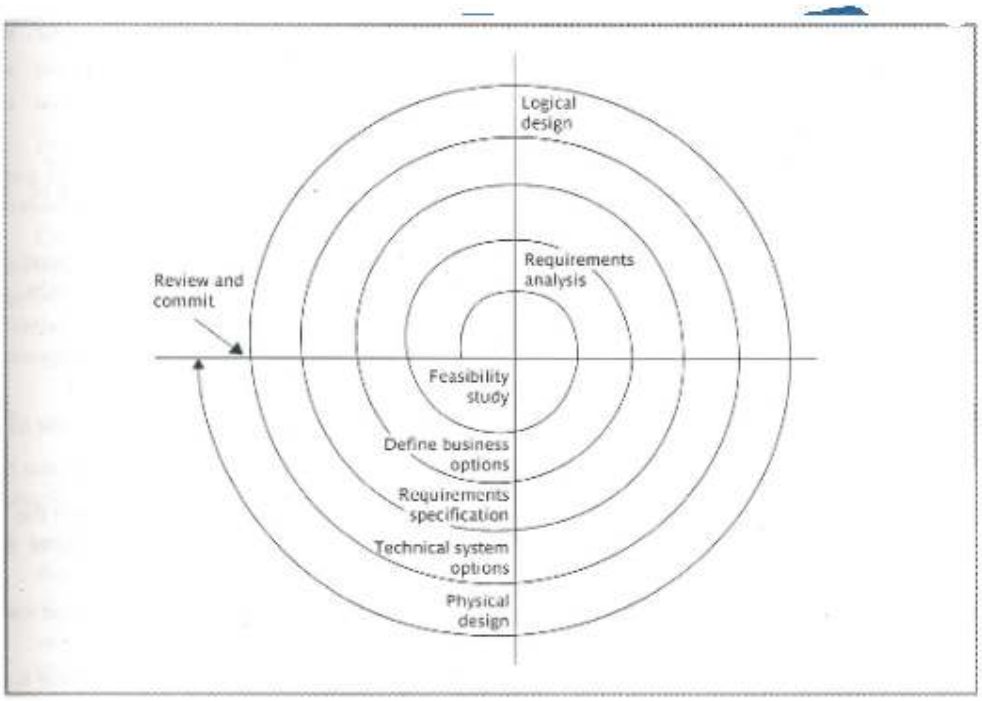
Spiral Model

- A greater level of detail is considered at each stage of the project.
- Represented as a loop or a spiral where the system is considered in more detail.
- This means greater confidence about the probability of success.
- Each sweep is terminated by an evaluation before the next iteration is embarked upon.



Prototyping Model

- Prototype is a working model of one or more aspects of the projected system.
- Goal
    - Gain knowledge
    - reduce risk and uncertainty
    - verify a design or implementation approach

The prototype is constructed and tested, quickly and inexpensively to test assumptions.

Classification of a Prototype

- Throw-away
    - Tests out some ideas.
    - Discarded when the true development of the operational system is started.
    - The prototype could be developed using a different SW and HW environment than those that will be used for the final system.
- Example: user interface
- Prototype :use a desktop application builder to produce an acceptable user interface.
- Final system: use a procedural programming language.

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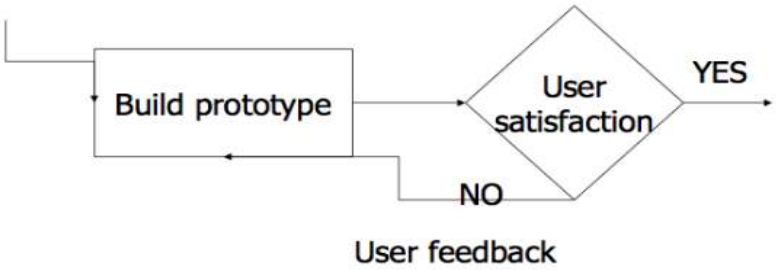

Benefits of Prototyping

- Learning by doing.
- Improved communication.
- Improved user involvement.
- Clarification of partially-known requirements.
- Demonstration of the consistency and completeness of a specification
- Reduced need for documentation.
- Reduced maintenance costs.
- Feature constraint.

Drawbacks of Prototyping

- Users sometimes misunderstand the role of the prototype.
- Lack of project standards possible.
- Lack of control.
- Additional expense.
- Machine efficiency.
- Close proximity of developers.

Prototypes at Different Stages

- Different projects will have uncertainties at different stages.
- Thus, prototypes can be used at different stages.

Examples:
At the requirements gathering stage: to pin down requirements that seem blurred and shifting.
At the design stage: to test out the user's ability to navigate through a sequence of input screens.

To what extent is the prototyping done?

- The prototyping usually simulates only some aspects of the target application, thus there might be:
- Mock-ups
    - e.g. Copies of input screens shown to the users on a terminal.
    - They cant actually be used.

- Simulated interaction
    - A user can type in a request to see a record in a database and an example of a result is shown.
    - There is no real access is made to the database.

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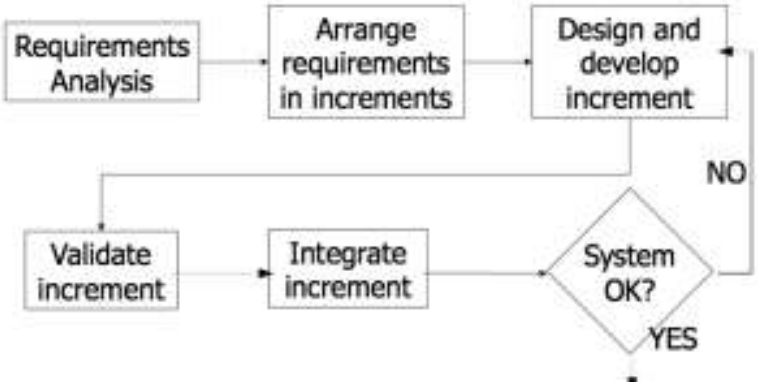
Forms of Prototypes

Partial working model
Vertical: only some features are fully prototyped
Horizontal: all featured are prototyped but not in detail.

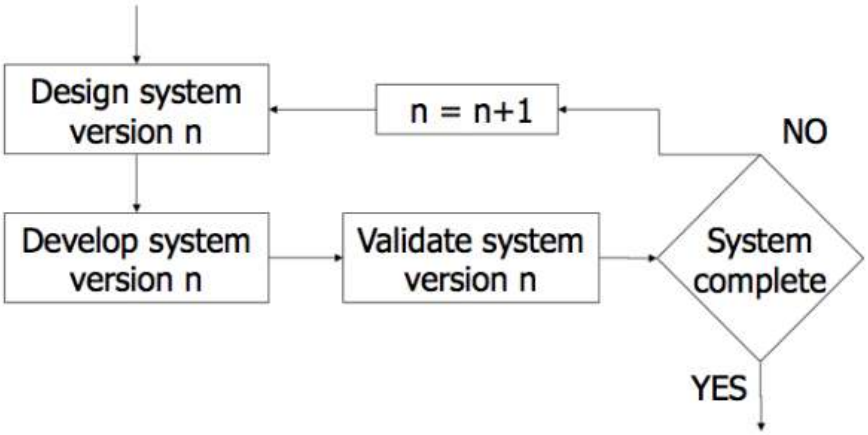
Incremental Model

- Break the system into small components.
- Implement and deliver small components in sequence.
- Every delivered component provides extra functionality to the user.



Iterative Model

Deliver full system in the beginning.
Enhance existing functionality in new releases.



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Software effort estimation technique

The software development effort estimation is an essential activity before any software project initiation. In this chapter I will illustrate how to easily estimate the software effort using known estimation techniques which are Function Points Analysis (FPA) and Constructive Cost Model (COCOMO).

What is Estimation and why it is important?

The estimation is a process to find the most accurate sizing figure for the software project effort, for example, how many months you will need to develop the software, how many resources you will need to finish the project in the required time. And this translated to money at the end.

The estimation is important because it gives the project team some confidence about the required effort and time to plan ahead for the project. Moreover, not all software project is time and material contracts, some of them are fixed cost projects and this estimate will be used as a foundation to negotiate the project cost.

The Estimation Process

As mentioned the estimation is a process and this process contains the following steps to reach the estimate, this process is cycling until you reach the final estimate for the project.

Estimation Process

1- Scoping

You need first to scope the project even if you do not have the full detailed requirements but you can assume some of them or add margins later. While in most cases you will have a defined scope to start with.

2- Decomposition In this step, you will need to break your software into smaller components and functions and you can categorize them to a different set of elements, this is similar to work

breakdown structure but only for the software components not all the working activities for the software.

You may also collect different data from the project team or the customer to ensure that you have listed all functionalities.

3- Sizing

In this step, the actual estimation will be done for each component alone, and I will illustrate more about how you will do that using the techniques mentioned above, this will be illustrated in 8 steps in details below.

In this step, and for more validation, you can use different estimation techniques to analyze the different estimation outputs and you may take an average of these estimates as well.

4- Expert and Peer Review

After initial estimate, you will need at some point to ask for expert opinion for some new functionalities you may not aware off, or for considering a review from your peers that you have done the correct estimation. Moreover, you may need to do some analogy based techniques for similar components or functions developed before or maybe a similar project to ensure that you are on the correct path.

5- Estimation Finalization

This can be considered the final step as you aggregate all the estimations from all components and functions and have a baseline estimate. You can go another round across the process until reaching the correct estimate which will be approved by the Project team and the Management as well.

How to Size

Before we start by describing the 8 sizing steps let us introduce briefly the techniques we will use to size the project effort.

Function Points Analysis

Function Point Analysis (FPA) is a sizing measure of clear business significance. First made public by Allan Albrecht of IBM in 1979. It depends mainly on estimation the lines of code for the software which is also considered as a critic for this technique.

FPA can be helpful to estimate the effort for a software project at the early stage when the requirements are known, but the details of implementation have not yet been specified or evaluated. Which is actually the most case of the software projects

To use the FPA, these are the steps to follow after defining the scope and decompose the system functionality and components:

1. Identify inputs, outputs, file accesses and interfaces to external systems
2. Determine the functional complexity of each function

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3. Calculate unadjusted FPs by summing weightings
4. Calculate Value Adjustment Factor for the software
5. Apply VAF to UFP to calculate adjusted FPs

Constructive Cost Model (COCOMO)

The **Constructive Cost Model** (**COCOMO**) is a procedural software cost estimation model developed by Barry W. Boehm

Program size is expressed in estimated thousands of source lines of code (KLOC). COCOMO applies to three classes of software projects:

- **Organic projects** – "small" teams with "good" experience working with "less than rigid" requirements.
- **Semi-detached projects** – "medium" teams with mixed experience working with a mix of rigid and less than rigid requirements.
- **Embedded projects** – developed within a set of "tight" constraints. It is also a combination of organic and semi-detached projects.(hardware, software, operational, …)

COCOMO is used for estimating the development effort and time.

Step 1

We will start with the FPA after we scoped the requirements and decompose the functions, we are ready to identify the inputs, outputs, file accesses and interfaces to external systems. FPA is measured based on these below elements:

1. **Internal Logical Files (ILF):** It is a group of logically related data that is stored and maintained within the application, for example, databases and files
2. **External Interface Files (EIF):** is a group of logically related data that will be used by the application. The difference that these data will not be maintained in the application, for example, external databases.
3. **External Input (EI):** It is mainly the data transactions which will be inserted into the application from outside the application boundary, for example, Data entry process.
4. **External Output (EO):** It is mainly the output of the system functions, for example, a transactional data into the database, messages or a report

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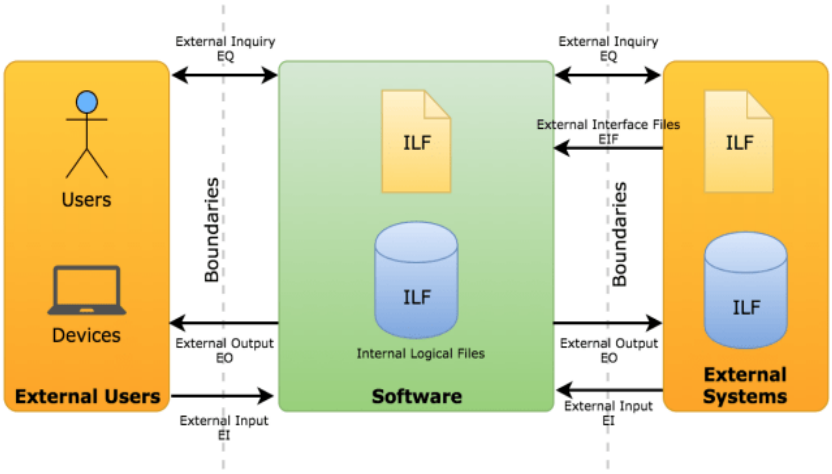
5. **External Inquiry(EQ)**: It used to present information to a user through the retrieval of data from ILF or EIF, for example, search queries, or exporting a report



Software Context

FPA classifies the complexity of each function type as below

Function type	Complexity		
	Simple (S)	Average (A)	Complex (C)
Internal Logical File	7	10	15
External Interface File	5	7	10
External Input	3	4	6
External Output	4	5	7
External Inquiry	3	4	6

Step 2

The next step is to relate our functions to these complexity levels and apply the weightings for each one, for example, let us assume that we have the following outcome from our functional points

Components List	**Inputs (EI)**	**Outputs (EO)**	**Files (ILF)**	**Inquiries (EQ)**	**Interfaces (EIF)**
Component 1	1 S*3 = 3	1 S*4 = 4 2 C*7 = 14	2 A*10 = 20	2 S*3 = 6	1 C*10 = 10
Component 2	2 A*4 = 8 1 C*6 = 6	3 A*5 = 15	1 C*15 = 15	2 A*4 = 8	2 S*5 = 10

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Component 3	3 A*4 = 12 2 C*6 = 12	3 S*4 = 12	1 S*7 = 7	– 2 A*7 = 14

As we can see in the table, that we have 3 components and after we applied the weights for each one, we can see that each one can have more than one input for example, and we can estimate each input weight according to our judgment of this input complexity. In component 3 we have 3 average inputs and 2 complex input but we do not have any inquiries.

Step 3

You can do the same for all the software components or functions and this will lead us to the next step of calculating the unadjusted function points by summation of all weights

Unadjusted Function Points (UFP) = (n × EI) + (n × EO) + (n × EQ) + (n × ILF) + (n × EIF)

In the example above the **UFP = 176**

Step 4

The next step, we will need to calculate Value Adjustment Factor, the VAF consists of **14 General System Characteristics (GSCs)** which are listed below, These GSCs represent characteristics of the application under consideration how the degree of influence for each factor on the system.

#	Technical factors	Brief Description
F1	Data communications	How many communication facilities are there to aid in the transfer or exchange of information with the application or system?
F2.	Distributed data processing	How are distributed data and processing functions handled?
F3.	Performance	Did the user require response time or throughput?
F4.	Heavily used configuration	How heavily used is the current hardware platform where the application will be executed?
F5.	Transaction rate	How frequently are transactions executed daily, weekly, monthly, etc.?
F6.	On-Line data entry	What percentage of the information is entered On-Line?
F7.	End-user efficiency	Was the application designed for end-user efficiency?
F8.	On-Line update	How many ILF's are updated by the On-Line transaction?
F9.	Complex processing	Does the application have extensive logical or mathematical processing?

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F10. Reusability	Was the application developed to meet one or many users needs?
F11. Installation Ease	How difficult are conversion and installation?
F12. Operational ease	How effective and/or automated are a start-up, back up, and recovery procedures?
F13. Multiple sites	How the application was specifically designed, developed, and supported to be installed at multiple sites for multiple organizations?
F14. Facilitate change	Was the application specifically designed, developed, and supported to facilitate change?

Each factor may have a value within 0 (no influence) to 5 (strong influence) to calculate the Total Degree of Influence (TDI). The VAF can vary in range from 0.65 (when all GSCs have no influence) to 1.35 (when all GSCs have strong influence) according to the equation below

VAF = 0.65 + (∑_(i=1)^14 Fi * 0.01)

Let us assume that we considered the influence of the GSCs and we calculated the VAF as follow:

VAF = 0.65 + ((1+4+5+4+1+0+2+4+3+4+4+1+1+1) * 0.01) **= 0.65 + 0.35 = 1**

Step 5

So, this will lead us to the final step of FPA which to calculate The Adjusted Function Points:

AFP = UFP * VAF = 176*1 = 176

Step 6

Now, we are ready to use the COCOMO estimation technique, this model is based on KLOC and to obtain our software KLOC, we will use the output from the functions points analysis.

According to Quantitative Software Management, they created a table contains updated function point language gearing factors for 37 distinct programming languages/technologies. We will use this table to calculate the KLOC by using this equation

KLines of code (KLOC) = AFP * QSM Index (programming language) / 1000

We assume that we will use .NET programming language, according to QSM table the average of .NET is 57

KLOC = 176 * 57 / 1000 ≈ 10 KLOC

Step 7

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According to COCOMO Complexity, the software effort is calculated based on predetermined coefficients based on complexity and, lines of code, for example, if we considered that we are using organic project type our calculation will be as follow:

Effort Applied (E)= a*(KLOC)^b = 3.2 * (10) ^ 1.05 ≈ **35 Person Months**

Development Time (T) = c*(Effort Applied)^d = 2.5 * (35) ^ 0.38 ≈ **9.7 Months**

Software Project	**a**	**b**	**c**	**D**
Organic	3.2	1.05	2.5	0.38
Semi-detached	3	1.12	2.5	0.35
Embedded	2.8	1.20	2.5	0.32

People required (P) = Effort Applied / Development Time = 35/9.7 ≈ **+/- 3.6 Persons**

Development Productivity = LOC/Effort Applied = 10,000/35 ≈ **286 LOC/Person Month**