Project Management

HU-801B

7 c's of Project Management:

All project managers are concerned about the perceived success of their projects. They want to minimize risk of failure and bring the project in on-time and on-budget. Considering each of these seven Cs for project success will lead to a truly successful outcome being accomplished.

Communication

The proliferation of email as the alternative to face to face meetings, or telephone conversations, has its disadvantages as well as advantages. Whilst the written word is more likely to ensure that specific technical details are fully understood, email does not allow for the same level of relationship building and developing trust as verbal communication does. Conversations, whether in person or on the phone, are also vital for detecting potential problems and clarifying the expectations of all parties involved in a project. Regular email communications should never take the place of verbal communication but be an additional tool towards the goal of project success.

Commitment

Building commitment in any project team at the outset will reap huge benefits during the course of the project and will ultimately lead to a successful conclusion. Projects undertaken without the full commitment of the stakeholders and the whole team are much more likely to fail. But by agreeing on the work required and the time and people needed to complete it, with realistic deadlines and expectations this will ensure that there is initial commitment that can be maintained throughout the course of the project.

It is surprising how often teams and individuals are assigned project work that they are not committed to. This can be for a number of reasons whether it is work overload or badly defined requirements or unrealistic budgets or deadlines. All, or any, of these factors will result in a lack of commitment from the team or individual. Yet ensuring individuals are committed to their tasks is a major factor in the quality of the work and hence the success of a project so should never be underestimated.

Cash

The budget of any project, large or small, should be realistic and include a generous contingency fund. It is impossible to set a realistic budget without knowing the requirements in detail. Yet in practice, the budget is frequently set before the requirements are documented and many budgets have little, or no, contingency. In such cases, the role of the project manager is to match the requirements to the available budget as closely as possible without compromising on the product that is ultimately delivered. Attempting to squeeze the requirements into an unrealistic budget is simply increasing the probability of something going wrong.

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Control

Keeping control of the budget and the schedule is vital to successfully completing the project. In practice this means planning the project in detail and then managing all the elements of that plan. Whilst a certain amount of flexibility on the part of the project manager will probably be necessary, that flexibility cannot come at the cost of losing control of the schedule, budget or quality of the final product.

The budget and schedule are, of course, the natural constraints for a project and project managers must discipline themselves and the team members to concentrate on delivering or completing each individual task well. Projects where clear milestones are set are far more likely to reach their goal than those that do not set clear objectives.

Cooperation

Cooperation between teams, departments or even different companies is often necessary for large corporate projects. These relationships may be ones of choice but they may also be ones of necessity. There may be underlying resentments and rivalries between these different groups but cooperation is essential for the success of the project.

Involving members of all groups in the early decision-making process and planning stages will help to build a team-spirit and alleviate any hostility between groups. Aiming to understand the human emotions involved, and not just the human skills, will lead to a better understanding of the different groups. This is a much more effective way of developing cooperation than trying to force groups or teams to work together.

Culture

Attitudes to work schedules, quality of work and to senior management vary greatly from culture to culture and even from company to company. In some environments problems will not be reported in the belief that extra hours and effort can resolve the issues. This can often result in a problem not becoming obvious until well into the project schedule. Such attitudes to admitting there is a problem to senior management are difficult to change in some companies and cultures.

So entrenched cultural attitudes must be addressed early on the project if they are not to contribute to project failure. This is a two-way problem for which there is unlikely to be a quick solution but it can be alleviated by both sides voicing, documenting and managing expectations of each other.

Coaching

The importance of coaching or training should never be underestimated. Proven training methods of project management can provide tools, tips and techniques to help every project manager achieve their mission of a successful project. The support and guidance available through project management courses can not only help with the day-to-day management and control of a project but also with the human element required to deal with different individuals, teams and cultures. And it will enthuse a project manager to propel the project forward in the right direction.

Characteristics of a Successful or Good project:

Every single project you work on in your career is probably going to be unique in one way or another. This makes the project manager role sound quite daunting but there are some common characteristics which you can look out for along the way.

Well Planned

If you want to have a chance of making a success of the piece of work then you need to get the basics right and in projects that means planning well. This might not be your favorite aspect of the job but it is one which is essential. At this point I have to confess that I am not a particularly keen planner either. The way I try and get round this is by telling myself that if I do it right then I only need to do it once. Obviously you need to keep your eye on the project plan as the work progresses but if you get it done well at the start then it will be a lot easier for you further down the line.

A Strong Team

Even the best project manager in the world isn't likely to be able to deliver completed projects on time without the support of a strong team. Part of your role is to make sure that everyone in the team understands the project, has the skills and resources to contribute and feels happy and motivated. If you can see that something is lacking in the team then it is your job to sort it out. This isn't always easy to do but you will benefit from doing so almost as much as the team member you help out. One thing you should be wary of is the danger of taking all the credit yourself. If the rest of the project team played a big part in the success then you should make sure that you point this out to your bosses and stakeholders.

Clear Communication

One of the features of a well run project is that it involves clear communication all the way through it. Obviously this doesn't just depend on the project manager but when you work in this role it is something which you will want to focus on. Lots of people will want to know what is happening and you are probably going to be the only one who can see the full project from everyone's point of view. This means that you will be under pressure to ensure that you keep everyone up to date at all times. The smartest way of dealing with this is to put your communication strategy in place at the start and stick to it. You obviously need to avoid missing meetings or not sending out updates, so a backup plan for the times when you aren't going to be able to do this is needed.

Good Change Control

Projects change as they go on, and the things you end up delivering could be very different from what you started out looking at. This means that a robust change control process is vital. If you have this in place you can be sure that you won't be faced with scope creep or suddenly realize that you don't know which version of the documents have been agreed with the stakeholders. As with so many things in the project environment, the key is in setting down the process at the start and then sticking to it from then on.

A Clear Vision

With so many distractions along the way it is easy to lose track of what you are trying to do in the first place. This is why it is important that you keep a clear vision in your hard about what you want to

achieve. The best way to make sure that you do this is to be clear in your initial project documentation about the goals. If you do this then you will always have this to look back on if things get too confusing.

Risk Control

There are many different types of risk which could affect your projects and you will want to have an effective way of managing them. Again, you need to identify them at the start and then get your stakeholders to sign off the document containing them. After this you have to track them and add in any emerging ones or others which change status. Project risks have a habit of getting out of hand if you let them, so it is an area you definitely need to keep a close eye on all the time.

How do you classify projects?

There are many ways to classify a project such as:

- By size (cost, duration, team, business value, number of departments affected, and so on)
- By type (new, maintenance, upgrade, strategic, tactical, operational)
- By application (software development, new product development, equipment installation, and so on)
- By complexity and uncertainty

Classification of Projects:

Strategic projects

Must meet all of the following criteria:

1. Directly related to or directly helping 3 priorities of the University as set out by the President in October 2015. A summary of these priorities as an institutional strategy is available here.
2. Projects, spanning weeks and/or months NOT days
3. Medium – High complexity

Examples: most projects within the NGSIS programs, Academic Toolkit Renewal

Tactical projects

Projects which are not Strategic AND meet majority of the following criteria:

1. Projects, spanning 3 or more weeks and/or months NOT days
2. 2 or more ITS units involved
3. High visibility
4. High impact
5. Needs significant external (to ITS) communication and marketing
6. Driven by an externally imposed deadline or regulatory requirements

Examples: VM Data Center set up, StarRez, OUAC modernization/upgrade, Kronos time tracking, Self-Serve Password Reset

Operational projects

1. Business as usual work on an existing system, provides incremental improvements or technology upgrades
2. Fixes and minor enhancements
3. Effort is typically small-medium (up to 3 weeks)

Project Life Cycle:

The Project Life Cycle refers to the four-step process that is followed by nearly all project managers when moving through stages of project completion. This is the standard project life cycle most people are familiar with. The Project Life Cycle provides a framework for managing any type of project within a business. Leaders in project management have conducted research to determine the best process by which to run projects. It has been found that following a project life cycle is critical for any services organization.

The Project Life Cycle is the standard process by which teams achieve project success. Lesser known but growing in popularity, the Professional Services Life Cycle exists because the standard project life cycle does not fit everyone's needs. The standard project life cycle works for some project managers, but professional services need a more robust process. In professional services, unlike other businesses, their product is their people. That is, professional services lend their expertise to other companies in exchange for profit. Due to the constant involvement of clients, professional services require a unique project life cycle that involves a recurring feedback loop to ensure project success.
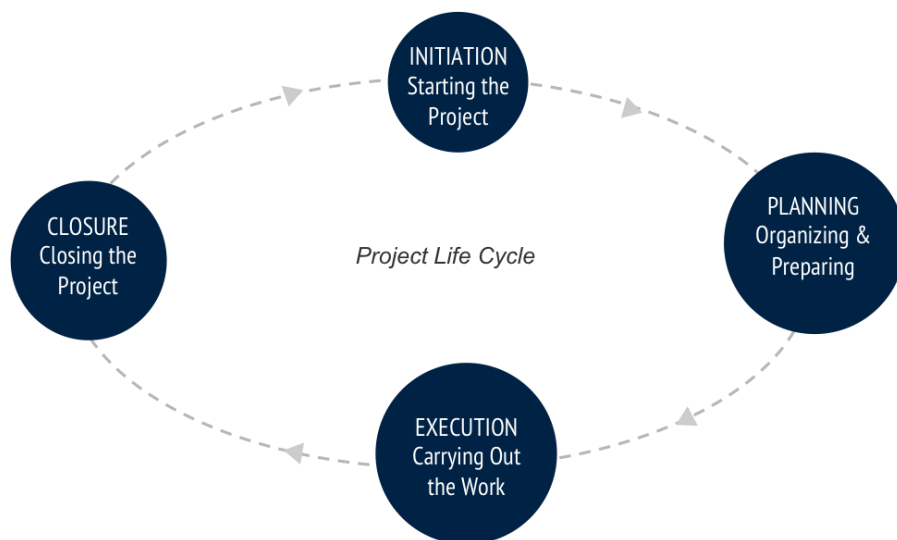
The Project Phases Involved:

Phase 1: The Initiation Phase

Phase 2: The Planning Phase

Phase 3: The Execution Phase

Phase 4: The Termination Phase

Initiation Phase

During the first of these phases, the initiation phase, the project objective or need is identified; this can be a business problem or opportunity. An appropriate response to the need is documented in a business case with recommended solution options. A feasibility study is conducted to investigate whether each option addresses the project objective and a final recommended solution is determined. Issues of feasibility ("can we do the project?") and justification ("should we do the project?") are addressed.

Once the recommended solution is approved, a project is initiated to deliver the approved solution and a project manager is appointed. The major deliverables and the participating work groups are identified, and the project team begins to take shape. Approval is then sought by the project manager to move onto the detailed planning phase.

Planning Phase

The next phase, the planning phase, is where the project solution is further developed in as much detail as possible and the steps necessary to meet the project's objective are planned. In this step, the team identifies all of the work to be done. The project's tasks and resource requirements are identified, along with the strategy for producing them. This is also referred to as "scope management." A project plan is created outlining the activities, tasks, dependencies, and timeframes. The project manager coordinates the preparation of a project budget by providing cost estimates for the labor, equipment, and materials costs. The budget is used to monitor and control cost expenditures during project implementation.

Once the project team has identified the work, prepared the schedule, and estimated the costs, the three fundamental components of the planning process are complete. This is an excellent time to identify and try to deal with anything that might pose a threat to the successful completion of the project. This is called risk management. In risk management, "high-threat" potential problems are identified along with the action that is to be taken on each high-threat potential problem, either to reduce the probability that the problem will occur or to reduce the impact on the project if it does occur. This is also a good time to identify all project stakeholders and establish a communication plan describing the information needed and the delivery method to be used to keep the stakeholders informed.

Finally, you will want to document a quality plan, providing quality targets, assurance, and control measures, along with an acceptance plan, listing the criteria to be met to gain customer acceptance. At this point, the project would have been planned in detail and is ready to be executed.

Implementation (Execution) Phase

During the third phase, the implementation phase, the project plan is put into motion and the work of the project is performed. It is important to maintain control and communicate as needed during implementation. Progress is continuously monitored and appropriate adjustments are made and recorded as variances from the original plan. In any project, a project manager spends most of the time in this step. During project implementation, people are carrying out the tasks, and progress information is being reported through regular team meetings. The project manager uses this information to maintain control over the direction of the project by comparing the progress reports with the project plan to measure the performance of the project activities and take corrective action as needed. The first course of action

should always be to bring the project back on course (i.e., to return it to the original plan). If that cannot happen, the team should record variations from the original plan and record and publish modifications to the plan. Throughout this step, project sponsors and other key stakeholders should be kept informed of the project's status according to the agreed-on frequency and format of communication. The plan should be updated and published on a regular basis.

Status reports should always emphasize the anticipated end point in terms of cost, schedule, and quality of deliverables. Each project deliverable produced should be reviewed for quality and measured against the acceptance criteria. Once all of the deliverables have been produced and the customer has accepted the final solution, the project is ready for closure.

Closing Phase

During the final closure, or completion phase, the emphasis is on releasing the final deliverables to the customer, handing over project documentation to the business, terminating supplier contracts, releasing project resources, and communicating the closure of the project to all stakeholders. The last remaining step is to conduct lessons-learned studies to examine what went well and what didn't. Through this type of analysis, the wisdom of experience is transferred back to the project organization, which will help future project teams.

Project Planning:

Project planning is part of project management, which relates to the use of schedules such as Gantt charts to plan and subsequently report progress within the project environment.

Initially, the project scope is defined and the appropriate methods for completing the project are determined. Following this step, the durations for the various tasks necessary to complete the work are listed and grouped into a work breakdown structure. Project planning is often used to organize different areas of a project, including project plans, work loads and the management of teams and individuals. The logical dependencies between tasks are defined using an activity network diagram that enables identification of the critical path. Project planning is inherently uncertain as it must be done before the project is actually started. Therefore the duration of the tasks is often estimated through a weighted average of optimistic, normal, and pessimistic cases. The critical chain method adds "buffers" in the planning to anticipate potential delays in project execution. Float or slack time in the schedule can be calculated using project management software. Then the necessary resources can be estimated and costs for each activity can be allocated to each resource, giving the total project cost. At this stage, the project schedule may be optimized to achieve the appropriate balance between resource usage and project duration to comply with the project objectives. Once established and agreed, the project schedule becomes what is known as the baseline schedule. Progress will be measured against the baseline schedule throughout the life of the project. Analyzing progress compared to the baseline schedule is known as earned value management.

The inputs of the project planning phase 2 include the project charter and the concept proposal. The outputs of the project planning phase include the project requirements, the project schedule, and the project management plan.

Project planning can be done manually, but project management software is often used.

So, the purpose of the project planning phase is to:

- Establish business requirements
- Establish cost, schedule, list of deliverables, and delivery dates
- Establish resources plans
- Obtain management approval and proceed to the next phase

Example

A web user may ask for a fast system. The quantitative requirement should be all screens must load in under three seconds. Describing the time limit during which the screen must load is specific and tangible. For that reason, you'll know that the requirement has been successfully completed when the objective has been met.

Project Scope:

Project scope is the part of project planning that involves determining and documenting a list of specific project goals, deliverables, features, functions, tasks, deadlines, and ultimately costs.

In other words, it is what needs to be achieved and the work that must be done to deliver a project.

It is important to pin down the scope early in a project's life cycle as it can greatly impact the schedule or cost (or both) of the project down the track.

Below is an overview of some of the key processes to follow in order to define scope correctly.

Define the Product Requirements

Before we determine what will be in the project's scope, you must be very clear about what are the product requirements, otherwise known as product scope. In other words, what are the functions and features required for the website, application and/or software solution being developed? Is there anything specifically that must be built into the design? Must it follow a specific set of branding guidelines? The list goes on.

Define the Process Requirements

Process requirements describe how people interact with a product and how a product interacts with other (often existing) business processes. When you discuss how data gets moved and how business transactions flow from one point to another, you are describing process requirements. For example, the requirements for billing transactions within a website, how such transactions link to invoicing and accounts, and at what point can staff view and alter the status of orders needs to be detailed.

Involve the correct stakeholders

It of course goes without saying that for a project to be delivered successfully, the correct stakeholders from the organization commissioning the project must be involved very intimately at various stages of the

project scope. When this does not occur, assumptions begin to be made (which are generally subjective) and stakeholder confusion can occur as the project goes on.

Identify the limitations

Perhaps even more important than what is in-scope for a project is what is out-of-scope for a project. Often it is crucial to document what will not be done – otherwise people will assume that certain things are to be executed that were not budgeted for or included in the project timeline.

Change Management

It is natural for parts of any large project to change along the way. While it is always best to avoid scope creep (a situation in which one or more parts of a project ends up requiring more work), sometimes it is unavoidable due to the changing nature of any business. In order to avoid disagreements and changes to a project's scope by all stakeholders, both client-side and agency-side, it is best to have strict change management processes in place. Once scope is defined, it must not be changed without the appropriate change management functions taking place, at which point appropriate action can be taken to address the shifting project requirements.

Project Scheduling:

Project scheduling is concerned with the techniques that can be employed to manage the activities that need to be undertaken during the development of a project.

Scheduling is carried out in advance of the project commencing and involves:

- identifying the tasks that need to be carried out;

- estimating how long they will take;

- allocating resources (mainly personnel);

- scheduling when the tasks will occur.

Once the project is underway control needs to be exerted to ensure that the plan continues to represent the best prediction of what will occur in the future:

- based on what occurs during the development;

- often necessitates revision of the plan.

Effective project planning will help to ensure that the systems are delivered:

- within cost;

- within the time constraint;

- to a specific standard of quality.

Project Scheduling Techniques:

Two project scheduling techniques will be presented, the Gantt Chart and the Activity Network.

Gantt Charts

A Gantt chart is a horizontal bar or line chart which will commonly include the following features:

• activities identified on the left hand side;

• time scale is drawn on the top (or bottom) of the chart;

Match the Bird Saga - Best Android Game

• a horizontal open oblong or a line is drawn against each activity indicating estimated duration;

• dependencies between activities are shown;

• at a review point the oblongs are shaded to represent the actual time spent (an alternative is to represent actual and estimated by 2 separate lines);

• a vertical cursor (such as a transparent ruler) placed at the review point makes it possible to establish activities which are behind or ahead of schedule.

Activity Networks

The foundation of the approach came from the Special Projects Office of the US Navy in 1958. It developed a technique for evaluating the performance of large development projects, which became known as PERT - Project Evaluation and Review Technique. Other variations of the same approach are known as the critical path method (CPM) or critical path analysis (CPA).

The heart of any PERT chart is a network of tasks needed to complete a project, showing the order in which the tasks need to be completed and the dependencies between them. This is represented graphically:

Example of Activity Network

The diagram consists of a number of circles, representing events within the development lifecycle, such as the start or completion of a task, and lines, which represent the tasks themselves. Each task is additionally labelled by its time duration. Thus the task between events 4 & 5 is planned to take 3 time units. The primary benefit is the identification of the critical path.

The critical path = total time for activities on this path is greater than any other path through the network (delay in any task on the critical path leads to a delay in the project).

Tasks on the critical path therefore need to be monitored carefully.

The technique can be broken down into 3 stages:

1. Planning:

- identify tasks and estimate duration of times;

- arrange in feasible sequence;

- draw diagram.

2. Scheduling:

- establish timetable of start and finish times.

3. Analysis:

- establish float;

- evaluate and revise as necessary

Gantt Chart:

What Is a Gantt Chart?

A Gantt chart is a visual presentation used in project management to show overview of timeline for project activities and their inter-dependence. Each project task or activity is represented with a bar chart clearly displaying start and end date. Thus the length of the bar shows the duration required for a task to complete. This way multiple tasks when displayed as bar charts, shows work breakdown structure on a timeline. Essentially Gantt chart shows when an activity starts, completes, how long it will take to complete an activities and also overall project, which is a project schedule.

Gantt Chart Importance

Here have been few tools or techniques used to identify and manage project activities before Gantt chart came into existence such as

- Message board
- Post-It boards
- To Do lists/Task lists

However these tools and techniques could not give a better picture about a project schedule. And this is where Gantt chart stands out.

- It shows breakdown structure
- It shows dependencies
- It shows expected timeline
- It shows current progress
- It shows schedule baseline
- It shows resources assigned
- It shows task priority

- It shows critical path
- It shows smallest as well as longest task

Advantages of Gantt Charts

- **It creates a picture of complexity.** I am quite a fan of diagrams and charts. We think in pictures. Therefore, if we can see complex ideas as a picture, this will help our understanding.
- **It organizes your thoughts.** I am also a big fan of the concept of dividing and conquering. A big problem is conquered by dividing it into component parts. A Gantt chart will force you to do this.
- **It demonstrates that you know what you're doing.** When you produce a nicely presented Gantt chart with high level tasks properly organized and resources allocated to those tasks, it speaks volumes about whether you are on top of the needs of the project and whether the project will be successful.
- **It (should) help you to set realistic time frames.** The bars on the chart indicate in which period a particular task or set of tasks will be completed. This can help you to get things in perspective properly. And when you do this, make sure that you think about events in your organization that have nothing to do with this project that might consume resources and time.
- **It can be highly visible.** It can be useful to place the chart, or a large version of it, where everyone can see it. This helps to remind people of the objectives and when certain things are going to happen. It is useful if everyone in your enterprise can have a basic level of understanding of what is happening with the project even if they may not be directly involved with it.

Disadvantages of Gantt Charts

- **They can become extraordinarily complex.** Except for the most simple projects, there will be large numbers of tasks undertaken and resources employed to complete the project. There are software applications that can manage all this complexity (e.g., Mavenlink, Wrike, Smartsheet, AceProject). However, when the project gets to this level, it must be managed by a small number of people (perhaps one) who manages all of the details. Sometimes this does not work so well in a business that is not used to this type of management. Big businesses will frequently employ one or more project managers who are very skilled in this. For a range of reasons, this may not work so well in a smaller enterprise.
- **The size of the bar does not indicate the amount of work.** Each bar on the chart indicates the time period over which a particular set of tasks will be completed. However, by looking at the bar for a particular set of tasks, you cannot tell what level of resources are required to achieve those tasks. So, a short bar might take 500 man hours while a longer bar may only take 20 man hours. The longer bar may indicate to the uninformed that it is a bigger task, when in fact it is not.
- **They need to be constantly updated.** As you get into a project, things will change. If you're going to use a Gantt chart you must have the ability to change the chart easily and frequently. If you don't do this, it will be ignored. Again, you will probably need software to do this unless you're keeping your project management at a high level.
- **Difficult to see on one sheet of paper.** The software products that produce these charts need to be viewed on a computer screen, usually in segments, to be able to see the whole project. It then becomes difficult to show the details of the plan to an audience. Further, you can print out the chart, but this will normally entail quite a large "cut and paste" exercise. If you are going to do this frequently, it can be very time-consuming.

<u>Line of Balance (LOB):</u>

Rama Moorthy, Chapter 3, pp 21-25

Project Network Analysis:

Rama moorthy, Chapter 4, pp 26-32

Dummy Activity:

A dummy activity is a simulated activity of sorts, one that is of a zero duration and is created for the sole purpose of demonstrating a specific relationship and path of action on the arrow diagramming method. Dummy activities are a useful tool to implement when the specific logical relationship between two particular activities on the arrow diagramming method cannot specifically be linked or conceptualized through simple use of arrows going from one activity to another. In this case, the creation of a dummy activity, which serves essentially as a form of a placeholder, can provide exceedingly valuable. Dummy activities should in no cases be allocated any duration of time in the planning and/or scheduling or project activities and components. When they are illustrated in a graphical format, dummy activities should be represented by the user of a dashed line with an arrow head on one end, and may in some cases be represented by a unique color.

Rama moorthy, Chapter 4, pp 27-29

PERT and CPM:

Definition of PERT

PERT is an acronym for Program (Project) Evaluation and Review Technique, in which planning, scheduling, organising, coordinating and controlling of uncertain activities take place. The technique studies and represents the tasks undertaken to complete a project, to identify the least time for completing a task and the minimum time required to complete the whole project. It was developed in the late 1950s. It is aimed to reduce the time and cost of the project.

In other words, PERT or Programme Evaluation and Review Technique is an event oriented method of network planning. In it, the emphasis is focused on start and completion events rather than on activities. The activities taking place between events are not specified.

PERT uses time as a variable which represents the planned resource application along with performance specification. In this technique, first of all, the project is divided into activities and events. After that proper sequence is ascertained, and a network is constructed. After that time needed in each activity is calculated and the critical path (longest path connecting all the events) is determined.

In PERT network, the events fall in logical sequence. But the logic of events may be different for different planners. Hence PERT network may vary from planner to planner depending upon their decision as which event to precede or occur concurrently.

In PERT network the start circle is omitted and only the completed event is recorded. PERT helps in identifying critical area which threatens the completion of the work. It provides the means to determine how resources can be transferred from one job to another job.
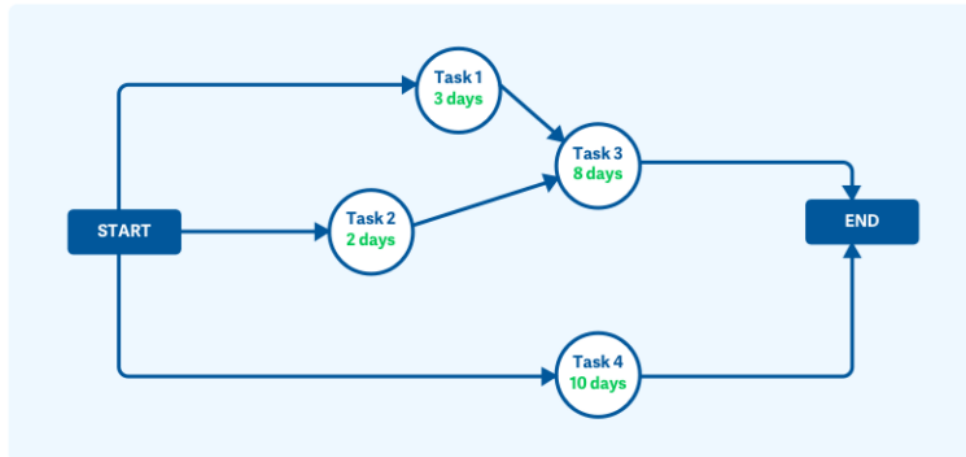
Definition of CPM

Developed in the late 1950's, Critical Path Method or CPM is an algorithm used for planning, scheduling, coordination and control of activities in a project. Here, it is assumed that the activity duration is fixed and certain. CPM is used to compute the earliest and latest possible start time for each activity.

The process differentiates the critical and non-critical activities to reduce the time and avoid the queue generation in the process. The reason behind the identification of critical activities is that, if any activity is delayed, it will cause the whole process to suffer. That is why it is named as Critical Path Method.

In this method, first of all, a list is prepared consisting of all the activities needed to complete a project, followed by the computation of time required to complete each activity. After that, the dependency between the activities is determined. Here, 'path' is defined as a sequence of activities in a network. The critical path is the path with the highest length.

So, CPM is also network comprising events and activities. This network is activity based. The activities are represented by arrowed lines and events by circles. The activities are connected in logical sequence. The time allotted to each activity is related to cost.
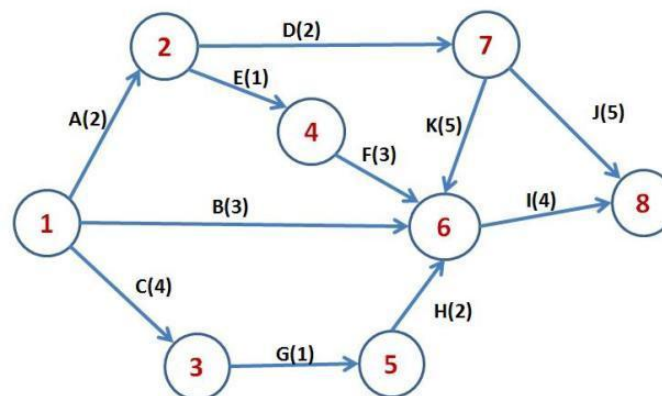
Difference Between PERT and CPM

The most important differences between PERT and CPM are provided below:

1. PERT is a project management technique, whereby planning, scheduling, organizing, coordinating and controlling of uncertain activities is done. CPM is a statistical technique of project management in which planning, scheduling, organizing, coordination and control of well-defined activities takes place.
2. PERT is a technique of planning and control of time. Unlike CPM, which is a method to control costs and time.
3. While PERT is evolved as research and development project, CPM evolved as construction project.
4. PERT is set according to events while CPM is aligned towards activities.
5. A deterministic model is used in CPM. Conversely, PERT uses probabilistic model.
6. There are three times estimates in PERT i.e. optimistic time (to), most likely time ™, pessimistic time (tp). On the other hand, there is only one estimate in CPM.
7. PERT technique is best suited for a high precision time estimate, whereas CPM is appropriate for a reasonable time estimate.
8. PERT deals with unpredictable activities, but CPM deals with predictable activities.
9. PERT is used where the nature of the job is non-repetitive. In contrast to, CPM involves the job of repetitive nature.
10. There is a demarcation between critical and non-critical activities in CPM, which is not in the case of PERT.
11. PERT is best for research and development projects, but CPM is for non-research projects like construction projects.
12. Crashing is a compression technique applied to CPM, to shorten the project duration, along with least additional cost. The crashing concept is not applicable to PERT.

Slack or Float:

What Is a Slack or a Float?

In project management, the terms slack and float describe the length of time that an activity can be delayed without delaying the finish date of a subsequent activity, or the finish date of the entire project. The terms are most commonly applied to a network analysis technique, known as the Critical Path Method, which was developed by the DuPont Corporation in 1957.

Slack versus Float

The terms "slack" and "float" are often used interchangeably. However, the essential difference between the terms is that slack is typically associated with inactivity, while float is associated with activity. Slack time allows an activity to start later than originally planned, while float time allows an activity to take longer than originally planned.

Free, Total and Independent Float

The term free slack, or free float, describes the length of time by which an activity can be delayed without delaying the early start of any subsequent activity, or activities. The term total slack, or total float, describes the length of time it can be delayed, beyond its early start, without delaying the finish date for

the whole project. The term independent slack, or independent float, describes the length of time by which an activity can be delayed if all previous activities start as late as possible and all subsequent activities start as early as possible. Independent float is associated with just one activity, rather than two or more.

Slack and Critical Activities:

Rama moorthy, chapter 5, pp. 37-39

Resource Allocation:

Resource allocation is used to assign the available resources in an economic way.

In project management, resource allocation is the scheduling of activities and the resources required by those activities while taking into consideration both the resource availability and the project time.

Resource Allocation plan

o Basic Allocation decision:
   - The choice of which items to fund in the plan
   - What level of funding it should receive
   - Which to leave unfunded
   - The resources are allocated to some items, not to others
o Contingency mechanisms
   - There is a priority ranking of items excluded from the plan, showing which items to fund if more resources should become available
   - There is a priority ranking of some items included in the plan, showing which items should be sacrificed if total funding must be reduced

Example of Resource allocation for jobs
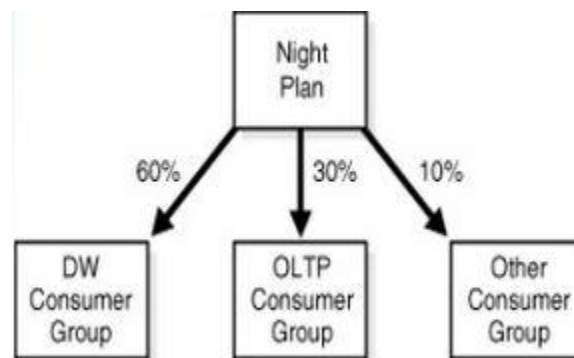
Assume that the active resource plan is called "Night Plan"

3 job classes: DW Consumer group, OLTP Consumer group, Other Consumer group

Resource Leveling:

Rama moorthy, chapter 8, pp. 55-59

## Project Life-cycle Costing:

Definition

The term Project life-cycle costing has been defined as follows, "It includes the cost associated with acquiring, using, caring for and disposing of physical asset including studies, research design, development, production, maintenance, replacement and disposed as well as support training and operating cost generated by the acquisition, use, maintenance and replacement of the permanent physical asset.

Different Elements or Costs of Life-cycle Cost

The Life-cycle cost includes the following elements:

(1) Specification cost
(2) Design/ Development cost
(3) Capital cost of equipment
(4) Installation and Commissioning cost
(5) Cost of operation
(6) Maintenance and spares cost
(7) Salvage/ disposal recovery cost
(8) Opportunity cost due to lost production or lower capacity utilization.

These can be grouped as capital or initial cost, operating cost and disposal cost.
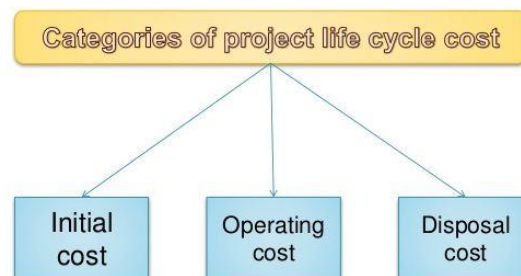
Example: ABC Ltd. purchased a machine for Rs. 2000/- on 1st January 2001 which had a useful life of 5 years and an estimated residual value of Rs. 500/-. The machine was being depreciated on straight line basis. However ABC Ltd. decided to sell the asset on 1st January, 2003 for Rs. 1500/- in order to raise cash for the purchase of a new machine.

Optimization of Project Life-cycle Cost

Optimization of Project Life-cycle Cost nothing but optimization of costs, situation, opportunity or resources. It is for we manage our times so that we optimize our productivity. This is through the following stages:

```
Optimization process
        ↓
     Defining
        ↓
     planning
        ↓
     execution
        ↓
      closing
```
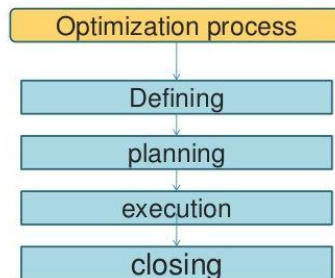
Defining includes the following:

- Goals
- Tasks
- Objectives
- Responsibility

Planning includes the following:

- Schedules
- Budget
- Resources
- Risk

Execution of project includes the following:

- Status report
- Changes
- Quality
- Forecast

Closing : That is communicating the closure of project to all stake holders.

Why is Life Cycle Costing Important to a Utility?

An important component of a Utility's activities is prioritizing the Capital Improvement Program, so that it can meet its most pressing needs. This prioritization occurs at the end of the capital project development process, which consists of Project Identification/Initial Validation, Risk Reduction, and Life Cycle Cost analysis, all of which are used to establish the final Business Case for each project. As can be seen in Figure 1, the Life Cycle Cost analysis is undertaken as part of the Business Case preparation.
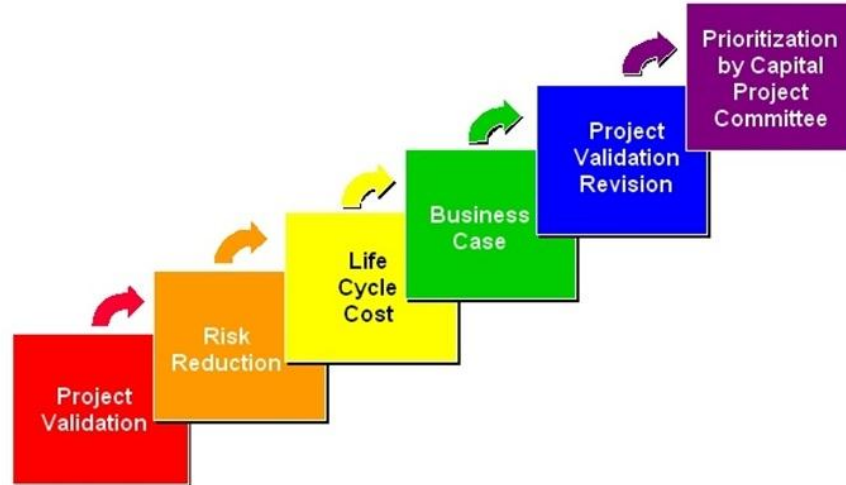
Figure → Capital Project Development Process Steps

The Life Cycle Cost analysis allows the Utility to examine projected life cycle costs for comparing competing capital and O&M project solutions and allows for appropriate comparison of alternatives of different capital values, and lengths of time.

Given the condition of the Utility's assets, the amount of capital available from the budget, and historical evidence, the project manager must decide which project alternatives will incur the least life cycle costs over the life cycle of the assets involved while delivering performance at or above a defined level. As a result, this analysis will enable the Utility to:

- make decisions for capital and O&M investments based on least life cycle costs,
- rank each of the projects based on total cost of ownership,
- combine the costing data with the Project Validation (See the Capital Project Validation and Prioritization Tool for an in-depth discussion of project validation concepts and practices) and Risk Reduction (See the Business Risk Exposure Tool for an in-depth discussion of risk) scores to prioritize the projects,
- make more informed decisions, and
- allow better reporting to key stakeholders.

A thorough Life Cycle Cost analysis yields a higher level of confidence in the project decision, which is part of the Project Validation calculation. Combined with a Risk Reduction analysis to identify the risk reduction of various alternatives considered, the information from Life Cycle Cost preparation is summarized in a business case, providing a consistent approach to the review of projects.

Project Cost Reduction Method:

Rama moorthy, chapter 19, pp. 134-143

<u>Different Forms of Organization</u>:

Generally, the following are the types of organization.

1. Line Organization

This is the simplest and oldest form of organization. It is also referred as the 'Military' or 'Traditional' or 'Scalar' or 'Hierarchical" form of organization. An important feature of such types of organization is the superior- sub-ordinate relationship. In this type of organization authority descends from the top to its bottom level through downward delegation of authority.

Sub-ordinates become responsible to their immediate superiors. All decisions and orders are made by the top executives and handed down to sub-ordinates. This type of organization is as that of military administration. The topmost management has full control over the entire enterprise. This form is suitable:

(a) If the business is comparatively small.

(b) If the labour management problems are easy to solve.

(c) If the processes are easily directed.

(d) If the work is of a routine nature.

Merits of Line Organization

1. It is simple to work.

2. It is economical and effective.

3. It is easy to fix responsibility.

4. It facilitates quick decisions and prompt actions.

5. Quick communication is easy.

6. Discipline can easily be maintained.

Demerits of Line Organization

1. The organization is rigid and inflexible.

2. It works on a dictatorial basis.

3. Departmental heads act in their own whims and desires; as such it is difficult to secure co-ordination of the activities of workers and department.

4. In big business it does not operate satisfactorily.

2. Functional Organization

The limitations of line organization have been removed under this system. All types of work of the organization are grouped and managed by the top executive.

There are separate functional departments for major functions of the enterprise, for example personnel department, sales department, purchase department, finance department, etc. Each department does its function for the entire organization. Sales department does its function for the whole organization.

Purchase department does its function for the whole enterprise. The functional organization works through the line organization. Functional organization is based on expert knowledge and makes the greatest use of division of labour resulting in high efficiency and specialization.

Features (Functional Organization)

1. The whole task of the enterprise is divided into specialized functions.

2. Each function is performed by a specialist.

3. The specialist in charge of a functional department has the authority over all other employees for his function.

4. Specialists operate with considerable independence.

Merits of Functional Organization

1. Greatest use of division of labour is possible.

2. The system is based on expert knowledge.

3. Functional efficiency of the worker can be maintained.

4. Mass production is made by standardization and specialization.

5. Separation of mental and manual functions is possible.

6. Methods and operations can be standardized.

Demerits of Functional Organization

1. Too many experts and bosses (high officials) create confusions in the minds of the worker.

2 It is difficult to fix responsibility on workers.

3. Discipline and morale of the workers are seriously affected, because of contradictory orders from different experts.

4. There are heavy overhead expenses.

3. Line and Staff Organization

In this type, the organization is based on the line organization and the functional experts advice the line officers as to the functions of the enterprise. The line officers are the executives and the staff officers are their advisors. Though the staff officers do not have the power to command the line officers, their advice is generally adhered to.

The combination of line organization with this expert staff forms the type of organization-line and staff. The Tine' keeps the discipline and the staff provides expert information. The line gets out the production and the staff carries on research, planning, fixing standard etc. This type of organization is suitable for large concerns.

The line officers give orders, decisions etc., to sub-ordinates in consultations or guidance with the staff officers. The underlying idea of this method is that specialized work is to be left to experts, who will give advice on specialized grounds- investigation, research, etc. The staff officers have no executive positions in the concern and are the thinkers, while the line officers are the doers.

Merits of Line and Staff Organization

1. This type is based on specialization.

2. It brings expert knowledge upon the whole concern.

3. Increased efficiency of operations may be possible.

4. Mass production is possible.

Demerits of Line and Staff Organization

1. There arises confusion unless the duties and responsibilities are clearly. Indicated by charts and office manuals.

2. Advice and expert information are given to the workers through the line officers. It is possible that the workers may misunderstand or misinterpret.

4. Committee Organization

Committee organization is widely used for the purpose of discharging advisory functions of the management. Committees are found in different levels of organization. A committee is a group of people who meet by plan to discuss or make a decision on a particular subject.

Because of its advantages, committee organization is preferred. Committee means a body of persons, for example, Management committee consisting of General Manager and Departmental heads.

Committees have become an important instrument of management in modern organizations; they may be used for the following objectives:

1. To secure view-point and consultation of various persons in the organizations.

2. To give participation and representation to different groups or interests;

3. To co-ordinate the activities of different departments;

4. To review the performance of certain units;

5. To facilitate communication and co-operation among diverse groups.

Merits of committee organization

1. It facilitates co-ordination of activity of various departments.

2. Pooled knowledge and judgment become available to the business thus its efficiency increases.

3. It is a good media of training and educating employees.

4. It helps to improve the motivation and morale of employees.

5. It promotes mutual understanding, teamwork and co-operation among employees.

Demerits of Committee Organization

1. It is not only costly in terms of time it consumes, but also in terms of money involved.

2. Difficulty in reaching agreement results in indecision.

3. Compromise at the cost of efficiency is often affected.

4. Indecision may lead to a breakdown of group action.

5. Committee management is slower in reaching decisions than a one-man rule.

Work Breakdown Structure (WBS):

A work-breakdown structure (WBS), also referred to as "contract work-breakdown structure" or "CWBS", in project management and systems engineering, is a deliverable-oriented breakdown of a project into smaller components. A work breakdown structure is a key project deliverable that organizes the team's work into manageable sections. The Project Management Body of Knowledge (PMBOK 5) defines the work-breakdown structure as a "A hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables."

A work-breakdown structure element may be a product, data, service, or any combination thereof. A WBS also provides the necessary framework for detailed cost estimating and control along with providing guidance for schedule development and control.

Following are a few reasons for creating a WBS in a project:

- Accurate and readable project organization.

- Accurate assignment of responsibilities to the project team.
- Indicates the project milestones and control points.
- Helps to estimate the cost, time and risk.
- Illustrate the project scope, so the stakeholders can have a better understanding of the same.

Why use a Work Breakdown Structure?

The work breakdown structure has a number of benefits in addition to defining and organizing the project work. A project budget can be allocated to the top levels of the work breakdown structure, and department budgets can be quickly calculated based on the each project's work breakdown structure. By allocating time and cost estimates to specific sections of the work breakdown structure, a project schedule and budget can be quickly developed. As the project executes, specific sections of the work breakdown structure can be tracked to identify project cost performance and identify issues and problem areas in the project organization. For more information about Time allocation, see the 100% Rule.

Project work breakdown structures can also be used to identify potential risks in a given project. If a work breakdown structure has a branch that is not well defined then it represents a scope definition risk. These risks should be tracked in a project log and reviewed as the project executes. By integrating the work breakdown structure with an organizational breakdown structure, the project manager can also identify communication points and formulate a communication plan across the project organization.

When a project is falling behind, referring the work breakdown structure will quickly identify the major deliverables impacted by a failing work package or late sub- deliverable. The work breakdown structure can also be color coded to represent sub- deliverable status. Assigning colors of red for late, yellow for at risk, green for on-target, and blue for completed deliverables is an effective way to produce a heat-map of project progress and draw management's attention to key areas of the work breakdown structure.

Construction of a WBS

Identifying the main deliverables of a project is the starting point for deriving a work breakdown structure.

This important step is usually done by the project managers and the subject matter experts (SMEs) involved in the project. Once this step is completed, the subject matter experts start breaking down the high-level tasks into smaller chunks of work.

In the process of breaking down the tasks, one can break them down into different levels of detail. One can detail a high-level task into ten sub-tasks while another can detail the same high-level task into 20 sub-tasks.

Therefore, there is no hard and fast rule on how you should breakdown a task in WBS. Rather, the level of breakdown is a matter of the project type and the management style followed for the project.

In general, there are a few "rules" used for determining the smallest task chunk. In "two weeks" rule, nothing is broken down smaller than two weeks worth of work.

This means, the smallest task of the WBS is at least two-week long. 8/80 is another rule used when creating a WBS. This rule implies that no task should be smaller than 8 hours of work and should not be larger than 80 hours of work.

One can use many forms to display their WBS. Some use tree structure to illustrate the WBS, while others use lists and tables. Outlining is one of the easiest ways of representing a WBS.

Following example is an outlined WBS:

Project Name			
	Task 1		
		Subtask 1.1	
			Work Package 1.1.1
			Work Package 1.1.2
		Subtask 1.2	
			Workpackage 1.2.1
			Workpackage 1.2.2
	Task 2		
		Subtask 2.1	
			Workpackage 2.1.1
			Workpackage 2.1.2

There are many design goals for WBS. Some important goals are as follows:

- Giving visibility to important work efforts.
- Giving visibility to risky work efforts.
- Illustrate the correlation between the activities and deliverables.
- Show clear ownership by task leaders.

WBS Diagram

In a WBS diagram, the project scope is graphically expressed. Usually the diagram starts with a graphic object or a box at the top, which represents the entire project. Then, there are sub-components under the box.

These boxes represent the deliverables of the project. Under each deliverable, there are sub-elements listed. These sub-elements are the activities that should be performed in order to achieve the deliverables.

Although most of the WBS diagrams are designed based on the deliveries, some WBS are created based on the project phases. Usually, information technology projects are perfectly fit into WBS model.

Therefore, almost all information technology projects make use of WBS.

In addition to the general use of WBS, there is specific objective for deriving a WBS as well. WBS is the input for Gantt charts, a tool that is used for project management purpose.

Gantt chart is used for tracking the progression of the tasks derived by WBS.

Following is a sample WBS diagram:
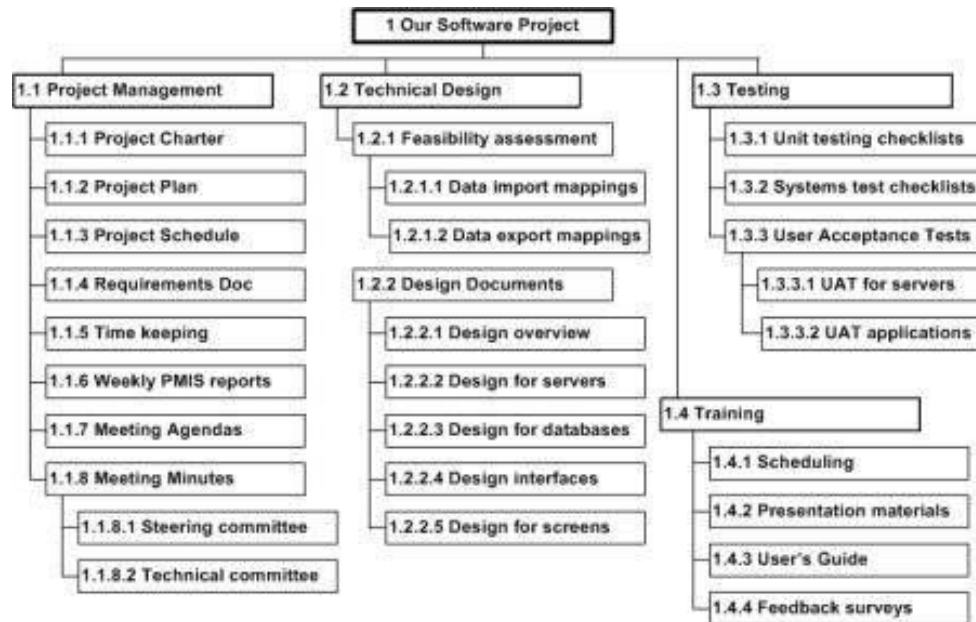
<u>Organizational Breakdown Structure (OBS):</u>

Organization Breakdown Structure or OBS is a hierarchical model describing the established organizational framework for project planning, resource management, time and expense tracking, cost allocation, revenue/profit reporting, and work management.

Work Breakdown Structure (WBS) captures all elements of projects in an organized fashion. Breaking down large, complex projects into smaller project pieces provides a better framework for organizing and managing current and future projects. WBS facilitates resource allocation, task assignment, measurement and control of project cost and billing. The WBS is utilized at the beginning of the project to define scope, identify cost centers and is the starting point to developing project plans/Gantt charts.

The Organization Breakdown Structure groups together similar project activities or "work packages" and relates them to the organization's structure. OBS (also known as *Organizational Breakdown Structure*) is used to define the responsibilities for project management, cost reporting, billing, budgeting and project control. The OBS provides an organizational rather than a task-based perspective of the project. The hierarchical structure of the OBS allows the aggregation (rollup) of project information to higher levels. When project responsibilities are defined and work is assigned, the OBS and WBS are connected providing the possibility for powerful analytics to measure project and workforce performance at a very high level (example business unit performance) or down to the details (example user work on a task).

To develop an **Organization Breakdown Structure**:

1. Draw of the entire organization as a hierarchy
2. Define all departments and project teams.
3. Specify functional (where cost for the work the user does is allocated to) and approval (who approves the work the user performs and any leave time approvals) groups for every user.

The following are the sample OBS:
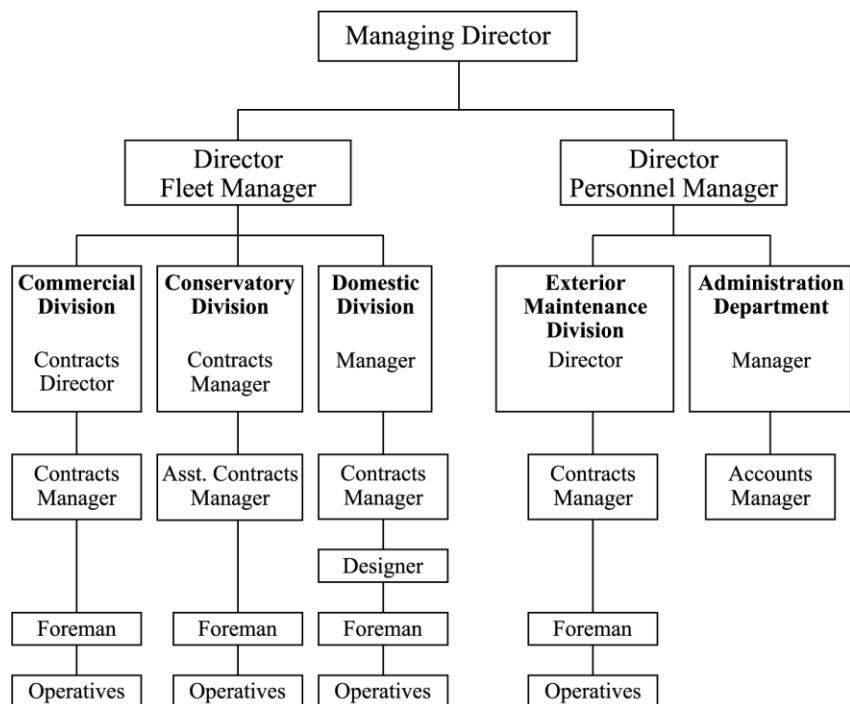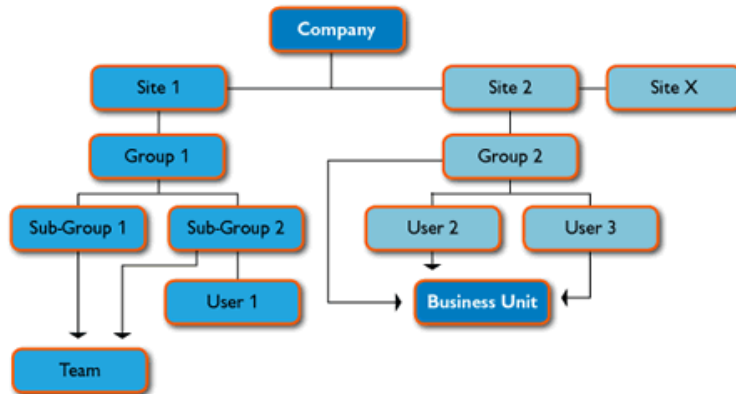
Operating Costs:

Rama mooethy, Chapter 29, pp 231-238

Difference between an Operating Expense and a Capital Expense:

An operating expense (OPEX) is an expense required for the day-to-day functioning of a business. In contrast, a capital expense (CAPEX) is an expense a business incurs to create a benefit in the future. OPEX and CAPEX are treated quite differently for accounting and tax purposes.

Capital Expenditures Focus on the Long-Term

A capital expenditure is incurred when a business spends money, uses collateral or takes on debt to either buy a new asset or add to the value of an existing asset with the expectation of receiving benefits for longer than a single tax year. Essentially, a capital expenditure represents an investment in the business. Capital expenses are recorded as assets on a company's balance sheet rather than as expenses on the income statement. The asset is then depreciated over the total life of the asset, with a period depreciation expense charged to the company's income statement, normally monthly. Accumulated depreciation is recorded on the company's balance sheet as the summation of all depreciation expenses, and it reduces the value of the asset over the life of that asset.

Examples of capital expenses include the purchase of fixed assets, such as new buildings or business equipment, upgrades to existing facilities, and the acquisition of intangible assets, such as patents.

Operating Expenses Cover the Short-Term

Operating expenses, on the other hand, are expenses incurred during the course of regular business, such as general and administrative expenses, research and development, and the cost of goods sold. Operating expenses are much easier to understand conceptually than capital expenses since they are part of the day-to-day operation of a company. All operating expenses are recorded on a company's income statement as expenses in the period when they were incurred.

OPEX cover a wide range of expense types, from office supplies and travel and distribution expenses to licensing fees, utilities, property insurance and property taxes. If equipment is leased instead of purchased, it is typically considered an operating expense. General repairs and maintenance of existing fixed assets such as buildings and equipment are also regarded as OPEX, unless the improvements will increase the useful life of the asset.

In running its business, a company sometimes has a choice whether to incur an operating expense or a capital expense. For example, if a company needs more storage space for housing its data, it can either invest in new data storage devices as a capital expense or lease space in a data center as an operational expense.

Project Appraisal:

Project appraisal is the process of assessing, in a structured way, the case for proceeding with a project or proposal, or the project's viability. It often involves comparing various options, using economic appraisal or some other decision analysis technique.

Process

- Initial Assessments
- Define problem and long-list
- Consult and short-list
- Evaluate alternatives
- Compare and select Project appraisal

Types of appraisal

- Technical appraisal
- Project appraisal
- Legal appraisal
- Environment appraisal
- Commercial and marketing appraisal
- Financial/economic appraisal
- organizational or management appraisal
  - Cost-benefit analysis
- Economic appraisal
  - Cost-effectiveness analysis
  - Scoring and weighting

Different Methods of Project Appraisal including Project Evaluation

Rama moorthy, chapter 36, pp. 306-311

Project Audit:

Definition and Scope

Rama moorthy, chapter 41, pp. 351

Project Auditor's Role

Rama moorthy, chapter 41, pp. 352-353

Total Quality Management (TQM):

There are many approaches in the business domain in order to achieve and exceed the quality expectations of the clients.

For this, most companies integrate all quality-related processes and functions together and control it from a central point.

As the name suggests, Total Quality Management takes everything related to quality into consideration, including the company processes, process outcomes (usually products or services) and employees.

Basic Principles of TQM

In TQM, the processes and initiatives that produce products or services are thoroughly managed. By this way of managing, process variations are minimized, so the end product or the service will have a predictable quality level.

Following are the key principles used in TQM:

- **Top management -** The upper management is the driving force behind TQM. The upper management bears the responsibility of creating an environment to rollout TQM concepts and practices.
- **Training needs -** When a TQM rollout is due, all the employees of the company need to go through a proper cycle of training. Once the TQM implementation starts, the employees should go through regular trainings and certification process.
- **Customer orientation -** The quality improvements should ultimately target improving the customer satisfaction. For this, the company can conduct surveys and feedback forums for gathering customer satisfaction and feedback information.
- **Involvement of employees -** Pro-activeness of employees is the main contribution from the staff. The TQM environment should make sure that the employees who are proactive are rewarded appropriately.
- **Techniques and tools -** Use of techniques and tools suitable for the company is one of the main factors of TQM.
- **Corporate culture -** The corporate culture should be such that it facilitates the employees with the tools and techniques where the employees can work towards achieving higher quality.
- **Continues improvements -** TQM implementation is not a one time exercise. As long as the company practices TQM, the TQM process should be improved continuously.

Implementation of TQM

The seven steps for implementing TQM are :

1. Energize the organization with quality awareness.

2. Change the culture of the organization.

3. Define the scope of your commitment to the organization as a whole.

4. Identify key process and product variables.

5. Implement statistical process control.

6. Incorporate process improvement activities in the organization.

7. Assess the quality improvement in the organization.

However, in order for these steps to be effective, the organization must be willing to invest resources in high-performance teams. A high-performance team is a team that performs at levels of excellence far beyond those of comparable systems (the concept of synergy). Some of the ingredients of a high-performance team are:

• They produce high-quality and high-value products and services.

• They consistently perform well against known internal and external standards.

• They use significantly fewer resources than one would expect.

• They generate a sense of enthusiasm and excitement among their members and those who come in contact with them.

To get these ingredients, a company must be willing to change. One change must be in the area of employee empowerment. It is imperative that the organization communicate to its employees the concept of "what is in it for me" rather than "do it because it is good for the organization." This change can be facilitated through a project management approach, since this integration of change will involve everyone in an organization. This integration will help in the project planning.

Benefits of TQM

- Strengthened competitive position
- Adaptability to changing or emerging market conditions and to environmental and other government regulations
- Higher productivity
- Enhanced market image
- Elimination of defects and waste
- Reduced costs and better cost management
- Higher profitability
- Improved customer focus and satisfaction
- Increased customer loyalty and retention
- Increased job security
- Improved employee morale
- Enhanced shareholder and stakeholder value
- Improved and innovative processes

Project management Software:

Steps for selecting a project management software package

1. **Plan the project**. Plan a software acquisition project to ensure you have overall agreement on the objectives, deliverables, scope, time frame, approach, etc., for choosing the software. This should include the background on what type of tool you will be considering, why it is needed, where it will fit in your technology architecture, etc. You should also build the work plan that you will use to manage the project. This planning step takes place just as it would for any projects that you manage.

2. **Gather and rank business requirements**. It's hard to select a tool or package if you are not sure what your requirements are. Again, this work is similar to the analysis you would do for any project.
Ask questions such as the following:
—What will people be using the package for?
—What problem will the package solve?
—What features and functions are required?
Many times, you will not be able to determine all the requirements by just asking the customers. You can also look for other potential requirements by reviewing prior research from industry analysts, reading magazines and periodicals, and searching the Web. These searches can be used to generate potential requirements that can be validated by your customers. Each requirement should be weighted on a numeric scale, or high/medium/low, to reflect the relative importance of some requirements over others. (Other weighting scales can be utilized as well.). This total list of requirements and weightings needs to be reviewed and approved by your sponsor and major customers and stakeholders.

3. **Create package long list**. At this point, look for any and all packages that might meet your needs. This can be accomplished by searching the Web, looking at trade magazines, talking to other companies, etc. The purpose of the step is to gather a comprehensive, but not exhaustive, list of vendors and packages that you want to consider further. If you think you already know the particular packages you are interested in, this step can be skipped-moving you directly to the short list. But this step helps ensure that there is not an obvious candidate that you are overlooking.

4. **Create package short list**. Perform an initial, high-level evaluation of the long list, looking for obvious reasons to eliminate some of the alternatives. For example, certain products may not fit within your technology architecture, some may be too new, or some may be obviously too expensive. In some cases, there may be a feature that you absolutely need that is not available. The purpose of this step is creating a short list of potential packages that look like they will have a reasonable chance to meet your needs. If the long list is not too large, you could send a Request for Proposal (RFP) to each candidate for feedback. You could also ask for product brochures and other literature. But, you must narrow down the packages to a small enough number that you can compare and contrast the remaining solutions during your final selection process.

5. **Evaluate package short list**. This step can be the most difficult part of package selection. You must map the package features and functions against your requirements and weighting factors to determine which package most closely meets your needs. If you did not send out an RFP to the long list, you might want to send one out now to the short list. You can also interview the vendors, set up product demonstrations, and make vendor site visits. Usually, some type of numerical calculation is made based on how well the package meets each requirement, multiplied by the weighting factor. The package with the highest score across all requirements should be the one that best meets your needs. When you have completed this step, you should have a first and second choice for the package that best meets your needs.

6. **Make final selection and negotiate contract**. In many organizations, the project team makes the final recommendation and then turns the process over to a formal purchasing or procurement organization. They are responsible for contract negotiation and legal details.

MS Project:

Microsoft Project is a project management software product, developed and sold by Microsoft. It is designed to assist a project manager in developing a plan, assigning resources to tasks, tracking progress, managing the budget, and analyzing workloads.

Microsoft Project was the company's third Microsoft Windows-based application, and within a couple of years of its introduction it became the dominant PC-based project management software.

It is part of the Microsoft Office family but has never been included in any of the Office suites. It is available currently in two editions, Standard and Professional. Microsoft Project's proprietary file format is .mpp.

Microsoft Project and Microsoft Project Server are the cornerstones of the Microsoft Office enterprise project management (EPM) product.

Features of MS Project

Project creates budgets based on assignment work and resource rates. As resources are assigned to tasks and assignment work estimated, the program calculates the cost, equal to the work times the rate, which

rolls up to the task level and then to any summary tasks and finally to the project level. Resource definitions (people, equipment and materials) can be shared between projects using a shared resource pool. Each resource can have its own calendar, which defines what days and shifts a resource is available. Resource rates are used to calculate resource assignment costs which are rolled up and summarized at the resource level. Each resource can be assigned to multiple tasks in multiple plans and each task can be assigned multiple resources, and the application schedules task work based on the resource availability as defined in the resource calendars. All resources can be defined in label without limit. Therefore, it cannot determine how many finished products can be produced with a given amount of raw materials. This makes Microsoft Project unsuitable for solving problems of available materials constrained production. Additional software is necessary to manage a complex facility that produces physical goods.

The application creates critical path schedules, and critical chain and event chain methodology third-party add-ons also are available. Schedules can be resource leveled, and chains are visualized in a Gantt chart. Additionally, Microsoft Project can recognize different classes of users. These different classes of users can have differing access levels to projects, views, and other data. Custom objects such as calendars, views, tables, filters, and fields are stored in an enterprise global which is shared by all users.

Project Risk Management:

Project risk management is an important aspect of project management. According to the Project Management Institute's PMBOK, Risk management is one of the ten knowledge areas in which a project manager must be competent. Project risk is defined by PMI as, "an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives.

Why Is Risk Management Important to Project Success?

Effective risk management strategies allow you to identify your project's strengths, weaknesses, opportunities and threats. By planning for unexpected events, you can be ready to respond if they arise. To ensure your project's success, define how you will handle potential risks so you can identify, mitigate or avoid problems when you need to do. Successful project managers recognize that risk management is important, because achieving a project's goals depends on planning, preparation, results and evaluation that contribute to achieving strategic goals.

Plans

Risk management plans contribute to project success by establishing a list of internal and external risks. This plan typically includes the identified risks, probability of occurrence, potential impact and proposed actions. Low risk events usually have little or no impact on cost, schedule or performance. Moderate risk causes some increase in cost, disruption of schedule or degradation of performance. High risk events are likely to cause a significant increase in the budget, disruption of the schedule or performance problems.

Preparation

To ensure that projects run smoothly, effective project managers communicate their plan to the project sponsors, stakeholders and team members. This sets expectations to people who provide funding and are affected by the outcomes. It ensures that the project runs smoothly so one step proceeds to the next

without disruption. By identifying, avoiding and dealing with potential risks in advance, you ensure that your employees can respond effectively when challenges emerge and require intervention.

Results

By defining risk management processes for your company, you make success more likely by minimizing and eliminating negative risks so projects can be finished on time. This enables you to meet your budget and fulfill targeted objectives. When you don't have risk management strategies in place, your projects get exposed to problems and become vulnerable. Effective risk management strategies allow your company to maximize profits and minimize expenses on activities that don't produce a return on investment. Through detailed analysis, effective leaders prioritize ongoing work based on the results produced, despite the odds.

Evaluation

To evaluate your project's success so you can use the best practices on your next project, assess the impact of your activities on mitigating exposure to problems and exploiting opportunities that capitalize on your company's strengths. For example, if you develop and deliver a training program that creates awareness about internet security, including phishing, viruses and identity theft, measure the number of help desk calls received about these problems. If they go down, you can reasonably assume your risk management initiatives have contributed to success. If not, revise your training program.

How is Risk managed?

Risk management is recognized as an integral component of good management and governance. It is an iterative process consisting of steps, which, when undertaken in sequence, enable continual improvement in decision making.

Risk management is the term applied to a logical and systematic method of establishing the context, identifying, analyzing, evaluating, treating, monitoring and communicating risks associated with any activity, function or process in a way that will enable organizations to minimize losses and maximize opportunities.

Risk management is as much about identifying opportunities as avoiding or mitigating losses.

The main elements of the risk management process are listed below.

- **Establish the context**
  - o Establish the context in which the rest of the process will take place
  - o Criteria against which risk will be evaluated should be established and the structure of the analysis defined
- **Identify risks**
  - o Identify what, why and how things can arise as the basis for further analysis
- **Analyze risks**
  - o Determine the existing controls and analyses risks in terms of consequence and likelihood in the context of those controls
  - o The analysis should consider the range of potential consequences and how likely those consequences are to occur

- **Evaluate risks**
  - o Compare estimated levels of risk against the pre-established criteria so risks can be ranked and management priorities identified
- **Treat risks**
  - o Low-priority risks should be monitored and reviewed
  - o For higher consequence risks, develop and implement a specific management plan or procedure that includes consideration of all aspects required to mitigate the risk to an acceptable level
- **Monitor and review**
  - o Monitor and review the performance of the risk management system and changes that might affect it
- **Communicate and consult**
  - o Communicate and consult with internal and external stakeholders as appropriate at each stage of the risk management process as well as the process as a whole

How can risk management be improved?

Maintaining effectiveness

To ensure changing circumstances do not alter risk profiles, it is necessary to monitor:

- risks
- the effectiveness of control measures, including
  - o the risk treatment plan
  - o strategies
  - o the management system set up to control implementation.

Few risks remain static. Factors that affect the likelihood and consequences of an outcome can change, as may the factors that affect the suitability or cost of the various treatment options. Ongoing review is essential to ensure the risk management treatment plan remains relevant.

Communicate the plan and consult those affected

Communication and consultation are important considerations at each step of the risk management process.

It is important to develop a communication plan for both internal and external stakeholders at the earliest stage of the process. This plan should address issues relating to both the risk itself and the process to manage it.

Effective internal and external communication is important to ensure that those responsible for implementing risk management, and those with a vested interest, understand the basis on which decisions are made and why particular actions are required. Seeking their input will facilitate the process.

Spiral Model:

The spiral model is similar to the incremental model, with more emphasis placed on risk analysis. The spiral model has four phases: Planning, Risk Analysis, Engineering and Evaluation. A software project repeatedly passes through these phases in iterations (called Spirals in this model). The baseline spirals, starting in the planning phase, requirements are gathered and risk is assessed. Each subsequent spiral builds on the baseline spiral. It's one of the software development models like Waterfall, Agile, V-Model.

Planning Phase: Requirements are gathered during the planning phase. Requirements like 'BRS' that is 'Business Requirement Specifications' and 'SRS' that is 'System Requirement specifications'.

Risk Analysis: In the **risk analysis phase**, a process is undertaken to identify risk and alternate solutions. A prototype is produced at the end of the risk analysis phase. If any risk is found during the risk analysis then alternate solutions are suggested and implemented.

Engineering Phase: In this phase software is **developed**, along with testing at the end of the phase. Hence in this phase the development and testing is done.

Evaluation phase: This phase allows the customer to evaluate the output of the project to date before the project continues to the next spiral.

Diagram of Spiral model
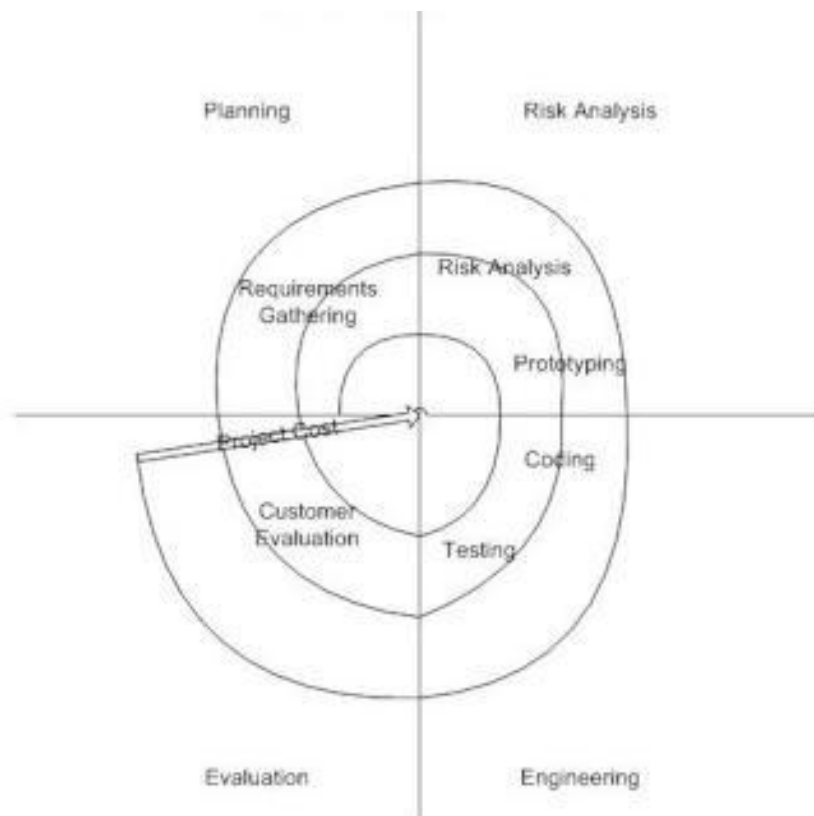
Advantages of Spiral model

- High amount of risk analysis hence, avoidance of Risk is enhanced.
- Good for large and mission-critical projects.
- Strong approval and documentation control.
- Additional Functionality can be added at a later date.
- Software is produced early in the software life cycle.

Disadvantages of Spiral model

- Can be a costly model to use.
- Risk analysis requires highly specific expertise.
- Project's success is highly dependent on the risk analysis phase.
- Doesn't work well for smaller projects.

When to use Spiral model

- When costs and risk evaluation is important
- For medium to high-risk projects
- Long-term project commitment unwise because of potential changes to economic priorities
- Users are unsure of their needs
- Requirements are complex
- New product line
- Significant changes are expected (research and exploration)

Why Spiral Model is called Meta Model?

The spiral model is called a meta model since it encompasses all other life cycle models. Risk handling is inherently built into this model. The spiral model is suitable for development of technically challenging software products that are prone to several kinds of risks. However, this model is much more complex than the other models – this is probably a factor deterring its use in ordinary projects.

Cost Benefit Analysis (CBA):

A technique to compare the total cost and the total benefit of a proposed solution. Both tangible and intangible factors need to be addressed and taken into account. Components may include:

- cost of labor
- equipment
- support services
- intangible factors, such as cultural impacts, customer satisfaction, or control savings factors, such as current expenditures vs. future expenditures

Although often treated as unquantifiable, intangibles also can and should be quantified.

Cost Benefit Analysis (CBA) - Deciding, Quantitatively, Whether to go ahead. Is a quick and simple technique that you can use for non-critical financial decisions. CBA can be applied to quality as well, is a quick and simple technique that you can use for non-critical financial decisions.

Broadly, CBA has two main purposes:

1. To determine if an investment/decision is sound (justification/feasibility) – verifying whether its benefits outweigh the costs, and by how much;
2. To provide a basis for comparing projects – which involves comparing the total expected cost of each option against its total expected benefits.

Applications

- To determine payback and/or rate of return for an enterprise change project.
- To take decisions about whether an action (project, program, policy, process) should or not be implemented.

Procedures

1. Obtain complete cost estimates.
2. Obtain complete benefit estimates.
3. Choose an appropriate Cost Benefit Analysis (CBA) algorithm to analyze the cost and benefit streams.
4. Compute estimated costs and benefits schedule over time to determine the payback period.
5. Make recommendations, and set next steps as required.

Fishbone Diagram:

Also called the cause-and-effect diagram or an Ishikawa diagram, the fishbone diagram is one of the seven basic qualities used in project management. This tool was developed by Professor Kaoru Ishikawa in 1960. It is called such because the completed diagram looks like the skeleton of a fish. The problem statement is placed at the head of the fishbone. It is also used as the starting point to track the source of the problem back to its root cause.

It is important to identify the problem statement which describes the problem or an objective that should be achieved. To create the fishbone, list the cause of the problem by asking "why" until an actionable root cause can be identified or until all the possibilities have been exhausted for the fishbone.

There are many advantages of using the fishbone diagram. One of its manage benefits is that it links the undesirable effects seen as a special variation to the assigned teams to implement different corrective actions in order to eliminate the special variation identified in the control chart.

Fishbone or Ishikawa Diagram Structure

The left side of the diagram is where the **causes** are listed. The causes are broken out into major cause categories. The causes you identify will be placed in the appropriate cause categories as you build the diagram.

The right side of the diagram lists the **effect**. The effect is written as the **problem statement** for which you are trying to identify the causes.
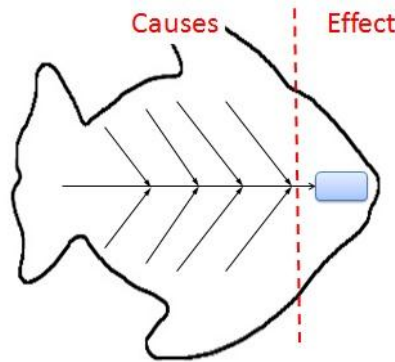
Fishbone diagram

The diagram looks like the skeleton of a fish, which is where the fishbone name comes from.

How to Create a Cause and Effect Diagram?

A cause and effect diagram can be created in six steps...

- Draw Problem Statement
- Draw Major Cause Categories
- Brainstorm Causes
- Categorize Causes
- Determine Deeper Causes
- Identify Root Causes

1) Draw Problem Statement

The first step of any problem solving activity is to define the problem. You want to make sure that you define the problem correctly and that everyone agrees on the problem statement.

Once your problem statement is ready, write it in the box on the right hand side of the diagram.

Fishbone Diagram - Problem Statement

2) Draw Major Cause Categories

After the problem statement has been placed on the diagram, draw the *major cause categories* on the left hand side and connect them to the "backbone" of the **fishbone chart**.

In a manufacturing environment, the traditional categories are...

- Machines/Equipment

- Methods
- Materials
- People

In a service organization, the traditional categories are...

- Policies
- Procedures
- Plant
- People

You can start with those categories or use a different set that is more applicable for your problem. There isn't a perfect set or specified number of categories. Use what makes sense for your problem.
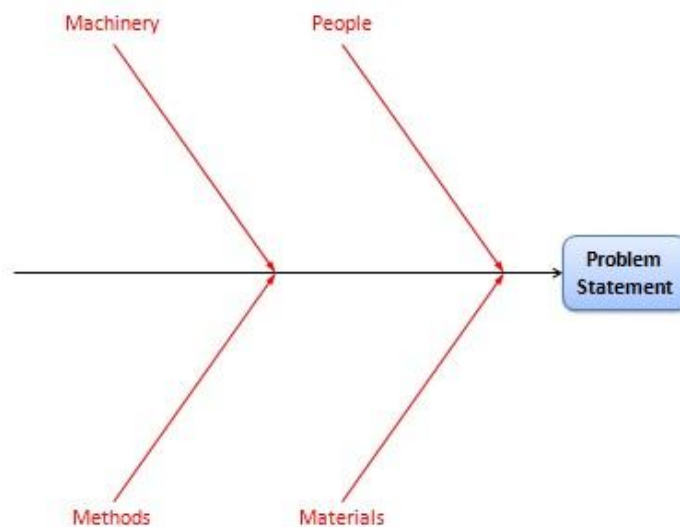
Cause and Effect Diagram - Major Cause Categories

3) Brainstorm Causes

Brainstorming the causes of the problem is where most of the effort in creating your Ishikawa diagram takes place.

Some people prefer to generate a list of causes before the previous steps in order to allow ideas to flow without being constrained by the major cause categories.

However, sometimes the major cause categories can be used as catalysts to generate ideas. This is especially helpful when the flow of ideas starts to slow down.

4) Categorize Causes

Once your list of causes has been generated, you can start to place them in the appropriate category on the diagram.

Ideally, each cause should only be placed in one category. However, some of the "People" causes may belong in multiple categories. For example, *Lack of Training* may be a legitimate cause for incorrect usage of *Machinery* as well as ignorance about a specific *Method*.
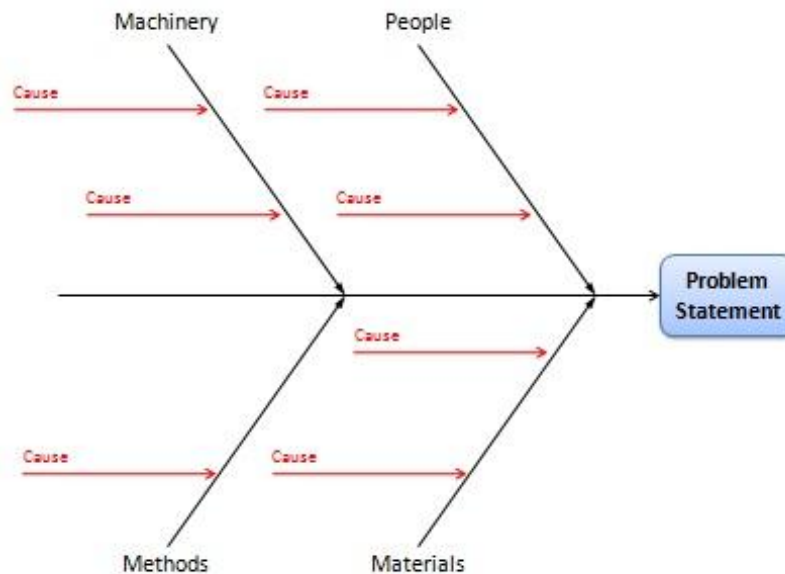

Fishbone Diagram - Categorize Causes

5) Determine Deeper Causes

Each cause on the chart is then analyzed further to determine if there is a more fundamental cause for that aspect. This can be done by asking the question, "Why does it happen?"

This step can also be done for the deeper causes that are identified. Generally, you can stop going deeper when a cause is controlled one level of management removed from your group. Use your judgment to decide when to stop.
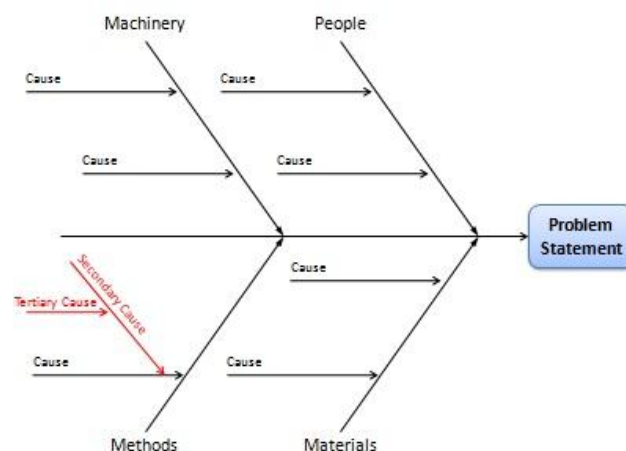
Fishbone Chart - Deeper Causes

6) Identify Root Causes

Identifying the root causes of the problem can be done in several ways...

- Look for causes that appear repeatedly
- Select using group consensus methods
- Select based on frequency of occurrence

Project Feasibility Study:

Feasibility Analysis is an analytical program through project manager determines the project success ratio and through feasibility study project manager able to see either project will useful for us or not and how much time, it will take to get completed. Also feasibility study allows project manager to determine all positive and negative points of the project.

Different Types of Feasibility Study

1. Technical Feasibility Study

2. Managerial Feasibility Study

3. Economic Feasibility Study

4. Financial Feasibility Study

5. Cultural Feasibility Study

6. Social Feasibility Study

7. Safety Feasibility Study

8. Political Feasibility Study

9. Environmental Feasibility Study

10. Market Feasibility Study

1) Technical Feasibility Study

The engineering feasibility of the project in viewed in the technical feasibility. Certain important engineering aspects are covered which are necessary for the designing of the project like civil, structural and other relevant aspects. Technical capability of the projected technologies and the capabilities of the personnel to be employed in the project are considered. In certain examples especially when projects are in third world countries, technology transfer between cultures and geographical areas should be analyzed. By doing so productivity gain (or loss) and other implications are understood due to the differences in fuel availability, geography, topography, infrastructure support and other problems.

2) Managerial Feasibility Study

Managerial feasibility is ascertained by certain key elements like employee involvement, demonstrated management availability & capability and commitment. The managerial and organizational structure of the project is addressed by this feasibility which ensures that the proponent's structure mentioned in the submittal is feasible to the kind of operation undertaken.

3) Economic Feasibility Study

Economic feasibility refers to the feasibility of the considered project to produce economic benefits. A benefit-cost analysis is needed. Furthermore the economic feasibility of a project can also be evaluated by a breakeven analysis. In order to facilitate the consistent basis for the evaluation, the tangible and intangible facet of a project must be translated into the economic terms. Economic feasibility is critical even when the project is non-profit in nature.

4) Financial Feasibility

Financial feasibility must be differentiated from economic feasibility. The ability of the project management to raise sufficient funds required to implement the proposed project is included in the financial feasibility. Additional investors and other sources of funds are considered by the project proponents for their projects in many cases. In such situations feasibility, sources, soundness and applications of these project funds may be a hindrance. Other aspects of financial feasibility should also be viewed, if appropriate, like credit worthiness, loan availability, equity, and loan schedule. The implications of land purchase, leases and other estates in land are also reviewed in the financial feasibility analysis.

5) Cultural Feasibility Study

The compatibility of the proposed project with the cultural environment of the project is included in the cultural feasibility. Planned operations should be integrated with the local cultural beliefs and practices in labor intensive projects. For example what a person is willing to perform or not perform is influenced by his religious beliefs.

6) Social Feasibility Study

The affect that a proposed project may have on the social system in the project environment is addressed in the social feasibility. It may happen that particular category of employees may be short or not available as a result of ambient social structure. The influence on the social status of the participants by the project should be evaluated in order to guarantee compatibility. It must be identified that employees in the particular industries may have specific status symbols within the society.

7) Safety Feasibility Study

Another important aspect that must be considered in the project planning is the safety feasibility. Safety feasibility involves the analysis of the project in order to ascertain its capacity to implement & operate safely with least unfavorable effects on the environment. Mostly in complex projects, environmental impact assessment is not properly addressed.

8) Political Feasibility Study

The directions for the proposed project are mostly dictated by the political considerations. This is certainly correct for large projects with potential visibility that may have important political implications and government inputs. For example, regardless of the merit of project, the political necessity may be a source of assistance for a project. On the other hand because of political factors, value able projects may face uncontrollable opposition. An evaluation of the objectives of project with the current objectives of the political system is required in the political feasibility analysis.

9) Environmental Feasibility Study

Environmental aspect is very crucial in making any potential project successful or failed. In the very early stages of the project, this aspect should be considered. All the environmental concerns raised or forecasted should be addressed in environmental feasibility so that proper actions can be taken to cover relevant issues of the environment. The ability of the project to timely acquire the required permits, licenses and approvals at a reasonable cost should also be included in this area.

10) Market Feasibility Study

Market feasibility must not be mixed up with the economic feasibility. The potential influence of market demand, competitive activities and available market share should be considered in the market feasibility analysis. During the start up, ramp up and commercial start up phases of the project, possible competitive activities (local, regional, national and international) should be analyzed for early contingency funding and impacts on the operating costs.

Benefits of Conducting a Feasibility Study

The importance of a feasibility study is based on organizational desire to "get it right" before committing resources, time, or budget. A feasibility study might uncover new ideas that could completely change a project's scope. It's best to make these determinations in advance, rather than to jump in and learning that the project just won't work. Conducting a feasibility study is always beneficial to the project as it gives you and other stakeholders a clear picture of the proposed project.

Below are some key benefits of conducting a feasibility study:

- Improves project teams' focus
- Identifies new opportunities
- Provides valuable information for a "go/no-go" decision
- Narrows the business alternatives
- Identifies a valid reason to undertake the project
- Enhances the success rate by evaluating multiple parameters
- Aids decision-making on the project
- Identifies reasons not to proceed

Apart from the approaches to feasibility study listed above, some projects also require for other constraints to be analyzed -

Internal Project Constraints: Technical, Technology, Budget, Resource, etc.

Internal Corporate Constraints: Financial, Marketing, Export, etc.

External Constraints: Logistics, Environment, Laws and Regulations, etc.

Statement of Work (SOW):

When it comes to implementing or constructing large and complex systems (such as an enterprise software system), the work requirements and conditions should be properly documented. Statement of Work (SOW) is such document that describes what needs to be done in the agreed contract.

Usually, the SOW is written in a precise and definitive language that is relevant to the field of business. This prevents any misinterpretations of terms and requirements.

An SOW covers the work requirements for a specific project and addresses the performance and design requirements at the same time.

Whenever requirements are detailed or contained within a supplementary document, SOW makes reference to the specific document.

The SOW defines the scope and the working agreements between two parties, typically between a client and a service provider. Therefore, SOW carries a legal gravity as well.

Purpose of SOW

The main purpose of a SOW is to define the liabilities, responsibilities and work agreements between clients and service providers.

A well-written SOW will define the scope of the engagement and Key Performance Indicators (KPIs) for the engagement.

Therefore, the KPIs can be used to determine whether the service provider has met conditions of the SOW and use it as a baseline for future engagements.

SOW contains all details of non-specifications requirements of the contractor or service provider's effort. Whenever specifications are involved, the references are made from SOW to specific specification documents.

These specification documents can be functional requirements or non-functional requirements.

Functional requirements (in a software system) define how the software should behave functionally and non-functional requirements detail other characteristics of the software such as performance, security, maintainability, configuration management, etc.

Format of SOW

The SOW formats differ from one industry to another. Regardless of the industry, some key areas of the SOW are common. Following are the commonly addressed areas in a SOW:

1. Scope

This section describes the work to be done in a technical manner. If the system to be built is a software system, this section defines the hardware and software requirements along with the exact work to be done in terms of the final system.

If there is anything 'out of scope', those areas are also mentioned under a suitable subheading.

2. Location

The location where the work is performed is mentioned under this section. This section also details the hardware and software specifications. In addition to that, a description about human resources and how they work are addressed here.

3. Timelines

This defines the timeline allocated for the projects. It includes the development time, warranty time and maintenance time. In addition to calendar time, the man days (total effort) required to complete the project is also noted.

4. Delivery schedule

This section of the SOW describes the deliveries and the due dates for the deliveries.

5. Standards

The standards (internal or external) are defined in this section. All deliveries and work done should comply with the standards defined in this section of the document.

6. Acceptance Criteria

This section defines the minimum requirements for accepting deliverables. It also describes the criteria used for acceptance.

7. Mode of contract and payments

There are a number of engagement models when it comes to contracting a service provider.

In the domain of software development, there are two distinct contract models, fixed bid and a retainer.

In fixed bid, the project cost is a constant and it is up to the service provider to optimize the resource allocation in order to maintain the profit margins.

The client does not worry about the number of resources, as long as the delivery schedule is met. In the retainer model, the client pays for the number of resources allocated to the project.

Since SOW is an integrated part of a project, almost all senior members of the project team should become aware of terms and conditions of the SOW. Sometimes, especially in software development projects, a penalty is applied if the delivery dates are missed. Therefore, everyone should be aware of such demanding terms of a SOW.