

## UNIT – IV

### **STRATEGIC & PROJECT MANAGEMENT**

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management** - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems)

## **STRATEGIC MANAGEMENT**

### **Strategy**

The term ‘Strategy’ is derived from military science. It is the art of a general leading an army. In other words, it is a technique of managing the war campaign by the military commanders in such a way as to make it favourable to the concerned military commanders and their army.

When it comes to business planning, strategy is the grand design, which an organisation chooses in order to move or react towards the set objectives by using its resources.

### **Definition of Strategy**

Chandler defined strategy as “the determination of basic long-term goals and objectives of an enterprise and the allocation of resources to carry out these goals.”

Strategy includes:

- An awareness of the goals that are to be attained
- The unpredictability and uncertainty of events which form the business environment.
- The need to take into accounts the probable or actual behaviours of others.

### **Objectives of Strategies**

The objectives of strategies are:

- To determine & communicate a picture of the kind of enterprise that is to envisage.
- To show a unified direction & imply a deployment of emphasis & resources.
- To serve the useful purpose of guiding enterprise thinking & action.
- To integrate knowledge about technology & social changes.
- To help in formulating programmes that embrace new technology, new products, enlarged markets & increased rate of growth.

### **Features of Strategies**

- Strategies are major course of action to achieve the objectives.
- Strategy is a long-term design chartered to fight competition in marketing campaigns.
- Strategies are mostly action-oriented.
- Strategy is an application of available resources for effectively meeting a competition in the market.
- Strategy is a broad line of action to meet uncertainty, risk and insecurity that may arise in future so that these can be met effectively.

### **Types of Strategies**

1. **Business Strategy:** A business strategy focuses on developing a long-term plan of action to achieve a company’s goals, such as increasing profits or market share. It

involves analyzing the current market and competitors, creating a strategic vision, and setting objectives and goals.

2. **Corporate Strategy:** Corporate strategy is a plan of action that defines how a company will reach its goals and objectives. It involves analyzing the current environment, identifying strategic goals and objectives, and determining the best way to meet them.
3. **Competitive Strategy:** Competitive strategy is a plan of action that companies use to gain an edge over their competitors. It involves analyzing competitors, identifying their strengths and weaknesses, and devising strategies to capitalize on opportunities and reduce threats.
4. **Innovation Strategy:** Innovation strategy is the process of developing new products, services, and processes that can give a company a competitive advantage. It involves identifying customer needs, brainstorming ideas, developing prototypes and testing them.
5. **Operational Strategy:** Operational strategy focuses on how to optimize resources and processes in order to create value and achieve organizational goals. It involves analyzing current operations, setting goals and objectives, and creating plans to reach those goals.

### Strategic Management

Strategic management involves developing and implementing plans to help an organization achieve its goals and objectives. This process can include formulating strategy, planning organizational structure and resource allocation, leading change initiatives, and controlling processes and resources.

Strategic Management is all about identification and description of the strategies that managers can carry so as to achieve better performance and a competitive advantage for their organization.

Strategic Management is a process of formulating, implementing & evaluating cross-functional decisions that enable the organisation to achieve the long-run objectives. The definition involves: - (a) Determination of long-term goals

(b) Adoption of courses of action

(c) Allocation of resources

### **Process of Strategic Management**



1. Defining the levels of strategic intent of the business:
  - Establishing vision
  - Designing mission
  - Setting objectives
2. Formulation of strategy
  - Performing environmental and organizational appraisal
  - Considering strategies
  - Carrying out strategic analysis
  - Making strategies
  - Preparing strategic plan
3. Implementation of strategy
  - Putting strategies into practice
  - Developing structures and systems
  - Managing behavioural and functional implementation
4. Strategic Evaluation and Control
  - Performing evaluation
  - Exercising control
  - Recreating strategies

Strategic Management is all about specifying organization's vision, mission and objectives, environment scanning, crafting strategies, evaluation and control.

### **Importance of Strategic Management**

- It guides the company to move in a specific direction. It defines organization's goals and fixes realistic objectives, which are in alignment with the company's vision.
- It assists the firm in becoming proactive, rather than reactive, to make it analyse the actions of the competitors and take necessary steps to compete in the market, instead of becoming spectators.
- It acts as a foundation for all key decisions of the firm.
- It attempts to prepare the organization for future challenges and play the role of pioneer in exploring opportunities and also helps in identifying ways to reach those opportunities.
- It ensures the long-term survival of the firm while coping with competition and surviving the dynamic environment.
- It assists in the development of core competencies and competitive advantage, that helps in the business survival and growth.

### **Vision**

A vision statement describes what a company desires to achieve in the long-run, generally in a time frame of five to ten years, or sometimes even longer. It depicts a vision of what the company will look like in the future and sets a defined direction for the planning and execution of corporate-level strategies.

Vision implies the blueprint of the company's future position. It describes where the organization wants to land. It is the dream of the business and inspiration, base for the planning process. It depicts the company's aspirations for the business and provides a peep of what the organization would like to become in future. Every single component of the organization is required to follow its vision.

### Key Elements of a Good Vision Statement

While companies should not be too ambitious in defining their long-term goals, it is critical to set a bigger and further target in a vision statement that communicates a company's aspirations and motivates the audience. Below are the main elements of an effective vision statement:

- Forward-looking
- Motivating and inspirational
- Reflective of a company's culture and core values
- Aimed at bringing benefits and improvements to the organization in the future
- Defines a company's reason for existence and where it is heading

### Developing a vision Statement

1. Conducting vision audit, which explain the current vision of the organisation
2. Targeting the vision, which involves setting of boundaries or constraints of vision statement.
3. Setting vision context where you are going to explain how organisation should work.
4. Developing future scenarios of your vision.
5. Generating alternative visions based on future scenarios & evaluating the each alternative.
6. Choosing the final vision.

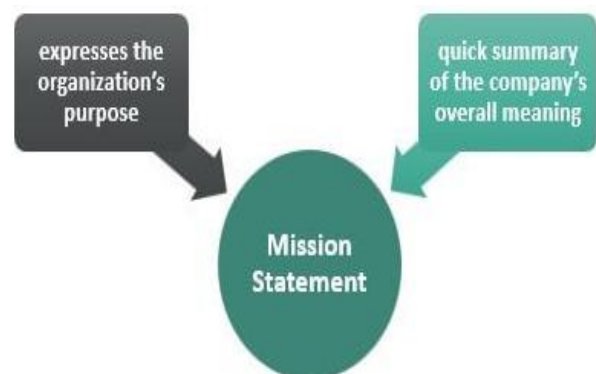
### Mission

Mission delineates the firm's business, its goals and ways to reach the goals. It explains the reason for the existence of the business. It is designed to help potential shareholders and investors understand the purpose of the company. A mission statement helps to identify, 'what business the company undertakes.' It defines the present capabilities, activities, customer focus and business makeup.

A mission statement defines what a company does & what purpose it serves. It describes the company's function.

### Components of mission:

- Customer
- Products / Services
- Markets
- Concern for survival, growth & Profitability
- Technology
- Philosophy
- Self-concept
- Concern for Public image
- Concern for employee



### How to write an effective mission statement?

• **Identify your Purpose:** Begin by pondering on the fundamental reason your business exists. What problem does it solve? How does it add value to your customers? What positive change do you wish to bring about through your business?

• **Define your Vision:** Once you've established a clear purpose, envision the future of your business. What long-term goals do you aspire to achieve? Where do you see your business in the next 10, 20, or even 50 years? Create a vision that is both ambitious and inspiring.

- **Establish your Values:** Determine what principles will guide your business operations and interactions. These values should resonate with your stakeholders and be reflected in every aspect of your business.
- **Keep it Authentic:** Aim to keep your mission statement genuine. Avoid jargon and aim for a simple yet powerful statement that your team and customers can connect with.
- **Make it Inspiring and Actionable:** A great mission statement not only describes your business but also motivates you. It should inspire your team to work towards your vision and encourage customers to support your business.
- **Review and Refine:** Don't expect to get it perfect the first time. Be prepared to revise and refine your mission statement until it accurately represents your business and its goals.

### Goal

For businesses, goals are broad, long-term outcomes that are reasonable to achieve within a time frame and with available resources. Because goals are often very open-ended, they leave room for separate departments and teams to develop specific actions to help reach these outcomes.

Goals are intermediate results which is expected to achieve by a certain time period with a set of resources. Goals are short-term oriented.

### **Objectives of Goals**

1. Clarity – Define a clear & specific target
2. Motivation – Provide a sense of purpose & inspiration
3. Focus – Concentrate on efforts & resources on key priorities.
4. Measurement – Establish criteria for evaluating process.
5. Achievement – Foster a sense of accomplishment upon completion.
6. Accountability – Encourage responsibility for one's action.
7. Direction – offer guidance on where to channel energy and resources.
8. Prioritization – Helps in determining which tasks are most important.
9. Feedback – Facilitate ongoing assessment & adjustments.
10. Time management – Assist in allocating time effectively.

### Objectives

An *objective* is something you plan to achieve. A military *objective* is the overall plan for a mission. The *objective* for a bake sale is to raise money. If your *objective* is to learn a new word, you have succeeded.

Objectives Indicates the results of an organisation which is expected to achieve long run. The objectives are end results.

### **Objectives of setting an Objective**

1. Clarity – Clearly define what needs to be achieved.
2. Measurability – Make objectives quantifiable for assessment.
3. Relevance – Ensure that objectives align with broader goals.
4. Achievability – Set realistic and attainable objectives

5. Time-Bound – Establish a time frame for achieving objectives.
6. Focus – Direct efforts towards specific, targeted outcomes.
7. Alignment – Ensure alignment with personal / organisational vision
8. Motivation – Provide a sense of purpose and drive for action
9. Communication – clearly communicate objectives to relevant partners.
10. Evaluation – enable periodic assessment of progress.

### **Strategy Formulation**

Strategy Formulation is an analytical process of selection of the best suitable course of action to meet the organizational objectives and vision. It is one of the steps of the strategic management process. The strategic plan allows an organization to examine its resources, provides a financial plan and establishes the most appropriate action plan for increasing profits.

### **Steps in Strategy Formulation**



1. **Establishing Organizational Objectives:** This involves establishing long-term goals of an organization. Strategic decisions can be taken once the organizational objectives are determined.
2. **Analysis of Organizational Environment:** This involves SWOT analysis, meaning identifying the company's strengths and weaknesses and keeping vigilance over competitors' actions to understand opportunities and threats. Strengths and weaknesses are internal factors which the company has control over. Opportunities and threats, on the other hand, are external factors over which the company has no control. A successful organization builds on its strengths, overcomes its weakness, identifies new opportunities and protects against external threats.
3. **Forming quantitative goals:** Defining targets so as to meet the company's short-term and long-term objectives. Example, 30% increase in revenue this year of a company.

4. **Objectives in context with divisional plans:** This involves setting up targets for every department so that they work in coherence with the organization as a whole.



5. **Performance Analysis:** This is done to estimate the degree of variation between the actual and the standard performance of an organization.
6. **Selection of Strategy:** This is the final step of strategy formulation. It involves evaluation of the alternatives and selection of the best strategy amongst them to be the strategy of the organization.

Strategy formulation process is an integral part of strategic management, as it helps in framing effective strategies for the organization, to survive and grow in the dynamic business environment.

### Levels of strategy formulation

There are three levels of strategy formulation used in an organization:



- **Corporate level strategy:** This level outlines what you want to achieve: growth, stability, acquisition or retrenchment. It focuses on what business you are going to enter the market.
- **Business level strategy:** This level answers the question of how you are going to compete. It plays a role in those organization which have smaller units of business and each is considered as the strategic business unit (SBU).
- **Functional level strategy:** This level concentrates on how an organization is going to grow. It defines daily actions including allocation of resources to deliver corporate and business level strategies.

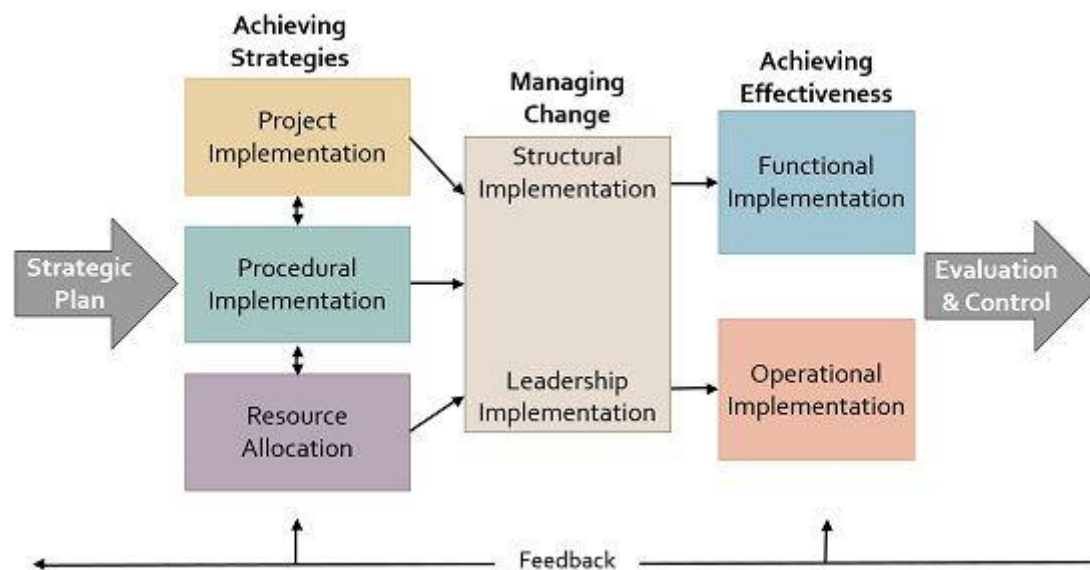
Hence, all organisations have competitors, and it is the strategy that enables one business to become more successful and established than the other.

### Strategy Implementation

Strategy Implementation refers to the execution of the plans and strategies, so as to accomplish the long-term goals of the organization. It converts the opted strategy into the moves and actions of the organisation to achieve the objectives.

Strategy Implementation is the fourth stage of the Strategic Management process, the other three being a determination of strategic mission, vision and objectives, environmental and

organisational analysis, and formulating the strategy. It is followed by Strategic Evaluation and Control.



### Process of Strategy Implementation

1. Building an organization, that possess the capability to put the strategies into action successfully.
2. Supplying resources, in sufficient quantity, to strategy-essential activities.
3. Developing policies which encourage strategy.
4. Such policies and programs are employed which helps in continuous improvement.
5. Combining the reward structure, for achieving the results.
6. Using strategic leadership.

The process of strategy implementation has an important role to play in the company's success. The process takes place after environmental scanning, SWOT analyses and ascertaining the strategic issues.

### Environmental Scanning

Environmental scanning is a process by which an organization monitors their internal & external environment to spot strength & weakness from internal environment and opportunities & threats from external environment.

#### Characteristics of Environmental Scanning

The characteristics of environmental scanning are as follows:

1. **Continuous Process-** The analysis of the environment is a continuous process rather than being sporadic. The rapidly changing environment has to be captured continuously to be on track.
2. **Exploratory Process-** Scanning is an exploratory process that keeps monitoring the environment to bring out the possibilities and unknown dimensions of the future. It stresses the fact that "What could happen" and not "What will happen".
3. **Dynamic Process-** Environmental scanning is not static. It is a dynamic process and depends on changing situations.
4. **Holistic View-** Environmental Scanning focuses on the complete view of the environment rather than viewing it partially.



**Components of Environmental Scanning**

1. **Internal Environmental Components-** The components that lie within the organization are internal components and changes in these affect the general performance of the organization. Human resources, capital resources and technological resources are some of the internal environmental components.
2. **External Environmental Components:** The components that fall outside the business organization are called external environmental components. Although the components lie outside the organization, they still affect the organizational activities. The external components can be divided into microenvironmental components, and macro environmental components.

Microenvironmental components include competitors, consumers, markets, suppliers, organizations, etc. Macro environmental components include political, legal, economical, cultural, demographic, and technological factors.

**Techniques of Environmental Scanning****1.Environmental Threat and Opportunity Profile Analysis (ETOP)**

ETOP is considered as a useful device that facilitates an assessment of information related to the environment and also in determining the relative significance of external environment threats and opportunities to systematically evaluate environmental scanning. By dividing the environment into different sections, the ETOP analysis helps in analyzing its impact on the organization. The analysis is based on threats and opportunities in the environment.

**2.Quick Environmental Scanning Technique Analysis (QUEST)**

QUEST is an environmental scanning technique that is designed to assist with organizational strategies by keeping adheres to change and its implications. Different steps involved in this technique are as follows:

- The process of environmental scanning starts with the observation of the organization's events and trends by strategists.
- After observation, important issues that may impact the organization are considered using environment appraisal.
- A report is created by making a summary of these issues and their impact.
- In the final step, planners who are responsible for deciding the feasibility of the proposed strategy, review reports.

**3.SWOT Analysis**

SWOT analysis stands for strengths, weaknesses, opportunities and threats analysis of a business environment. Strengths and weaknesses are an organization's internal factor while threats and opportunities are considered as external factors. So, the process of SWOT analysis includes the systematic analysis of these factors to determine an effective marketing strategy. It is a tool that is used by the organization for auditing purposes to find its different key problems and issues.

**Different techniques of environmental scanning are described below:**

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These are identified through internal and external environmental analysis.

### Internal environment analysis/ scanning

Different factors are considered while analyzing the internal environment of an organization like the structure of the organization, physical location, the operational capacity and efficiency of the organization, market share, financial resources, skills and expertise of employees, etc.

**Strengths:** The strength of any organization is related to its core competencies i.e. efficient resources or technology or skills or advantages over its competitors.

**Weaknesses:** A weakness or limitation of an organization is related to the scarcity of its resources or skill-set of staff or capabilities that creates an adverse effect on its performance.

### External environment analysis/scanning

Different factors that are considered while scanning the external environment of the organization like Competitors, customers, suppliers, technology, social and economic factors, political and legal issues, market trends, etc.

**Opportunities:** An opportunity of the organization's environment is considered as its most favorable situation. These are the circumstances that are external to the business and can become an advantage to the organization

**Threats:** Threats of an organization are current or future unfavorable situations that may occur in its external environment.

## 4. PEST Analysis

PEST technique for a firm's environmental scanning includes analysis of political, economic, social, and technical factors of the environment.

**Political/ Legal factors:** Different factors like changes in tax policy, availability of raw material, etc. creates a direct effect on a business. So organizations are required to constantly monitor tax-related policy changes as an increase in tax may increase the heavy financial burden on them. Similarly, different laws like "Consumer protection act" also play an important role in an organization's operation activities as it is important to abide by the act.

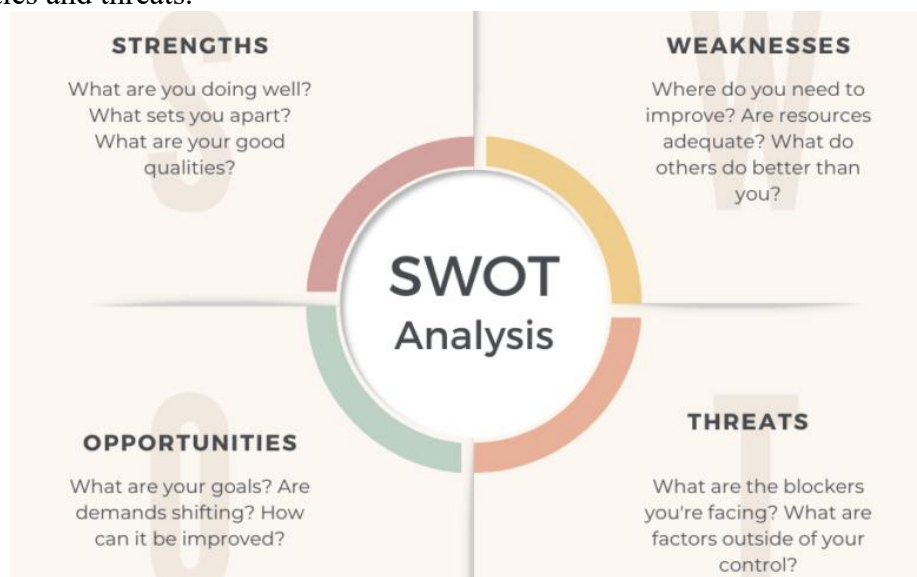
**b) Economic factors:** Different economical Factors like the unemployment rate, inflation, cost of labor, economic trends, disposable income of consumers, monetary policies, etc. play an important role in environmental scanning.

**c) Social / Cultural factors:** Attitude, trends, and behavioral aspects of society also create an impact on the functioning of the organization. Studying and understanding the lifestyle of consumers is very much required to target the right audience and to offer the right product or services based on their preferences.

**d) Technological Factors:** Technological factors affect the way firms produce products and services as well as market them. Like, “processes based on new technologies” is one of the important factors of a technological environment. To maximize profits, production should be handled most cost-effectively and this, technology has an important contribution.

### **SWOT Analysis**

A SWOT analysis is a planning process that helps your company overcome challenges and determine which new leads to pursue. “SWOT” stands for strengths, weaknesses, opportunities and threats.



#### **Strengths**

Strengths are things that your organization does particularly well, or in a way that distinguishes you from your competitors. Think about the advantages your organization has over other organizations. These might be the motivation of your staff, access to certain materials, or a strong set of manufacturing processes.

#### **Weaknesses**

Weaknesses, like strengths, are inherent features of your organization, so focus on your people, resources, systems, and procedures. Think about what you could improve, and the sorts of practices you should avoid.

#### **Opportunities**

Opportunities are openings or chances for something positive to happen, but you'll need to claim them for yourself! They usually arise from situations outside your organization, and require an eye to what might happen in the future. They might arise as developments in the market you serve, or in the technology you use. Being able to spot and exploit opportunities

can make a huge difference to your organization's ability to compete and take the lead in your market.

**Threats**

Threats include anything that can negatively affect your business from the outside, such as supply-chain problems, shifts in market requirements, or a shortage of recruits. It's vital to anticipate threats and to take action against them before you become a victim of them and your growth stalls.

**Corporate Planning Process**

Corporate planning is a total system of planning which involves the determination of the objectives for the company as a whole and for each department of the it; formulation of strategies for the attainment of these objectives (all this being done against the background of SWOT analysis); conversion of strategies into tactical plans (or operational plans); implementation of tactical plans and a review of the progress of tactical plans against the corporate planning objectives.

**Process of Corporate Planning:**

Major steps involved in corporate planning are as follows:

**(i) Environmental Analysis and Diagnosis:**

The first steps (which is, in fact, the background step), involved in corporate planning is environmental analysis and diagnosis. (A detailed account of this step is attempted subsequently, in the discussion about corporate planning).

**(ii) Determination of Objectives:**

All planning starts with a determination of the objectives for the plan; and corporate planning is no exception to this generality. In corporate planning, after environmental analysis and diagnosis, the planners determine objectives for the company as a whole and for each department of it; which become the beginning point of corporate planning.

All objectives of corporate planning must represent an integrated or coordinated system of objectives. In order to make corporate planning a realistic approach to attaining objectives; objective setting for corporate planning is done in the light of environmental analysis and diagnosis.

**(iii) Strategy Formulation:**

Strategy formulation is the core aspect of corporate planning. Strategy is, in fact, the weapon of the planner devised for attaining objectives of corporate planning. It is easier to set objectives; it is difficult to realize them. Strategies facilitate the attainment of objectives.

There is no doubt about it that success of strategies is the success of corporate planning; and vice-versa. Strategy formulation is also done in the light of environmental analysis and diagnosis.

**(iv) Development of Tactical Plans:**

Strategies are translated into action plans called tactical plans or operational plans. Tactical plans are necessary for implementation of strategies leading to the attainment of corporate planning objectives. For example, if the strategy of a company is to develop the skills and talents of manpower for realizing objectives; then designing of suitable training programmes would amount to making tactical plans.

Corporate planning and strategy formulation have a long-term perspective; while tactical plans have a short-term perspective, as the latter are to be implemented immediately, in the usual course of organisational life.

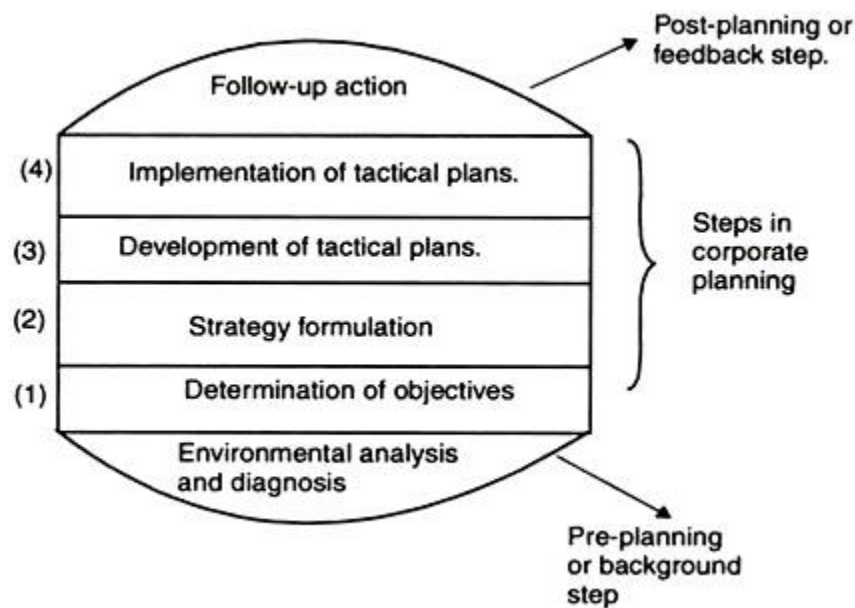
**(v) Implementation of Tactical Plans:**

Mere paper planning is no planning; unless and until it is put into practice. As such, tactical plans are put into a process of implementation, just at the right time, as decided by management. For implementation purposes, necessary communications are made to the operating staffing; who are also provided with necessary facilities to implement the tactical plans.

**(vi) Follow-Up-Action:**

After the tactical plans have been put into practice; a review of progress is done i.e. an examination of what results are following from the implementation of the plan and what feedback action is necessary, for the betterment of the corporate planning process.

The following chart depicts the corporate planning process:



## PROJECT MANAGEMENT

**Project** – A project can be defined as “a complex of non-routine activities that must be completed with a set amount of resources and within a set time limit.”

A project is an investment made on a package of inter-related time-bound activities. Generally, a project becomes a time bound task. Every project has two phases:

11. Preparation & construction
12. Its operation

Project planning deals with specific task, operations or activities, which must be performed to achieve the project goals. Any project that we may consider as an objective or a set of objectives, to achieve it. It has to be operated within a set of rules, regulations, constraints and restrictions.

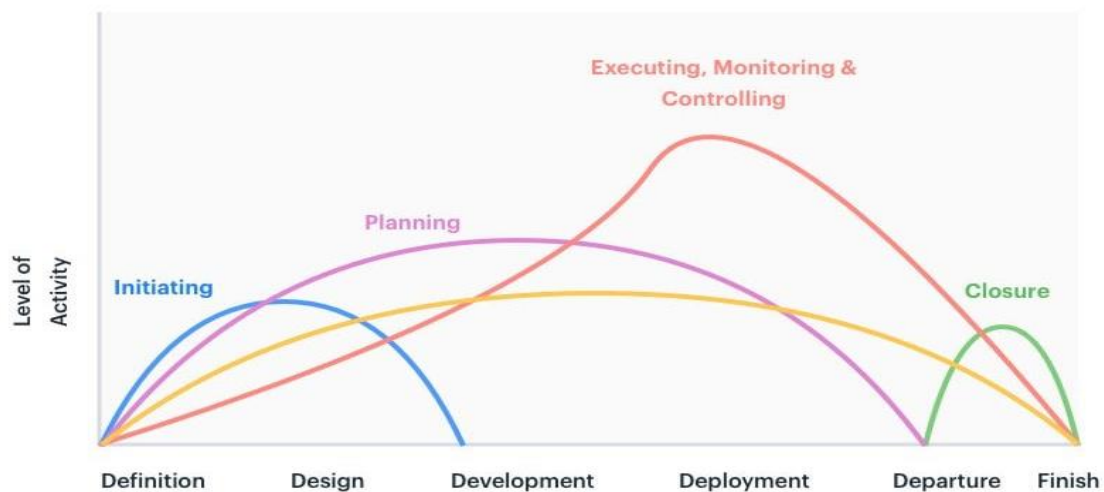
Implementation of project needs resources or inputs. Every project converts the given inputs into outputs through a process of implementation.

### Project Management

Project Management deals with planning, scheduling, controlling and monitoring the complex non-routine activities that must be completed to reach the pre-determined objectives of the project.

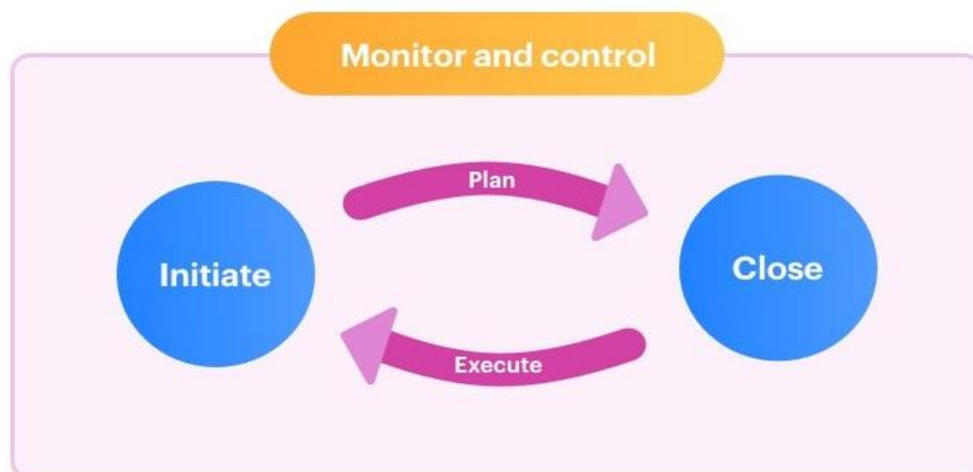
Project management is defined as the process of steering a project from the start through its lifecycle. The main objective of project management is to complete a project within the established goals of time, budget, and quality. Projects have life cycles since they aren't intended to last forever. A project management life cycle starts when the project is initiated and ends when the project is either completed or terminated in one way or another.

## The Project management life cycle



### Phases of Project Management

Project management phases are different tasks, behaviors, and skill sets that are essential to creating successful projects.



**1. Initiation** - The project initiation phase marks the beginning of a project by determining high-level expectations like why a project is required, if it is feasible or not, and what is needed to complete the project.

Outputs of this phase include required stakeholder approvals to proceed to the next phase, documentation pertaining to project needs (business case), and rough estimates of time and resources required to complete the project (project charter), and an initial list of stakeholders.

**2. Planning** - In the planning phase, project managers detail the project scope, time frame, and risks. Completeness and continuity are the major components of a successful project plan.



Outputs of this phase include a detailed project plan, a project communication plan (if there is no project plan), budget baseline, project scheduling, individual project goals, scope document, and updated stakeholder registry.

**3. Execution** - In the project execution phase, the project team members are coordinated and guided through proper project communication to get the work done as explained in the approved project management plan.

Additionally, this phase also covers the proper allocation and management of other project resources like materials and budgets. Project deliverables are the output of the execution phase.

**4. Monitoring and Control** - During the project monitoring and controlling phase, the time, cost, and performance of the project are compared at every stage and necessary adjustments are made to the project activities, resources, and plan to keep things on the right track.

Outputs from this phase include project progress reports and other communications that ensure adherence to project plans and prevent larger milestones and deadline disruptions.

**5. Closure or Completion** - The process of finalizing the project, reviewing the project deliverables, and transitioning them to the business leaders is called the project closure phase in a project management life cycle.

This stage offers time for both celebration and reflection. Outputs from this project management phase include approved project results and learnings that can be applied to similar projects in the future.

### **Network Analysis**

**Network** - Graphic representation of a project's operations is called a network. It is the combination of activities and events which are required to reach the end objective of a project. Various activities are performed at the same time and there are various activities which can be started only at the completion of other activities in a big project. The main work for detailed study of the project is to determine the information about the project and then discover a new, better and quicker way to get the work done.

### **Network Analysis**

Network analysis involves a group of techniques which are used for presenting information about the time and resources involved in the project so as to assist in the planning, scheduling and controlling of the project. The information usually represented by a network includes the sequences, interdependencies, interrelationships and critical activity of various activities of the project.

It is a technique through which the large projects are broken down into individual jobs or events and arranged in a logical network. These individual jobs or given time estimates for their execution and the network helps in identifying those jobs or events which control the implementation of the project.

### **Objectives**

1. To complete the project within a stipulated period.
2. Optimum utilisation of available resources.
3. Minimisation of costs and time required for the completion of the desired work.
4. To identify the bottlenecks, if any, in the system and focus attention on critical activation.
5. To reduce the cost of set-up and change over.

### **Advantages of Network Analysis:**

1. For planning, scheduling and controlling of operations in large and complicated projects network analysis is very important and powerful tool.

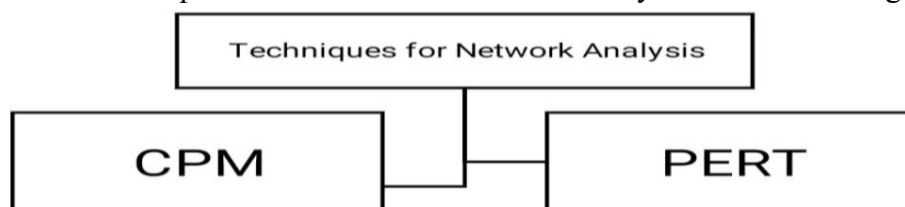
2. For evaluating the performance level of actual performance in comparison to planned target network analysis is a very useful tool.
3. With the use of network analysis technological interdependence of different activities can be determined for proper integration and co-ordination of various operations.
4. Network analysis gives the proper co-ordination and communication between various parts of the project.
5. Network analysis deals with the time-cost trade-off and provides the optimum schedule of the project.
6. This technique is very simple and suitable for the computer users.

**Disadvantages of Network Analysis:**

1. Network construction of complex project is very difficult and time consuming in network analysis.
2. Actual time estimation of various activities is a difficult exercise.
3. Analysis of the project is a very difficult work because a number of resource constraints exist in the project.
4. In many situations time-cost trade off procedure is complicated.

**Techniques for Network Analysis:**

The two common techniques which are used in network analysis are shown in figure below :



The managers are supported by two well-known network analysis techniques, viz, Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) in planning and controlling of large scale construction projects, research and development, and so on.

These techniques prove to be very important in supporting the managers in handling such products and performing their project management responsibilities.

**Critical Path Method (CPM)**

It is a technique used for the planning & controlling the most logical and economical sequence of operating for accomplishing a project. The Critical Path Method (CPM) is a way to determine the critical path of a schedule. The critical path is the longest path of scheduled activities that must be met to execute a project. This is important for Program Managers (PM) to know since any problems on the critical path can prevent a project from moving forward and being delayed.

**Objectives of CPM**

1. To assign time for each operation
2. To find the critical path & critical activities
3. To determine the maximum time required to complete the project
4. To find the difficulties in the course of production process
5. To ascertain starting & finishing times of work.

**Advantages of CPM**

1. It helps in ascertaining time schedules.
2. It identifies most critical events.

3. It helps to identify the sequence of jobs that determines the earliest completion date for the project.
4. Better & detailed planning is possible.
5. It provides standard method for communicating project plans, schedule & cost performance.

#### **Limitations of CPM**

1. It does not suitable for situation where there is no definite start & finish time.
2. It operates on the assumption that there is a precise known time.
3. It does not incorporate statistical analysis for time estimate.

#### **Steps in CPM**

- **Step 1:** List of all activities required to complete the project (see Work Breakdown Structure (WBS)).
- **Step 2:** Determine the sequence of activities
- **Step 3:** Draw a network diagram
- **Step 4:** Determine the time that each activity will take to completion
- **Step 5:** Determine the dependencies between the activities
- **Step 6:** Determine the critical path
- **Step 7:** Update the network diagram as the project progresses

The CPM calculates the longest path of planned activities to the end of the project and the earliest and latest that each activity can start and finish without making the project longer. This process determines which activities are “critical” (i.e., on the longest path) and which have “total float” (i.e., can be delayed without making the project longer).

#### **Project Evaluation Review Technique (PERT)**

It is a technique used for scheduling & controlling the projects, whose activities are subject to considerable degree of uncertainty in the performance time.

“PERT”

P – Program – (a) Job Analysis

(b) Management by objective

(c) Determination of events & activities and their relationship

(d) Network Representation

E- Evaluation – (a) Time (b) Cost (c) Feasibility (d) Probability

R – Review – (a) Progress (b) Resource Allocation (c) Time Schedule (d) Expenditure

T- Technique – (a) To attain defectives

(b) To forecast time

(c) To avoid failures

(d) To attain major drawbacks

#### **Steps in PERT**

1. The project is broke down into different activities.
2. Determine the sequence of activities
3. Draw the network diagram
4. Earliest start time and latest finish time, expected times are calculated.
5. Tabulate various times & mark EST and LFT on the network diagram.
6. Critical path is identified.
7. Expected time for each activity is calculated.
8. The above times are marked on the network diagram
9. Length of critical path & project duration is determined.
10. Lastly probability that the project will finish and due date is calculated.

### Time Estimates

There are three types of time estimates in PERT. They are explained below:

**1.Optimistic Time** – It is the minimum time an activity will take if good luck is experienced and everything goes right the first time.

**2.Most Likely Time** – It is the time an activity will take most often, when it is repeated under similar circumstances.

**3.Pessimistic Time** – It represents the maximum time an activity will take because of the possibility of some initial failures.

### Expected Time

Using the three time estimates, the average expected time can be calculated by the following formula:

$$T_e = \frac{T_o + 4T_m + T_p}{6}$$

Where,  $T_e$  = Expected Time ;  $T_o$  = Optimistic Time;  $T_m$  = Most Likely Time;  $T_p$  = Pessimistic Time

### Variance & Standard Deviation

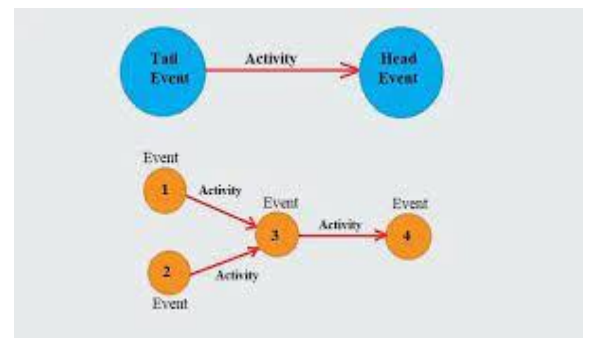
$$\text{Standard deviation: } \sigma = \frac{t_p - t_o}{6}$$

$$\text{For a PERT network, } \sigma^2 = \left( \frac{t_p - t_o}{6} \right)^2$$

### Basic Terminologies used in CPM & PERT

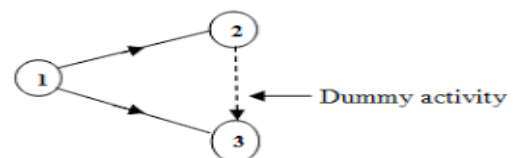
#### 1.Activity

An activity is a part of the project denoted by an arrow on the network. The tail of the arrow indicates the start of the activity whereas the head indicates the end of the activity. One and only one arrow is used to represent one activity of given duration. The arrows of the activities are not drawn to scale. The durations of the activities are written along their arrows.



#### 2.Dummy Activity

The activity which neither uses any resources nor any time for its completion is called dummy activity. It is represented by a dotted arrow or a solid arrow with zero time duration.



#### 3. Event

Event is the stage or point where all previous jobs merging in it are completed and the jobs bursting out are still to be completed.

#### 4. Network

The diagrammatic representation of the activities of the entire project is called network of flow diagram. On this diagram various jobs of the project are shown in the order in which these are required to be performed.

#### 5. Early Start Time (E.S.T.)

The earliest possible time at which an activity may start, is called early start time.

#### 6. Early Finish Time (E.F.T.)

The sum of the earliest start time of an activity and the time required for its completion is called early finish time.

#### 7. Latest Start Time (L.S.T.)

The latest possible time at which an activity may start without delaying the date of the project, is called late start time.

#### 8. Latest Finish Time (L.F.T.)

The sum of the late start time of an activity and the time required for its completion is called late finish time.

#### 9. Total Float

The difference between the maximum time allowed for an activity and its estimated duration is called total float. It is the duration of time by which the activity can be started late, without disturbing the project schedule.

#### 10. Free Float

The duration of time by which the completion time of an activity can be delayed without affecting the start of succeeding activities is called free float.

#### 11. Critical Activities

The event which has no float, are called critical activities. The critical events are required to be completed on schedule.

#### 12. Critical Path

The path in the network joining the critical events is called the critical path of the work (or) the longest path involving those sequence of activities connecting start to end event in a network.

#### 13. Slack

the slack of an event is the difference between the latest allowable time & Earliest expected time of an event.

### Differences between PERT & CPM

PERT	CPM
A probabilistic model with uncertainty in activity duration	A deterministic model with well known activity.
An event oriented approach	An activity oriented approach
It has three time estimates & expected time is calculated.	It has one time estimate. It assumes that the expected time is actually the time taken.
Analysed statistically suitable for non-repetitive projects.	Not statistically analysed. Designed for repetitive projects.
Cost varies directly with time.	Cost is not directly proportional to time.
Time is controlling factor.	Cost is controlling factor.
PERT does not demarcates between critical & non-critical activities.	Suitable for problems in industrial setting, plant maintenance, etc...

### **Project Crashing**

Project crashing is when you shorten the duration of a project by reducing the time of one or more tasks. Crashing is done by increasing the resources to the project, which helps make tasks take less time than what they were planned for. Of course, this also adds to the cost of the overall project. Therefore, the primary objective of project crashing is to shorten the project while also keeping costs at a minimum.

### **Project Crashing Management Stages**

When the circumstances where a project crashing becomes evident, then you would need to do a crash analysis to identify what changes need to be made, which activities should be sped up, how they could be sped up, what would be the cost and more such details.

