Introduction to project management

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Good project management does not guarantee the success of every project, but poor project management usually contributes to failure..

Preface

Organizations and government engineering directorates are increasingly using project management techniques within their operations, and the specialist language of project management has become more and more commonplace in managerial and executive meetings. This trend is here to stay and it means that managers need to be familiar with project management roles, terms, and processes.

Project management skills are required to make things happen. To make decisions that lead to actions, a manager must be competent in his field. Anything that involves many people or cross-departmental borders may require a high level of competence.

Introduction

The impact of technology and its influence on organizational processes is an essential aspect of any growth strategy. It is hard to find any development or procedural change that does not have an information technology aspect and in many cases it is actually the changes in available technology that drive the need to change organizational processes.

This has led to a merging of IT working practices into that of general management including the use of project management

Managers now find that they are frequently involved in projects that are being managed using a formalized project management methodology. Communications forms a key part of such projects and if you are going to be successful in your role as a manager it is essential that you have a thorough understanding of project management terminology, processes, and procedures.

There are various ways in which projects can be approached and a host of 'methodologies,' 'frameworks,' and 'processes' have been developed over the past 60 years or so. Some of these have their origins in academic research whereas others have grown out of proprietary methods developed by organizations that are highly project focused, for example management consultancies.

Each of these approaches has its own way of looking at projects and its own terminology for the documents and processes that make up project management.

There has been some rationalization in recent years but there are still a dozen widely used methods. The ones we are most likely to encounter are PMBOK®, PRINCE2, Critical Chain, and Agile.

PMBOK®:

Is short for **Project Management Body of Knowledge**, which describe Project management practices that are common to 'most projects, most of the time.' The PMBOK® is published by the Project Management Institute (PMI), which was formed in the USA in 1969. The PMI also offers various levels of certification and the PMBOK® is widely used and respected.

PRINCE2: is a process-based approach for project management, providing an easily tailored and scalable methodology for the management of all types of projects.
The method is the standard for public sector projects in the UK and is practiced worldwide. The acronym stands for Projects in a Controlled Environment and this is a project management program that shares more of the functional and financial authority with senior management, not just the project manager.

The **Critical Chain** method is not fundamentally different from the current mainstream approaches but it differs in the way that it handles risk and contingency.
Developed in 1997 it is a method of planning and managing project execution designed to deal with uncertainties inherent in managing projects, while taking into consideration the limited availability of resources.

The **Agile** approach uses an iterative method of determining requirements for engineering and software development projects in a highly flexible and interactive manner. It is most often used in small-scale projects or in cases where the final deliverables are too complex for the customer to understand and specify before testing prototypes.

What is a Project?

Before concerning ourselves with the details of project management documents and processes, it is a good idea to take a step back and think about what makes something a project and why it needs to be managed differently from the day-today work of the organization. In other words,
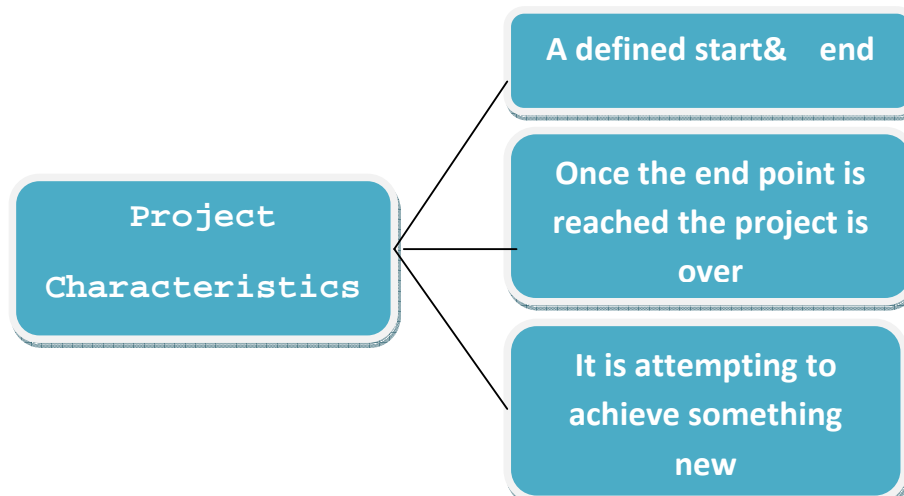
'*Why do we need project management?*'

There are many different definitions of what constitutes a project:

Project Management Institute—'*A project is a temporary endeavor undertaken to create a unique product, service or result.*'

PRINCE2—'*A Project is a temporary organization that is created for the purpose of delivering one or more business products according to an agreed Business Case.*

Association for Project Management (APM)—'*A project is endeavor in which human material and financial resources are organized in a novel way to deliver a unique scope of work of given specification often within constraints of cost and time to achieve beneficial changes defined by quantitative and qualitative objectives.*

Many organizations also have their own definition of what constitutes a project. Whichever definition you prefer does not really matter; the important thing is to be able to identify work that constitutes a project so that it can be properly managed.

Project Characteristics
- A defined start& end
- Once the end point is reached the project is over
- It is attempting to achieve something new

Projects have some or all of the following characteristics:

●They have a definite start and endpoint
●Once the endpoint is reached the project is over
●They are attempting to achieve something new

Projects can vary in size and small projects can be planned and managed by the same person whereas larger projects may employ thousands of people working on many sites and require a dedicated group in order to manage and coordinate the activities.

Types of Project

Projects can be broadly classified into engineering projects and management projects.
Engineering projects encompass civil, electrical, and mechanical engineering and the final deliverables are physical objects, for example a building, reservoir, bridge, refinery, or pre-production sample. Specialist companies or consortia invariably undertake these types of project.

Management projects include things like: restructuring the organization, preparing for an exhibition, developing an IT system, launching a new marketing campaign, moving offices, or indeed anything where the objective is to produce an end result that is not identifiable as a physical item.
A broad range of organizations does these types of project, including: commercial companies, government departments, charities and NGOs (Non Governmental Organizations), and other not-for-profit organizations.

The differences between these types of project go further than just the nature of the final deliverable. For example:

Use of Specialist Staff;

Engineering projects almost always represent the day-to-day work of the organization.
For example, a construction company will employ people who specialize in building office blocks, public buildings, houses, or roads.

Similarly, a manufacturing company will have design engineers to take a product from conception, through the design process and prototyping before the work is handed over to production engineers who will then be responsible for mass production.

This is quite different from a management project where people who don't usually run projects may find themselves doing much the work.

Environmental Issues

The challenges of engineering projects are often physical in nature. For example, a construction project may be held up by bad weather, the discovery of archeological remains, or other unforeseen environmental problems.

Management projects on the other hand usually take place on the organization's own premises and are not subject to these sorts of issues.

Specification of Final Deliverable

In the case of engineering projects the final deliverable is usually specified in detail at the beginning of the project because it will need to comply with existing standards or legislation. If the deliverable is a mechanical or electronic part then it will need to fit with the rest of the finished product.

This is not usually the case with management projects where the exact form of the final deliverable may not become clear until some of the work of the project has been done.

It may also alter as the project develops, or in response to market research or other developments.

Generally speaking, engineering projects and management projects are quite different things and this eBook is aimed at managers undertaking management projects rather than engineering projects.

What is Project Management?

Projects need to be managed to meet their objectives, which are defined in terms of expectations of time, cost, and quality.
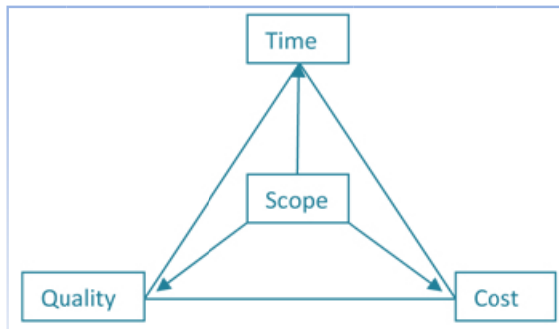
The scope of the project is defined as:

The totality of the outputs, outcomes, and benefits and the work required to produce them.

This can change over time, and it is the project manager's responsibility to ensure the project will still deliver its defined benefits. Consequently, a project manager must maintain focus on the relative priorities of time, cost, and quality with reference to the scope of the project.

The Project Management Institute (PMI) defines project management in the following way:
 '**Project management is the application of knowledge, skills, tools and techniques to meet project requirements.**

This definition begs the question 'Exactly what knowledge, skills, tools, and techniques will need to successfully manage a project?' In order to answer this question, it is helpful to look at project management from three different perspectives.

The project managers ask 3 key questions:

1. **How the project fits into the organization**—This refers to both the project and the individuals who will be involved in it, including how their responsibility are defined and how they interact with each other.

2. **How the project will evolve over time**—This is referred to as the project life cycle and is the chronological sequence of activities that need to happen in order to deliver the project. Whatever their differences, all projects will by definition share a similar life cycle; they will all have a beginning, middle, and an end.

3. What knowledge is required to successfully manage the project—These are usually referred to as 'Project Knowledge Areas' because there are discrete areas within project management that can be considered in isolation even though they are interdependent.

This might sound unnecessarily complicated, but looking at a project from each of these three viewpoints will give us a much better understanding of the whole process than using any one of them individually.

Understanding the Project life cycle

There is very little agreement about the life cycle phases of a project and many organizations have their own internal definitions and templates. This is understandable because of the complicated nature and diversity of projects, which can vary enormously in size and complexity

Despite this, all projects can be mapped to the following simple life cycle structure:

1. Starting the project
2. Organizing and preparing
3. Carrying out the work
4. Closing the project

This is known as a **four-phase life cycle** and the phases are usually referred to as:
1. Initiation
2. Planning
3. Execution
4. Closure

Each of these phases is made up of discrete activities, each of which has an associated definition and guidelines. The number of activities depends on the scope of the project.

A simple project will involve only a few activities while a more complex project may involve hundreds or thousands of individual activities. This model can be applied to a variety of project scenarios although the cost and duration of each phase will vary according to the particular project.
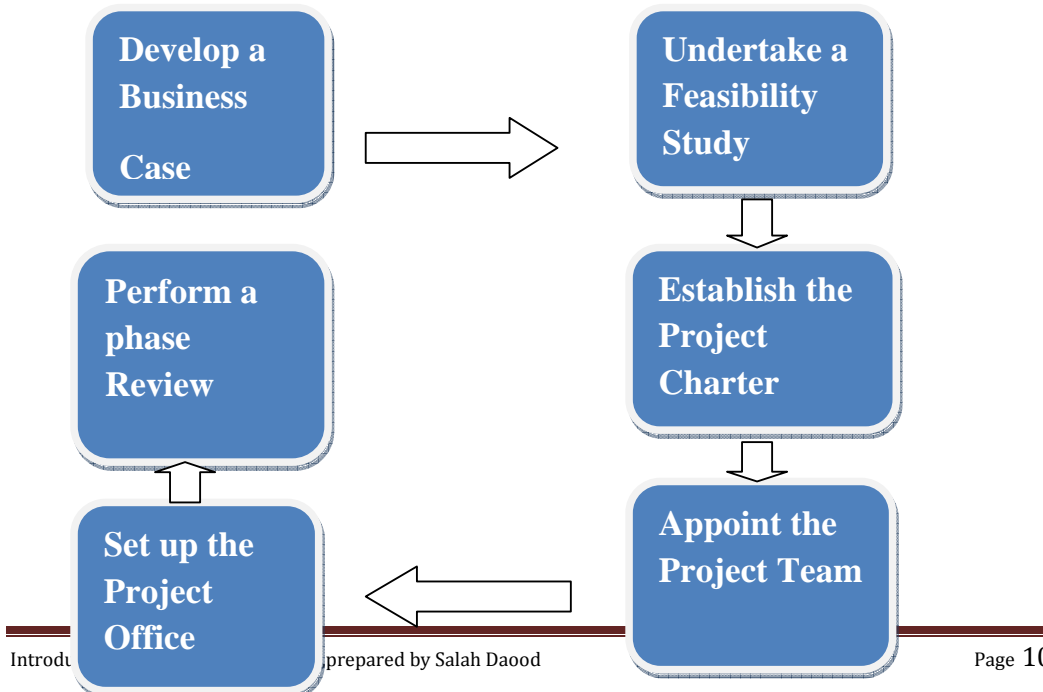
The **project life cycle** defined as:

'*A collection of generally sequential project phases whose names and number are determined by the control needs of the organization or organizations involved in the project.*

1. The Initiation Phase

The **Project Initiation Phase** is the 1st phase in the *Project Management Life Cycle*, as it involves starting up a new project. You can start a new project by defining its objectives, scope, purpose and deliverables to be produced. You'll also hire your project team, setup the Project Office and review the project, to gain approval to begin the next phase.

Overall, there are six key steps that you need to take to properly initiate a new project. These *Project Initiation steps* and their corresponding templates are shown in the following diagram. Click each link below, to learn how Method123 templates help you to initiate projects.

Activities

Develop a Business Case	→	Undertake a Feasibility Study
Perform a phase Review		Establish the Project Charter
Set up the Project Office	←	Appoint the Project Team

Overview of the Project Process

The project process is outlined on the following flow chart;

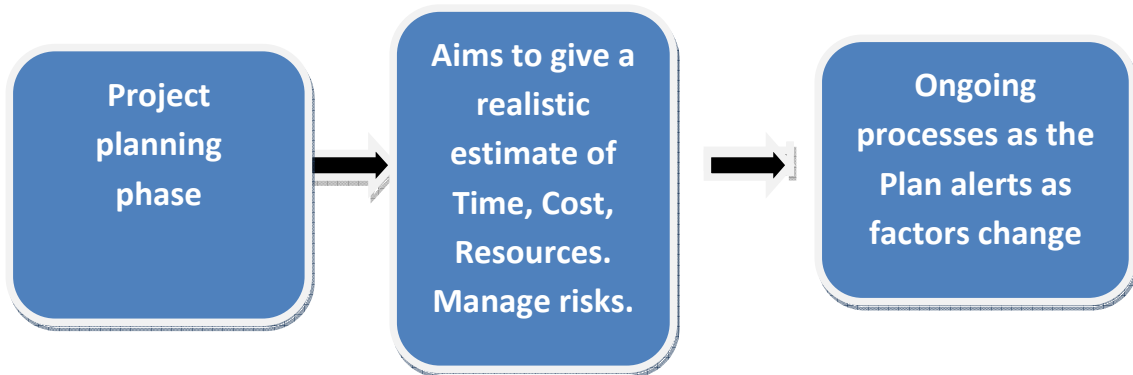| 1. Identify the project (Start Work Plan development) | 6. Deter mine Project Schedule | 10. Launch Project |
2. Select the project team	7. Cost/ Benefiti Analysis	11. Progress Plans
3. Identify the stakeholders	8. Determine Role &Responsibilities	12. Risk Management as required
4. Identify the Risk	9. Identify training needs, policies &procedures	13. Project Close-out & Evaluation
5. Define the project objectives		

2. The planning phase

 As its name suggests, the planning process aims to create a plan that can be used to manage the project. The PMBOK® defines it as:

'Those processes performed to define and mature the project scope, develop the project management plan, and identify and schedule the project activities that occur within a project.'
A common misconception is that this phase must be completed before the actual work of the project can begin. This is not true; planning is an

activity that continues almost to the very end if the project. In any project, there will always be factors that change as it progresses.

Project planning phase	→	Aims to give a realistic estimate of Time, Cost, Resources. Manage risks.	→	Ongoing processes as the Plan alerts as factors change

In fact, it can be a serious mistake to spend too much time on planning in the early stages of the project as this not only wastes time but can give everyone involved a false impression of how much is really known at this stage. In contrast to the initiation phase (which does have a definite endpoint), it is simply impossible to plan a project and then execute the plan without taking account of changing circumstances.

The main purpose of this phase is to plan time, cost, and resources adequately to estimate the work needed and to effectively manage risk. Initial planning generally consists of:

●Developing the scope statement
●Selecting the planning team
●Identifying deliverables
●Creating the work breakdown structure
●Identifying the activities needed to complete those deliverables
●Sequencing the activities in a logical way
●Estimating the resources needed
●Estimating the time needed
●Estimating the costs
●Developing the schedule
●Developing the budget
●Gaining formal approval to begin

However, it must be understood that as soon as work begins new factors will become apparent, priorities will change, and promised resources will not materialize. If the planning process is not sufficiently flexible to take account of these things then the project will fail.

The need for re-planning should be built in from the beginning of the project and decisions will need to be made regarding:
● How often to re-plan
● How to manage the information that is needed for this re-planning
● How to control changes to the plan
● How to communicate these changes
● How and when to involve stakeholders

Even if the answers to these questions are not clear at the outset, the important thing is to make decisions about them and then modify those decisions as it becomes clear what is and is not working.

Out puts of planning phase

Project Management plan

9 Knowledge Area Management Plans

Ongoing Plan Updates

The main output of this phase is the project plan and its associated updates. It also produces the management plans for the nine knowledge areas—scope, time, cost, quality, human resources, communications, risk, procurement, and stakeholder management.

There are two definitions of project plan;

1. **According to the PMBOK®, a project plan is defined as**:

'A formal, approved document used to guide both project execution and project control. The primary uses of the project plan are to document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope, cost, and schedule baselines. A project plan may be summarized or detailed.'

2. **The PRINCE2 definition states:**

'The Project plan is a statement of how and when a project's objectives are to be achieved, by showing the major products, milestones, activities and resources required on the project.'

What we want to have in our project plan is:

1. Aim of project
2. Outputs.
3. Quality criteria.
4. Resources.
5. Management structure.
6. Milestones.
7. Tolerances.
8. Dependencies.
9. Risks.
10. Schedule.

Let's have a look at these in turn, and see why they are needed, and what we want to achieve with each of them.

1. Aim of Project

What do we want to produce? The aim of the project is a mixture of the reasons for doing the project and the benefits that are expected from it. This section of the plan can be either fulfilled by linking to the main business case, or by restating it in language for the expected audience. For example, your business case may have been written for high level approval in your organization. You may want to now put it in terms the project executive expects.

2. Outputs

Given the aim of the project, what do we actually need to produce to get there? What will your completed project be made up of? These need to be clearly defined. For example, your project's aim may be to upgrade the IT infrastructure in an organization. Your final output would be a completed computer network, a new computer on every desk, and all appropriate software installed and ready to go.

3. Quality Criteria

Now we have the outputs, we need to understand what quality they need to be of. In the example above, we have an output of a completed computer network. However, we need to know that the network can actually cope with the amount of traffic going over it!

This means we need the completed output to be of a certain quality, and we need to define what that quality is. These targets tell you what success is, what completion of the project is. They need to be SMART:

- Specific: Clearly defined and precise.
- Measurable: e.g. not "new computers," but "computers with 2Gb of memory," etc.
- Attainable: Don't ask for the impossible.
- Relevant: Is the criterion actually related to the aim of the project?
- Time-based: Enough time to achieve this. There is no point expecting a year's worth of work in one week!

It is important you take some time with the stakeholders in your project to produce this list. The final customer of the project will naturally be very involved, but don't forget your business head - don't promise everything without considering the costs. Your project executive, and a representative of those who will be doing the work, will have major inputs into this also.

Finally, you will also need to decide who has the final say over the quality of the outputs. Hopefully your work on defining the quality criteria will mean there are no arguments over the quality (i.e. no qualitative judgments only quantitative) but you need to make sure you schedule in time and people to do the evaluation work.

4. Resources

We have now set down what outputs we need to produce, and what quality they need to be at. This means we are now in a position to look at the resources we will need to achieve this. Resources include staff time, particular knowledge or skill sets, money (e.g. buying equipment), and time (some tasks can't be increased by throwing more people at the problem, e.g. delivery times, setting time for concrete, etc.).

5. Management Structure

How are we going to manage the work? You need to describe the general approach to the project here. Who will be the decision makers for the various different streams of work? For example, you may be doing a significant procurement - who makes the decision about what company to buy from?

How will we share progress on the project? Who will we share it to? For example, you may decide to have regular project team meetings - who needs to attend? What level of information will you be sharing? Who else needs to be kept informed, at what level of detail, and how often? For example, you may want to keep the project executive updated at an overview level of detail on a weekly basis, while you keep other managers appraised at a higher level of detail.

You will also need to spell out the relationship of yourself to the project executive, in terms of the monitoring of progress. Equally, you need to put down how you will be monitoring progress of the allocated tasks.

There is no one right answer for how this should be done, and indeed it will vary with every project. Make sure you think about the size and complexity of the project, and also the organization's ethos and current management style.

6. Milestones

Here we need to think about how we will break up the project. Unless it is very small, we don't want to have the entire project as one lump of work, with the only check on progress at the very end. Instead, it makes sense to break the project up into discrete chunks, where related tasks can be lumped together, with a sensible milestone at the end of them. For example, in the technology refresh in the example above, we may want to break the project down into something like:

1. Requirements Gathering.
2. Tender Writing.
3. Tendering Process.
4. Contract Negotiation.
5. Deployment.
6. Testing

It makes sense to have a defined milestone, so we know when each section is completed. There is also another benefit of breaking the project into chunks, which I'll come back to.

7. Tolerances

We will have already looked at the resources you need. Now we need to set how far us, or the project executive, can let the project stray from these targets before needing to sound the alarm. For example, you could set a tolerance in terms of finance of +/- 5%, and a tolerance in terms of time of +/- 10%. Equally, you may want to look at tolerances of quality - i.e. how far from the quality criteria are you willing to accept?

It is remarkably unlikely that a project will not deviate from its resource or quality targets. Setting tolerances allows you to be able to manage the project without continually seeking guidance from the project executive as to whether you should carry on. This is not to say that you should be happy with these deviations, and you should try to avoid them, and monitor them closely. That way you can build your understanding of the project for the future.

8. Dependencies

This is where you look at what needs to happen before something else. For example, in our example above, you need to complete the requirements gathering before you can finish the tender documentation. You need to start thinking about the dependencies so you, and the project team, can understand the impact of changes in any part of the project.

These dependencies should include both those internal to the project (i.e. those under your control), and those external to it (i.e. those outside of your control). For example, you may need an accurate figure for the number of staff in the organization. This needs to come from your HR department, and would be an external dependency.

9. Risks

Simply, what could go wrong? What could happen that would damage your ability to deliver the project? Are there things you can do to avoid them, or minimize them?

10. Scheduling

This is the Gantt chart-style information that many people envisage when a project plan is mentioned. In this, you need to put down what you expect to happen when. It will include your dependencies, milestones, and probably resources. At this point, it will be a relatively high overview of the whole project.

There is something you need to understand about this schedule, and that is this: it will be wrong.

I know that seems a strong statement, but it is vital that you understand that you cannot make a perfect schedule. You really would be getting into the realm of prophecy if you think you can sit down now, and accurately and precisely pinpoint the date the project will end. No, what you need to do here is achieve the possible.

The schedule needs to include the overview, with the project broken down into sensible chunks. This is the other advantage of breaking the project into chunks we mentioned above. By having the project broken up in this way, you will be able to start planning the first section in quite some detail, extending out for a few weeks. But from then on, it will start to be based more and more on blind guesswork and faith. Don't try to be artificially precise - keep it vague, use rough figures.

As you come to the end of each chunk of the project, you will be able to plan the next one. You can use the information and experience you have just gained from the previous section, and thus you will be able to be more confident.

Make sure you explain this to your project stakeholders! Often your project executive may look at a schedule, and imagine everything is laid out and known. You must get this idea out of their head straight away! Explain that the early part is firmer than the rest, and make sure they expect changes as the project moves on.

Your executive will crave certainty, and absolute dates for the project, from the very beginning. You must resist the pressure to name a specific date, and explain why. While there may be a temptation to give an answer (no doubt of a date plucked, essentially, from the air) you need to instead be realistic about what is and isn't possible in terms of scheduling. Anything else can only lead to trouble for you, the project, and ultimately your executive further down the line.

The Project Manager:

The Project Manger is the key member who is responsible for the success or failure of the project. His/her normal roles and responsibilities include the following:

- o Planning
    - Responsible for preparing maintain the project work plan.
    - Establish project and performance requirements.
    - Establish clear milestones
    - Provide contingency planning.
    - Control changes if they are required and gain all concerned parties support
    - Define clearly the team member's responsibilities.
    - Define schedules and budgets.
    - Ensure the work plan can be implemented

- o Organizing
    - Develop a work breakdown structure which defines measurable unit of work.
    - Establish an organizational chart.
    - Clearly define each team member' s scope of work.

- o Resources
    - Mobilizes project resources.
    - Manages materials and facilities.
    - Procure equipment and supplies.
    - Maintain equipment, facilities and inventories.
    - Maintain security system and operate insurance policies.

- o Human Resources
    - Work with the human resources department to select team members.
    - Provide a clear orientation which defines goals and objectives of the project.
    - Manages staff.
    - Manages staff training and rewards good performance.

- o Directing and Coordinating
  - ▪ Lead the team and coordinate all aspects of the project.
  - ▪ Motivate the team.
  - ▪ Work out problems when they occur in a cooperative manner.

- o Communications
  - ▪ Maintains project communications; reports; records of meetings and correspondence.
  - ▪ Maintain working relationships with contractors, subcontractors, regulatory authorities, and reports to the head of projects and or department, donor or authority as necessary.

- o Quality
  - ▪ Increase quality and performance objectives are realized.

- o Controlling
  - ▪ Maintains records of planned and executed work.
  - ▪ Maintain weekly or monthly milestone chart.
  - ▪ Maintain staff meeting to ensure the team is informed.
  - ▪ Maintain all meetings records and critical conversation.
  - ▪ Maintain project cost records.
  - ▪ Maintain and evaluate progress.

- o Time
  - ▪ Monitors time so that project is completed on schedule.
- o Costs…Budget

    Manages funds, expenditure and prepares financial reports.

In order to effectively manage the project, the Project manager must have certain skills such as leadership, the ability to provide direction, motivation to the team members, make trade-off decisions, expedite work when necessary, put our fires, and monitor time, budget and

technical details. If the Project Manager lacks certain skills required for the project, he or she rely on his or her team member's skills, guide them and evaluate their efforts.

Sometimes ethical issues arise in connection with a project, for examples; withhold information in order to get a project approved, alteration statement on status reports, false records, compromising workers/ employees safety. In such cases it's the responsibility of the managers at all levels to maintain and enforce ethical standards. A code of ethics should be established and available to all workers/employees.

A successful Project Manager:

- o Plans in advance – start the project with the end in mind.
- o Review project priorities.
- o Prepare a functional work plan.
- o Update the work plan.
- o Use appropriate management style.
- o Achievable –if can't achieve it by himself/herself, rely on other member' input.
- o Measurable-expectations upon completion.
- o Leadership skills.
- o Maintain good communications.
- o Decision.
- o Set standards of performance - results are achieved.
- o Controls information – set up project control systems.
- o Look at alternative.

Leadership

 The Project manager should have a strong personality, charisma, high standard of values and ethics, honesty, gain support , respect and trust of his/her team and superiors, and strong communications skills.

Team Building Pillars

- o Key words are pressure, responsibility, honesty, kindness, respect and communications.
- o To avoid hiding problems and mistakes and point blame.
- o Maintain effective communication by providing clear information and receive feedback on what is expected and when.
- o The project sponsor should have good qualifications criteria to select designers, contactors, and third party participants in order to set priorities related to cost, schedule, quality, safety, and tracking vendors shipping and delivery dates.
- o Vendors and purchasing agents are important participants in the team.
- o Motivate team members by ascertaining their needs and determining appropriate methods to meet their needs.
- o Continuity in the project team.

Project management Tools

- o WBS (work Breakdown Structure);a planning tool needed to develop lists of activities.
- o Network Diagram; a visual tool used to estimate project duration, identify critical activities, slack time areas and activity schedules.
- o Gantt Charts; a visual aid used to plan and monitor activities.
- o Risk management Analysis; potential failures, assessments of possible problems and impacts, and contingency plans.

Generally people with diverse skills and knowledge form the team of a project. Some of these people may work together on a project throughout its Life Cycle and some may moved from one project to another.

Organizations normally use a "Matrix Organization" that allows to integrate the activities of a variety of specialists within a functional framework. As an example; they may have project team members specialized in engineering, construction, business development,

proposals, project monitoring, project control, finance, human resources, etc.

Work Breakdown Structure (WBS);

The WBS is the principal foundation of the Program Controls System that defines the organization for budgeting, tracking expenditures, forecasting and scheduling the work. It divides the program into elements of the Scope of work. it is developed with assignment codes to allow the tracking of reporting elements into meaningful packages to summarize progress and cost. The WBS coding structure is uses to break down all planning design scopes of work for budgeting and progress payments.

The following steps are considered in developing the **WBS:**

- o Identify major elements of the project and divide the project into parts that can be managed.
- o Establish a base for scheduling and control.
- o Identify supporting activities for each of the major elements.
- o Each major supporting activity is broken down into a list of the activities that will be required to accomplish it.

Bar Charts/Gantt Charts

Bar Charts (Gantt Charts) are normally used as a tool which enables the Project Manager to initially schedule the activities and monitor progress over time by comparing planned progress with actual progress. However, it may fail to indicate certain relationships among activities that can be crucial to the project. A network diagram can be used in conjunction with the chart to provide more effective information about the project.

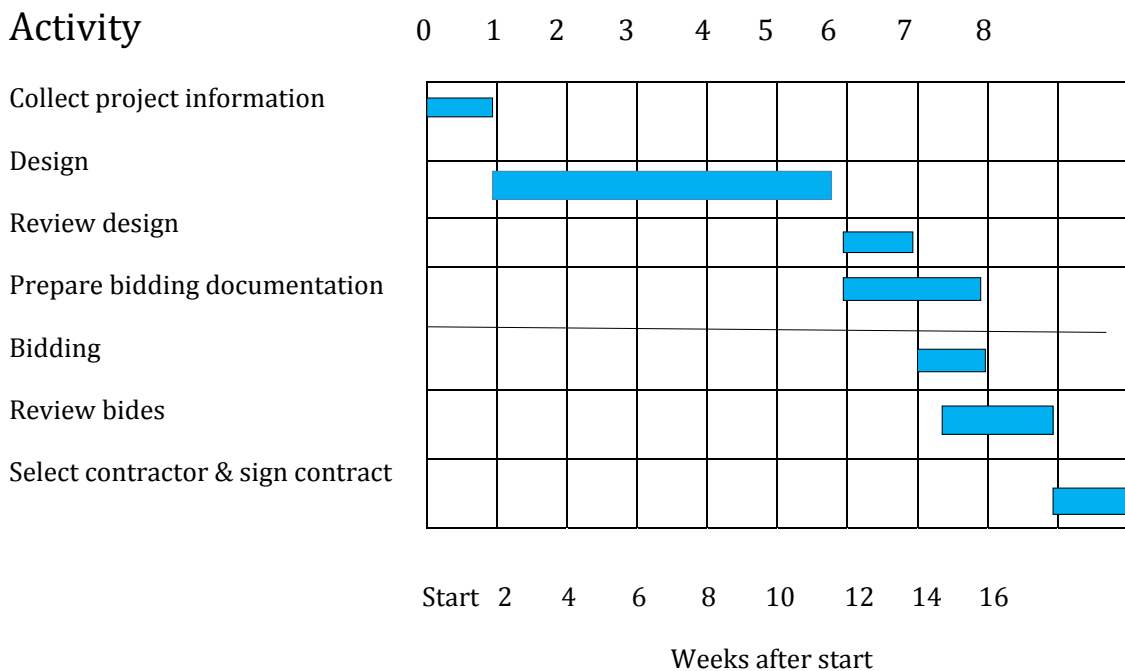Construction schedules are usually in the form of bar-chart indicating;

i. Different operation of a project.
ii. Quantity, unit and rate of construction of each operation, and

iii. Estimate the date of starting and completing each item of work.

To create the Gantt chart;

- List the activities/tasks and show the possible completion date.
- Plot the activities/ tasks onto the chart.
- Schedule the tasks.

Example: construct an office building

Activity	0	1	2	3	4	5	6	7	8

Collect project information

Design

Review design

Prepare bidding documentation

Bidding

Review bides

Select contractor & sign contract

Start 2   4   6   8   10   12   14   16

Weeks after start

Gantt Chart

PERT and Critical Path Method (CPM)

PERT (program evaluation and review technique);is a method to analyze the involved tasks in completing a project, especially the time needed to complete each task, and to identify the minimum time needed to complete the total project.

It is commonly used in conjunction with the critical path method (CPM).

It is mostly used to obtain;

- Graphical display of project activities.
- Project duration.
- Indicate which activities are most critical.
- How long an activity can be delayed

Critical Path Analysis

It allows scheduling and managing more complex projects. CPM is sequential and based on the concept that some activities cannot start until the others are finished. Other activities which are referred to as "Parallel" may not be dependent upon others, so they can be completed at any prior time.

PERT Network diagram;

The main features of PERT and related techniques are their use of a network diagram to depict major activities and their sequential relationships.

PERT network is based on events, so it is event-oriented. In other words, the inertest is focused upon the start or completion of events rather than on the activities themselves. In this network the activities that take place between events are not specified. It does not consume time or resources.

Definitions: Some elements or terms used in Network Diagram defined below:

Event or **Node**; This is either beginning or end of a job, and represented by a number enclosed in a circle or in a rectangular, it requires no time or resources itself.

Activity: It is the performance of a specific task, it requires time and resources to perform an activity.

Arrow; It is drawn to represent each activity included by the network for a project, joining two events, designated by two numbers ,one at the tail, and another at the head.

ES; Earliest start

EF; Earliest finish

LS; Latest start

LF; Latest finish

The arrows designate activities and under another convention the nodes designate activities. These conventions are referred to as activity –on-arrow (AOA) and activity on node (AON) activities consume resources and time. The nodes in the AOA approach represent the activities 'starting and finishing points, which are referred to as events. Events are points in time. Unlike activities, they don't consume resources or time. Nodes in the AON diagram represent activities.

It is customary to start time with the first arrows at the left end of the network and to proceed to the right.
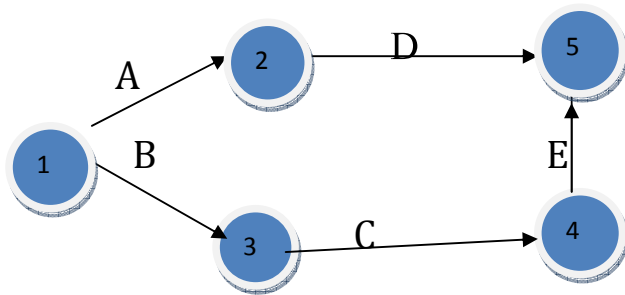

Activity –on- Arrow, AOA
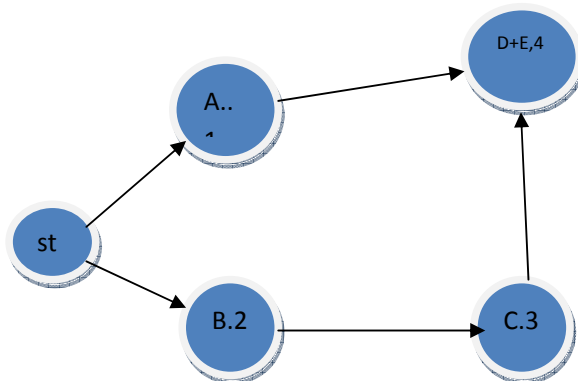
Activity-on-node (AON)

3. The Execution phase

The whole point of a project is to produce deliverables of some sort. The execution phase is where this happens. Essentially, work is done according to the project plan and that work is monitored and the results fed back to the people responsible for the plan so that it can be updated to reflect the progress made.
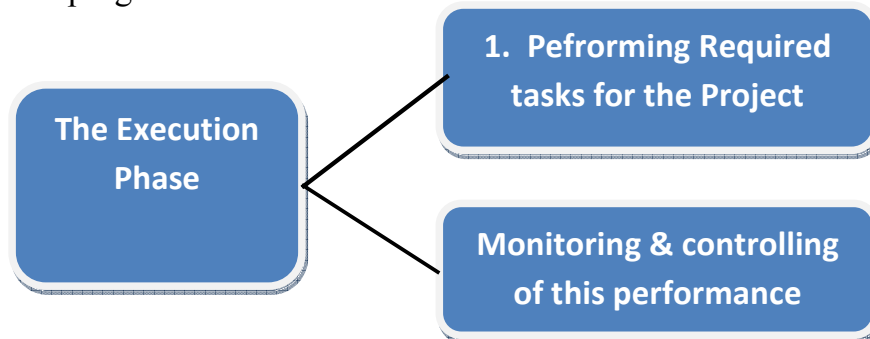
It is possible to see this phase of the project as consisting of two processes: the 'doing' or executing, and the monitoring and controlling. This is how the PMBOK® views this phase of the project.
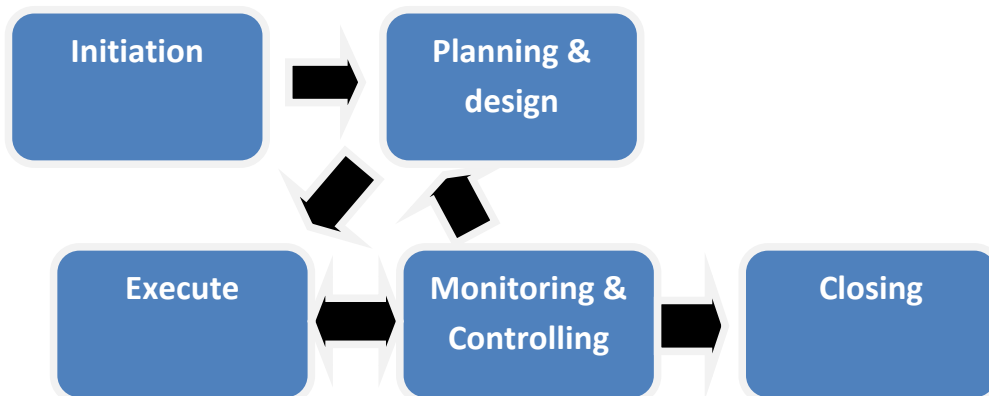
This phase is often called 'Execution and Control' because it does not represent a blind implementation of the initial project plan but rather a cyclical process. As you can see from the diagram above, the planning, executing, and the monitoring and controlling processes are all interdependent.

Executing consists of the processes used to complete the work defined in the project plan to accomplish the project's requirements. Execution process involves coordinating people and resources, as well as integrating and performing the activities of the project in accordance with the project management plan.

The PMBOK® defines the executing process as:

'Those processes performed to complete the work defined in the project management plan to accomplish the project's objectives defined in the project scope statement.
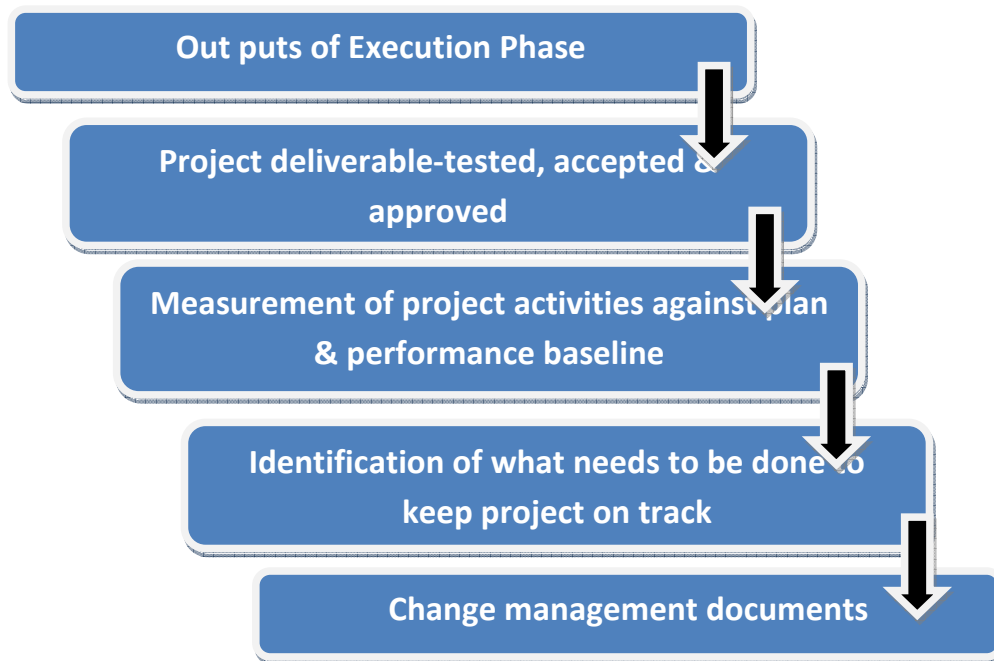
The main output of this process is the project deliverables and producing these will be the responsibility of the project team who will be working to the project plan.

The PMBOK® defines the **monitoring and controlling** process as:
'*Those processes performed to measure and monitor project execution so that corrective action can be taken when necessary to control the execution of the phase or project.'*

Monitoring and controlling consists of monitoring project execution so that potential problems can be identified in a timely manner and corrective action taken as necessary.
Monitoring and controlling includes measuring the ongoing project activities and the project variables (cost, effort, scope, etc.) against the project management plan and the project performance baseline. It then identifies what needs to be done in order to get the project back on track. Over the course of any project, the scope may change either as the result of necessary design modifications, differing site conditions, material availability, contractor-requested changes, value engineering and impacts from third parties, to name a few.

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┌─────────────────────────────────────────┐
│        Out puts of Execution Phase       │
└─────────────────────────────────────────┘
        │
        ▼
    ┌─────────────────────────────────────────┐
    │  Project deliverable-tested, accepted &  │
    │                 approved                 │
    └─────────────────────────────────────────┘
            │
            ▼
        ┌─────────────────────────────────────────┐
        │ Measurement of project activities against plan │
        │          & performance baseline          │
        └─────────────────────────────────────────┘
                │
                ▼
            ┌─────────────────────────────────────────┐
            │ Identification of what needs to be done to │
            │          keep project on track           │
            └─────────────────────────────────────────┘
                    │
                    ▼
                ┌─────────────────────────────────────────┐
                │        Change management documents       │
                └─────────────────────────────────────────┘
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The change normally needs to be documented to show what was actually done; this is referred to as change management. This phase continues until all of the relevant parties acknowledge that all of the outputs delivered have been tested, accepted, and approved

Project monitoring and controlling

. The Monitoring and Controlling process oversees all the tasks and metrics necessary to ensure that the approved and authorized project is within scope, on time, and on budget so that the project proceeds with minimal risk. This process involves comparing actual performance with planned performance and taking corrective action to yield the desired outcome when significant differences exist. Monitoring and Controlling process is continuously performed throughout the life of the project.

Key Tasks

- Begin Execution Phase Activities
- Assemble Execution Phase Project Team
- Team Development
- Assign Resources
- Execute Project Management Plans
- Direct and Manage Project Execution

- Execute Task Assignments
- Conduct Progress Status Meetings
- Quality Assurance
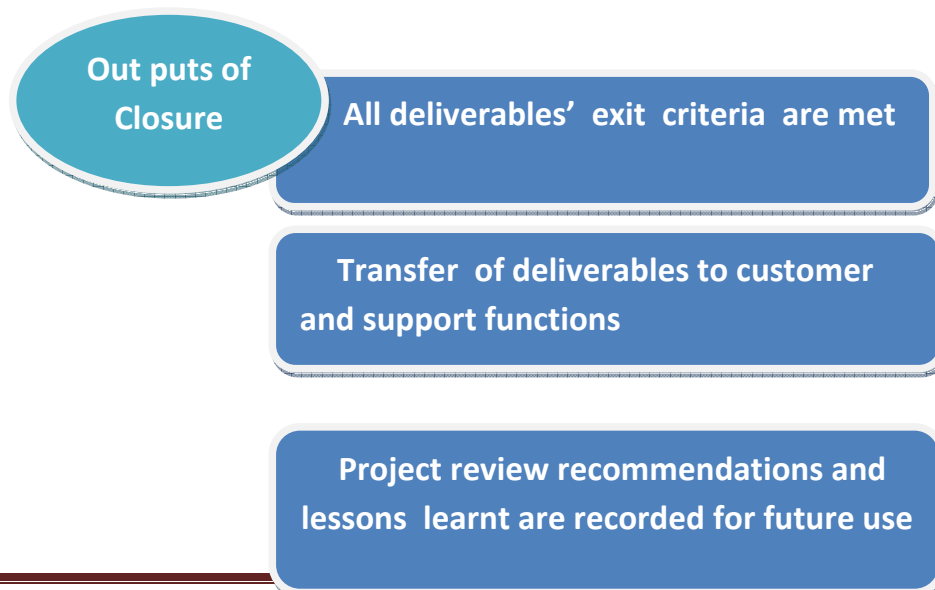- Complete Execution Phase Review

- Cost Control
- Quality Control
- Performance Reporting
- Risk Control
- Contract Administration
- Complete Monitoring and Controlling
  Phase Review

4. The Closure Phase

This represents the formal completion of the project deliverables and their transfer to the final beneficiaries—usually internal or external customers. This phase also includes 'administrative closure,' which is the termination of the activities of the project team, the completion of all project documentation, and a formal sign-off of any contracts.

The PMBOK® defines **closure** as:

'***Those processes performed to terminate formally all activities of a project or project phase, and the transfer of the completed product to others or close a cancelled project.***

Out puts of Closure

All deliverables' exit criteria are met

Transfer of deliverables to customer and support functions

Project review recommendations and lessons learnt are recorded for future use

Project documents are usually archived so that they can be referred to if the organization takes on a similar project where the experience gained and the lessons learned in the current project would prove useful.

The Closing phase includes all the activities necessary for the project office to close the project. Project Close may be signified by system acceptance and transfer to the support organization, or by official system retirement or replacement. It is important that lessons learned during the project are captured and that project information is properly archived. This phase marks the end of the project's operation, including transferring operations and/or data to a follow-on system (as applicable) and retirement of any legacy system. This phase includes archiving project data and documenting final lessons learned

Key Tasks

- Collect Contract Documentation
- Complete Contractor Final Review
- Formal Acceptance
- Administrative Closure
- Financial Closure and Audit
- Archiving
- Personnel and Facilities
- Complete Closeout Phase Review and Lessons Learned
- Celebrate Success
- Complete Post Implementation Evaluation Report

References

1. Project Management Institute '*A framework for project management*'.

2. Adams, John. '*Principles of Project Management*'.

3.S.P.ARORA. '*Building Construction*'.