ENGINEERING MANAGEMENT

Functions of management

Management entails four basic functions: planning, organizing, leading, and controlling resources (land, labor, capital, and information) to efficiently reach a company's goals. Managers are the employees responsible for performing these four functions in addition to a number of other duties to coordinate the organization's work. These duties, or roles, fall into three main categories:

1) **Interpersonal roles**. Managers perform ceremonial obligations; provide leadership to employees; build a network of relationships with bosses, peers, and employees; and act as liaison to groups and individuals both inside and outside the company (such as suppliers, competitors, government agencies, consumers, special-interest groups, and interrelated work groups).

2) **Informational roles**. Managers spend a fair amount of time gathering information by questioning people both inside and outside the organization. They also distribute information to employees, other managers, and outsiders.

3) **Decisional roles**. Managers use the information they gather to encourage innovation, to resolve unexpected problems that threaten organizational goals (such as reacting to an economic crisis), and to decide how organizational resources will be used to meet planned objectives. They also negotiate with many individuals and groups, including suppliers, employees, and unions.

Being able to move among these roles while performing the basic management functions is just one of the many skills that managers must possess.

The Basic Functions of Management

Steve Case (Stephen McConnell Case, born August 21, 1958, is an American businessman, investor, and philanthropist best known as the former chief executive officer and chairman of America Online) demonstrates that when managers possess the right combination of vision, skill, experience, and

determination, they can lead an organization to success. To do this, however, they must perform the basic functions of management:

1. Planning,
2. Organizing,
3. Staffing
4. Directing, and
5. Controlling

THE PLANNING FUNCTION

Planning is the primary management function, the one on which all others depend. Managers engaged in planning develop strategies for success, establish goals and objectives for the organization, and translate their strategies and goals into action plans. To develop long-term strategies and goals, managers must be well informed on a number of key issues and topics that could influence their decisions.

Understanding the Strategic Planning Process

Strategic plans outline the firm's long-range (two to five years) organizational goals and set a course of action the firm will pursue to reach its goals. These long-term goals encompass eight major areas of concern: market standing, innovation, human resources, financial resources, physical resources, productivity, social responsibility, and financial performance. A good strategic plan answers:

- Where are we going?
- What is the environment?
- How do we get there?

To answer these questions and establish effective long-term goals, managers require extensive amounts of information. For instance, managers must study:

- Budgets,

- Production schedules,
- Industry and economic data,
- Customer preferences,
- Internal and external data,
- Competition and so on.

Managers use this information to set a firm's long-term course of direction during a process called strategic planning.

Develop a Clear Vision - Most organizations are formed in order to realize a vision, a realistic, credible, and attainable view of the future that grows out of and improves on the present.

• Henry Ford envisioned making affordable transportation available to every person.

• Fred Smith (founder of FedEx) envisioned making FedEx an information company (besides being a transportation company).

• Bill Gates (chairman of Microsoft) envisioned empowering people through great software, anytime, anyplace, and on any device.

Translate the Vision into a Meaningful Mission Statement To transform vision into reality, managers must define specific organizational goals, objectives, and philosophies. A starting point is to write a company mission statement, a brief document that defines why the organization exists, what it seeks to accomplish, and the principles that the company will adhere to as it tries to reach its goals.

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الادارة الهندسية

المحاضرة الرابعة: التنظيم الإداري والتكنولوجي لمنشأة صناعية

مدرس المادة: د. عمر عبد الهادي مصطفى

Administrative and production organization of industrial enterprises

To achieves the goals of any organization or foundation, it must be organize the works and chain of processes to reach the best situation in which the processes will not intersected each other, therefore, the necessity of the organizing appears in every step of the project implementation. From all above, the steps, shown below, must take in account before starting the implementation of any project.

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1. Determining the general goals of the organization represented in the quantities and types of products;

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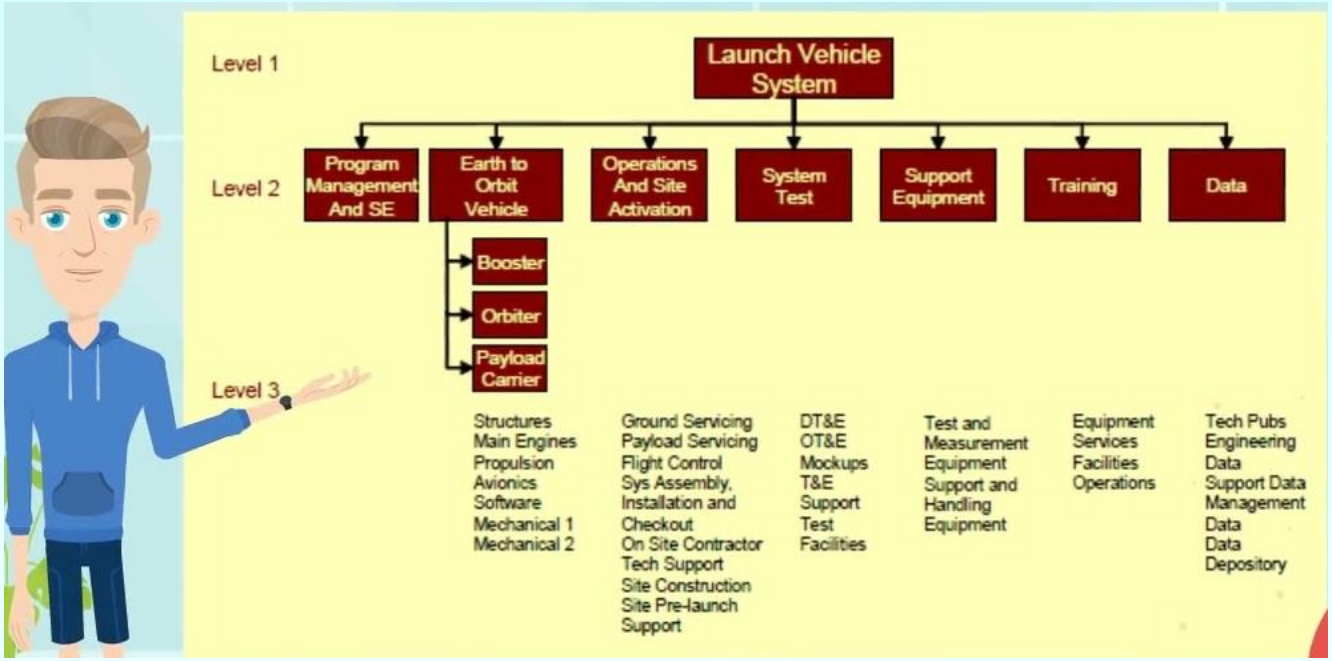
2. Formation of plans and policies to achieve these goals by designing the technological paths necessary for manufacturing steps;



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3. Assigning the main tasks and duties to implement the plans to reach the goals by preparing the materials, equipment necessary for the work, the required expertise and the schedules for operation and maintenance needed for continuity.

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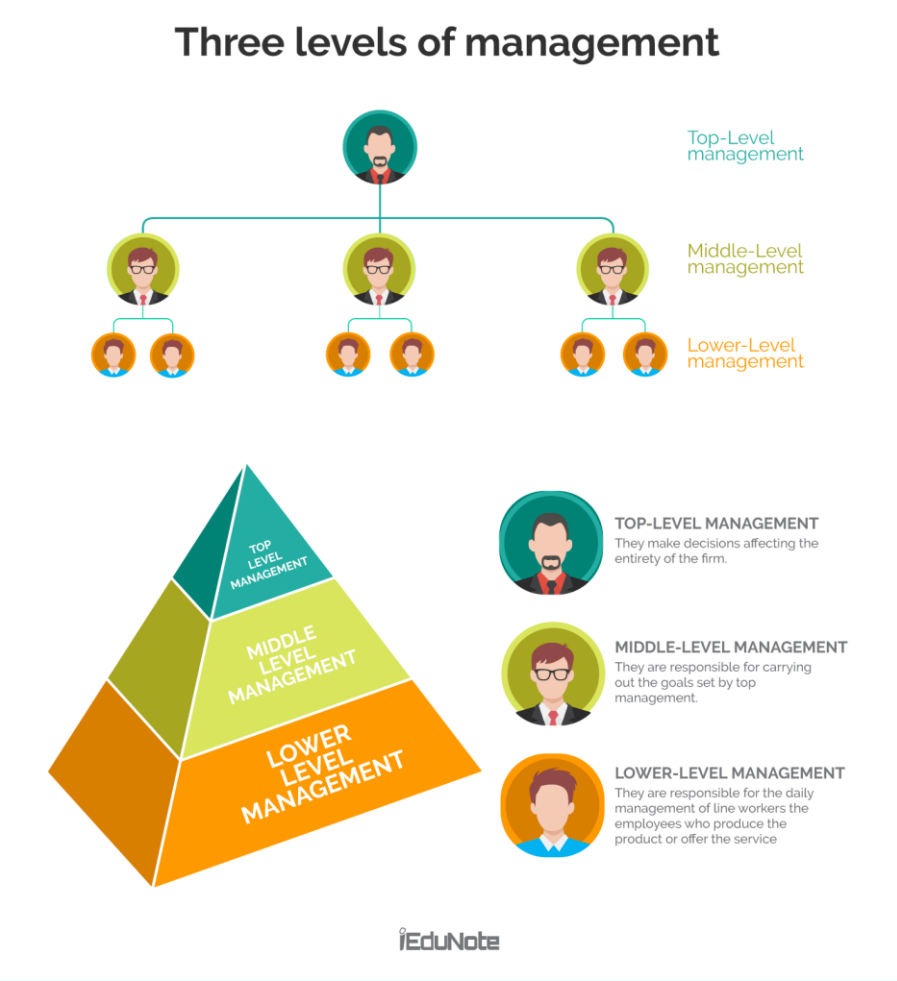
4. Accurate guidance of the functions necessary for the efficient completion of work through the preparation of the appropriate organizational structure.



Administrative and production organization of industrial enterprises

5. Distributing these jobs in the form of groups to ensure the best results at the lowest cost and the shortest time, and appointing a supervisor for each group to direct each member of the group to his task.

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6. Authorizing group administrators with the necessary powers to enable them to carry out their work properly.

Through a study conducted on more than 1000 American companies, this study proved that the ability of each person in administration never exceed 10 person, where the effectiveness of the managers decrease when the ratio of the workers to their administrators at each cluster branch, exceed the level of 1:10.

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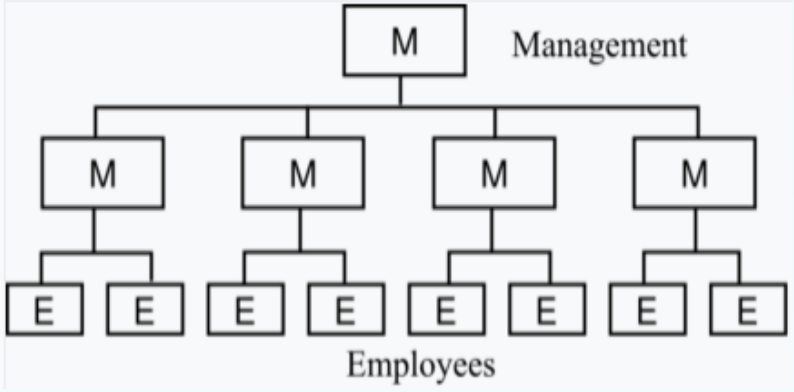
Types of organizations and corresponding administrative levels:

1. Linear structure (simple structure) in management

This type of structure is appropriate in case of small companies or organizations, where the manager, directly, control the financial and logistical deals in the company through the med staff of managers which directly in contact with the employees. In a linear structure, there are two types of positions: managers and employees as shown in the figure.



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Facts of linear structure

- The manager can lead a certain number of workers. The maximum number of workers is **span of control**.
- In the organization with many levels of management, the higher-rank manager leads the lower-rank managers.
- Every employee in the organization has only one superior, so that limits the possibility of conflicting commands.
- In this type of structure, there is a communication problem between the lower level (employees) and the higher-rank manager, because of the following:

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1. If an employee wants to pass information to the director of the company, before this, information has to be provided to a direct supervisor of the employee. This carries the risk of diffusing the content of the information in the submission from the bottom level to upper levels.
2. the enrichment of the content of the information transferred from top level to bottom levels.
3. Manager passes to upper levels only information it deems to be relevant.
4. Transmission to bottom levels is often accompanied by additional instructions to complete a task.

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Advantages of linear structure

1. simple and clear management roles,
2. allows to make quick decisions,
3. discipline among employees is easy to maintain,
4. ease of setting clear areas of competence and responsibility.

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Disadvantages of linear structure

1. manager takes care of all functions, i.e. recruits, settles wages, evaluates, plans, etc.; therefore his knowledge must be quite extensive,

2. there is difficulty in adapting to changing operating conditions, such as the introduction of new legislation,

3. it promotes the centralization of power, limiting workers' initiatives,

4. there is risk of immobilization of the company as a result of the interruption of business routes (during the absence of a manager),

5. low flexibility causes problems during changes.

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2. Consulting structure

This type of structure is suitable for the factories or organizations defined as medium size. This structure is similar to the first type organization structure but it includes the different consultants that help the chairman make the decision.

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Advantages of the consulting structure

1. Quickly solving the problems depending on the talents of the consultants,
2. Ease in goal achievement because the administrative functions are separated from the technicians functions,
3. Improvement the talent of the first line managers through the advice of the consultants,
4. Making of the wise decisions of the managers because of the suggestions of the consultants.

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Disadvantages of the consulting structure

1. Delay in decisions because it pass through the chain of consultants,
2. This type of structure gives weakness to the manager authority because of the effects of the consultants on the final decisions,
3. Also it gives the ability of the managers to evade responsibility through referring to the consultants as a source of the mistakes.

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3. Functional structure

Functional structure is one of the most common types of organizational structure in business, especially in larger companies, where groups of employees are organized according to the function they perform. In this type of organizational structure, businesses are organized according to their roles and skills into **smaller groups or departments**.

The structure of this type of organization will be as in the following:

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The advantages of this type of structure are:

1. Specialization - departments focus on one area of work.

2. Productivity - specialism means that staff are skilled in the tasks they do.

3. Accountability - there are clear lines of management.

4. Clarity - employees understand their own and others' roles.

However, the nature of departmentalism within a functional structure can present certain risks.

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Disadvantages of a functional structure:

This silo mentality can cause problems around:

1. Aligning priorities across the business
2. The flow of information and communication
3. Collaboration
4. Co-ordination of decision-making
5. Embedding and managing change across departments

Establish Company Goals and Objectives

As mentioned earlier, establishing goals and objectives is the key task in the planning process. Although these terms are often used interchangeably, a goal is a broad, long-range accomplishment that the organization wishes to attain in typically five or more years, whereas an objective is a specific, short-range target designed to help reach that goal.

For Zain- Iraq, a goal might be to become the number-one Internet service provider in the Iraqian marketplace, and an objective might be to add 100,000 new Iraqian subscribers by year-end.

Develop Action Plans

Once managers have established a firm's long-term strategic goals and objectives, it must then develop a plan of execution.

- **Tactical plans** lay out the actions and the allocation of resources necessary to achieve specific, short-term objectives that support the company's broader strategic plan. Tactical plans typically focus on departmental goals and cover a period of one to three years. Their limited scope permits them to be changed more easily than strategic plans.
- **Operational plans** designate the actions and resources required to achieve the objectives of tactical plans. Operational plans usually define actions for less than one year and focus on accomplishing a firm's specific objectives such as increasing the number of new subscribers by 5 percent over the next six months.

THE ORGANIZING FUNCTION

Organizing, the process of arranging resources to carry out the organization's plans is the second major function of managers. During the organizing stage, managers think through all the activities that employees carry out (from programming the organization's computers to mailing its letters), as well as all the facilities and equipment employees need in order to complete those activities. They also give people the ability to work toward organizational goals by determining who will have the authority to make decisions, to perform or supervise activities, and to distribute resources.

We will discuss the three levels of a corporate hierarchy—top, middle, bottom— commonly known as the **management pyramid**. In general,

- **Top managers** are the upper-level managers who have the most power and who take overall responsibility for the organization. An example is the chief executive officer (CEO). **Top managers establish the structure for the organization as a whole** and they select the people who fill the upper-level positions. Top managers also make long-range plans, establish major policies, and represent the company to the outside world at official functions and fund-raisers.

- **Middle managers** have similar responsibilities, but usually for just one division or unit. They develop plans for implementing the broad goals set by top managers, and they coordinate the work of first-line managers. In traditional organizations, managers at the middle level are plant managers, division managers, branch managers, and other similar positions—reporting to top-level managers. But in more innovative management structures, middle managers often function as team leaders who are expected to supervise and lead small groups of employees in a variety of job functions. Similar to consultants, they must understand every department's function, not just their own area of expertise. Furthermore, they are granted decision-making authority previously reserved for only high-ranking executives.

- At the bottom of the management pyramid are **first-line managers** (or supervisory managers). They oversee the work of operating employees, and they put into action the plans developed at higher levels. Positions at this level include supervisor, department head, and office manager.

THE DIRECTING (LEADING) FUNCTION

Leading—the process of influencing and motivating people to work effectively and willingly toward company

goals—is the third basic function of management.

Managers with good leadership skills have greater success in influencing the attitudes and actions of others, both through the demonstration of specific tasks and through the manager's own behavior and spirit.

Additional studies have shown that managers with strong interpersonal skills and high emotional quotients (EQs) tend to be more effective leaders. The characteristics of a high EQ include:

- **Self-awareness**. Self-aware managers have the ability to recognize their own feelings and how they, their job performance, and other people are affected by those feelings. Moreover, managers who are highly self-aware know where they are headed and why.
- **Self-regulation**. Self-regulated managers have the ability to control or reduce disruptive impulses and moods. They can suspend judgment and think before acting. Moreover, they know how to utilize the appropriate emotion at the right time and in the right amount.
- **Motivation**. Motivated managers are driven to achieve beyond expectations— their own and everyone else's.
- **Empathy**. Empathetic managers thoughtfully consider employees' feelings, along with other factors, in the process of making intelligent decisions.
- **Social skill**. Socially skilled managers tend to have a wide circle of acquaintances, and they have a knack for finding common ground with people of all kinds. They assume that nothing important gets done by one person alone and have a network in place when the time for action comes.

The three broad categories of leadership style are *autocratic, democratic,* and *laissez-faire.*

- **Autocratic leaders** make decisions without consulting others.
- **Democratic leaders** delegate authority and involve employees in decision making. Even though their approach can lead to slower decisions, soliciting input from people familiar with particular situations or issues may result in better decisions.
- The third leadership style, laissez-faire, is sometimes referred to as free-rein leadership. The French term *laissez faire* can be translated as "**leave it alone**," or more roughly as "hands off." **Laissez-faire leaders** take the role of consultant, encouraging employees' ideas and offering insights or opinions when asked. The laissez-faire style may fail if workers pursue goals that do

not match the organizations. However, the style has proven effective in some situations.

Managers at Hewlett-Packard's North American distribution organization adopted a laissez-faire style when they were given nine months to reorganize their order-fulfillment process. The managers eliminated all titles, supervision, job descriptions, and plans, and they made employees entirely responsible for the project. At first there was chaos. However, employees soon began to try new things, make mistakes, and learn as they went. In the end, the team finished the reorganization ahead of schedule, reduced product delivery times from 26 days to 8 days, and cut inventory by 20 percent. Moreover, the employees experienced a renewed sense of challenge, commitment, and enjoyment in their work.

Adapting leadership style to current business circumstances is called **contingency leadership**. You can think of leadership styles as existing along a continuum of possible leadership behaviors, as shown on digital display.

THE CONTROLLING FUNCTION

Controlling is the fourth basic managerial function. In management, controlling means monitoring a firm's progress toward meeting its organizational goals and objectives, resetting the course if goals or objectives change in response to shifting conditions, and correcting deviations if goals or objectives are not being attained.

The Control Cycle

Many firms control for quality through a four-step cycle that involves all levels of management and all employees. In the:

- First step, top managers set standards, or criteria for measuring the performance of the organization as a whole.
- In the second step of the control cycle, managers assess performance, using both quantitative (specific, numerical) and qualitative (subjective) performance measures.
- In the third step, managers compare performance with the established standards and search for the cause of any discrepancies.

- If the performance falls short of standards, the fourth step is to take corrective action, which may be done by either adjusting performance or reevaluating the standards.
- If performance meets or exceeds standards, no corrective action is taken.

Management Skills

- **Interpersonal Skills** To communicate with other people, work effectively with them, motivate them, and lead them are interpersonal skills.
- **Technical Skills** A person who knows how to operate a machine, prepare a financial statement, program a computer, or pass a football has technical skills: Managers at all levels use administrative skills, which are the technical skills necessary to manage an organization.

Conceptual Skills Managers need conceptual skills to see the organization as a whole, in the context of its environment, and to understand how the various parts interrelate. Conceptual skills are especially important to top managers. These managers are the strategists who develop the plans that guide the organization toward its goals. A key managerial activity requiring conceptual skills is decision making, a process that has five distinct steps: (1) recognizing the need for a decision, (2) identifying, analyzing, and defining the problem or opportunity, (3) generating alternatives, (4) selecting an alternative and implementing it, and (5) evaluating the results.

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Feasibility Study

Why a feasibility study?

Objectives:

- To find out if an system development project can be done:
  1.Is it possible?
  2.Is it justified?

- To suggest possible alternative solutions.
- To provide management with enough information to know:
  1.Whether the project can be done
  2.Whether the final product will benefit its intended users
  3.What the alternatives are (so that a selection can be made in subsequent phases)
  4.Whether there is a preferred alternative

Feasibility Study

- **A management-oriented activity:**

1. After a feasibility study, management makes a “go/don’t-go” decision.

2. Need to examine the problem in the context of broader business strategy

Content of a feasibility study

Things to be studied in the feasibility study:

1. The present organizational system
   - Stakeholders, users, policies, functions, objectives,...
2. Problems with the present system
   - inconsistencies, inadequacies in functionality, performance,…
3. Goals and other requirements for the new system
   - Which problem(s) need to be solved?
   - What would the stakeholders like to achieve?
4. Constraints
   - including nonfunctional requirements on the system (preliminary pass)
5. Possible alternatives
   - “Sticking with the current system” is always an alternative
   - Different business processes for solving the problems
   - Different levels/types of computerization for the solutions
6. Advantages and disadvantages of the alternatives

Four Types of feasibility

Technical feasibility

1. Is the project possible with current technology?
2. What technical risk is there?
3. Availability of the technology:
   - Is it available locally?
   - Can it be obtained?
   - Will it be compatible with other systems?

Economic feasibility

1. Is the project possible, given resource constraints?
2. What are the benefits?
   - Both tangible and intangible
   - Quantify them!
3. What are the development and operational costs?
4. Are the benefits worth the costs?

Four Types of feasibility

Schedule feasibility

1. Is it possible to build a solution in time to be useful?
   - What are the consequences of delay?
   - Any constraints on the schedule?
   - Can these constraints be met?

Operational feasibility

1. If the system is developed, will it be used?
2. Human and social issues...
3. internal issues:
   - Potential labour objections?
   - Manager resistance?
   - Organizational conflicts and policies?
4. external issues:
   - Social acceptability?
   - legal aspects and government regulations?

Technical Feasibility

❖ **Is the proposed technology or solution practical?**

1. Do we currently possess the necessary technology?
2. Do we possess the necessary technical expertise
   - ➢ ...and is the schedule reasonable for this team?
3. Is relevant technology mature enough to be easily applied to our problem?

❖ **What kinds of technology will we need?**

1. Some organizations like to use state-of-the-art technology
   - ➢ .but most prefer to use mature and proven technology.
2. A mature technology has a larger customer base for obtaining advice concerning problems and improvements.

❖ **Is the required technology available "in house"?**

1. If the technology is available:
   - ➢ .does it have the capacity to handle the solution?
2. If the technology is not available:
   - ➢ .can it be acquired?

Economic Feasibility

❖ Can the bottom line be quantified yet?

1. Very early in the project...
   - ➢ a judgment of whether solving the problem is worthwhile.
2. Once specific requirements and solutions have been identified.
   - ➢ the costs and benefits of each alternative can be calculated

❖ Cost-benefit analysis

1. Purpose - answer questions such as:
   - ➢ Is the project justified (I.e. will benefits outweigh costs)?
   - ➢ What is the minimal cost to attain a certain system?
   - ➢ How soon will the benefits accrue?
   - ➢ Which alternative offers the best return on investment?
2. Examples of things to consider:
   - ➢ Hardware/software selection
   - ➢ Selection among alternative financing arrangements (rent/lease/purchase)
3. Difficulties
   - ➢ benefits and costs can both be intangible, hidden and/or hard to estimate
   - ➢ ranking multi-criteria alternatives

Benefits

Tangible Benefits

- Readily quantified as money values
- Examples:
  - increased sales
  - cost/error reductions
  - increased throughput/efficiency
  - increased margin on sales
  - more effective use of staff time

Intangible benefits

- Difficult to quantify
  - But maybe more important!
  - business analysts help estimate money values
- Examples:
  - increased flexibility of operation
  - higher quality products/services
  - better customer relations
  - improved staff morale

How will the benefits accrue?

- When - over what timescale?
- Where in the organization?

Costs

Development costs (OTO)

- Development and purchasing costs:
  - Cost of development team
  - Consultant fees
  - software used (buy or build)?
  - hardware (what to buy, buy/lease)?
  - facilities (site, communications, power,...)
- Installation and conversion costs:
  - installing the system,
  - training personnel,
  - file conversion,____

Operational costs (on-going)

- System Maintenance:
  - hardware (repairs, lease, supplies,...),
  - software (licenses and contracts),
  - facilities
- Personnel:
  - For operation (data entry, backups,..)
  - For support (user support, hardware and software maintenance, supplies,.)
  - On-going training costs

Analyzing Costs vs. Benefits

Identify costs and benefits

- Tangible and intangible, one-time and recurring
- Assign values to costs and benefits

Determine Cash Flow

- Project the costs and benefits over time, e.g. 3-5 years
- Calculate Net Present Value for all future costs/benefits
  - determines future costs/benefits of the project in terms of today's dollar values
  - A dollar earned today is worth more than a potential dollar earned next year

Do cost/benefit analysis

- Calculate Return on Investment:
  - Allows comparison of lifetime profitability of alternative solutions.

$$ROI = \frac{Total\ Profit}{Total\ Cost} = \frac{Lifetime\ benefits - Lifetime\ costs}{Lifetime\ costs}$$

- Calculate Break-Even point:
  - how long will it take (in years) to pay back the accrued costs:

Accrued Benefit > Accrued Cost

Calculating Present Value

Present value is the value of a future cash stream discounted at the appropriate market interest rate, called discount rate.

A dollar today is worth more than a dollar tomorrow...

- Your analysis should be normalized to “current year" dollar values.

The discount rate

- measures opportunity cost:
  - Money invested in this project means money not available for other things
  - Benefits expected in future years are more prone to risk
- This number is company- and industry-specific.
  - “what is the average annual return for investments in this industry?"

Calculating Present Value

Present Value:

$$PV = \frac{FV}{(1+r)^n}$$

Where:
PV - is the present value of the amount,
FV - is the future value of the amount during n period from now,
r - is the discounted rate,
n - year that the amount occur.

Example:

- The “current year" dollar value for costs/benefits n years into the future
  - for a given discount rate r

$$PV = \frac{1}{(1+r)^n}$$

if the discount rate is 12%, then

For one year $PV = \frac{1}{(1+0.12)^1} = 0.893$

For two year $PV = \frac{1}{(1+0.12)^2} = 0.797$

Net Present Value (NPV)

Net Present Value is a direct measure of a project's money benefit. NPV approach fully accounts for time value of money and considers all cash flow over the life of the project. NPV assumes that firms can reinvest all of the cash inflow at the project's required rate of return throughout the life of the project. This rate is more realistic than the (Internal Rate of Return) rate. NPV approach provides the accept-reject decision for both independent and mutually exclusive project.

Net Present Value helps managers to make perfect decision, where the following limits represent the guide of the decision:

1. Accept if NPV is greater than zero
2. Reject if NPV is less than zero

For mutually exclusive projects (choose one project over others), accept the project with the highest positive NPV.

Net Present Value (NPV)

The disadvantages of using the net present value can be illustrate through the followings:

1. NPV does not provide a gauge for relative profitability. For example, NPV $1,000 is highly desirable for a project costing $2,000 but not for a project coating $1 million. NPV only provide the total profits gained, but not the percentage gained.

2. Some people have difficulty understanding the meaning of NPV measure. Therefore, in practice, managers often prefer a percentage return to a PV of dollar return.

Internal Rate of Return (IRR)

Internal Rate of Return measures profitability as a percentage showing the return on each dollar invested. IRR approach fully accounts for time value of money and considers all cash flow over the life of the project. IRR provides the safety margin information to management. Thus, the higher IRR is the safety margin. Some managers prefer the IRR because they like dealing with the percentage rates of return more than with the dollar value in NPV.

To be able depending the internal rate of return as a reference in our decision, we must remember the following:

1. Accept if IRR is equal or greater than required rate of return.
2. Reject if IRR is less than required rate of return.

For mutually exclusive projects, accept the project with the highest IRR that is greater than required rate of return.

Internal Rate of Return (IRR)

The disadvantages of using the Internal Rate of Return can be illustrate through the followings:

1. IRR method can provide no IRR or multiple IRRs if a project has a non conventional cash flow pattern, such as, cash flow pattern has more than one sign change (-/+/-).

2. IRR assumes that firms can reinvest all of the cash inflow at the IRR rate throughout the life of the project. This rate may be unrealistic.

3. IRR may lead to inconsistence of ranking for mutually exclusive projects as it does not provide the magnitude or duration of its cash flow.

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The Basic Functions of Management

1. Planning

3. Staffing

5. Controlling

2. Organizing

4. Directing

THE PLANNING FUNCTION

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2. What is the environment?
3. How do we get there?

Strategic Planning Process

To answer these questions and establish effective long-term goals, managers require extensive amounts of information. For instance, managers must study:

1. Budgets,
2. Production schedules,
3. Industry and economic data,
4. Customer preferences,
5. Internal and external data,
6. Competition and so on.

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المحاضرة الثانية: تحديد الاهداف والغايات

مدرس المادة: د. عمر عبد الهادي مصطفى

Establish Goals and Objectives

Establishing goals and objectives is the key task in the planning process. Although these terms are often used interchangeably, a goal is a broad, long-range accomplishment that the organization wishes to attain in typically five or more years, whereas an objective is a specific, short-range target designed to help reach that goal.

Develop Action Plans

Tactical plans

Operational plans

THE ORGANIZING FUNCTION

There are three levels of a corporate hierarchy—top, middle, bottom—commonly known as the management pyramid. In general,

THE DIRECTING (LEADING) FUNCTION

Leading—the process of influencing and motivating people to work effectively and willingly toward company goals—is the third basic function of management.

Additional studies have shown that managers with strong interpersonal skills and high emotional quotients (EQs) tend to be more effective leaders. The characteristics of a high EQ include:

1. Self-awareness.
2. Self-regulation
3. Motivation
4. Empathy
5. Social skill

The broad categories of leadership style

Autocratic leaders

Democratic leaders

Laissez-faire

THE CONTROLLING FUNCTION

The Control Cycle

First step, top managers set standards, or criteria for measuring the performance of the organization as a whole.

In the second step of the control cycle, managers assess performance, using both quantitative (specific, numerical) and qualitative (subjective) performance measures.

In the third step, managers compare performance with the established standards and search for the cause of any discrepancies.

If the performance falls short of standards, the fourth step is to take corrective action, which may be done by either adjusting performance or reevaluating the standards.

If performance meets or exceeds standards, no corrective action is taken.

Management Skills

Management Skills

Management Skills

Conceptual Skills

- The mental ability to diagnose and analyze complex situations.
- Ability to think creatively and understand abstract ideas.
- Ability to think organization as a whole and visualize various functions and their interaction with the organization.
- Examples: Strategic skills

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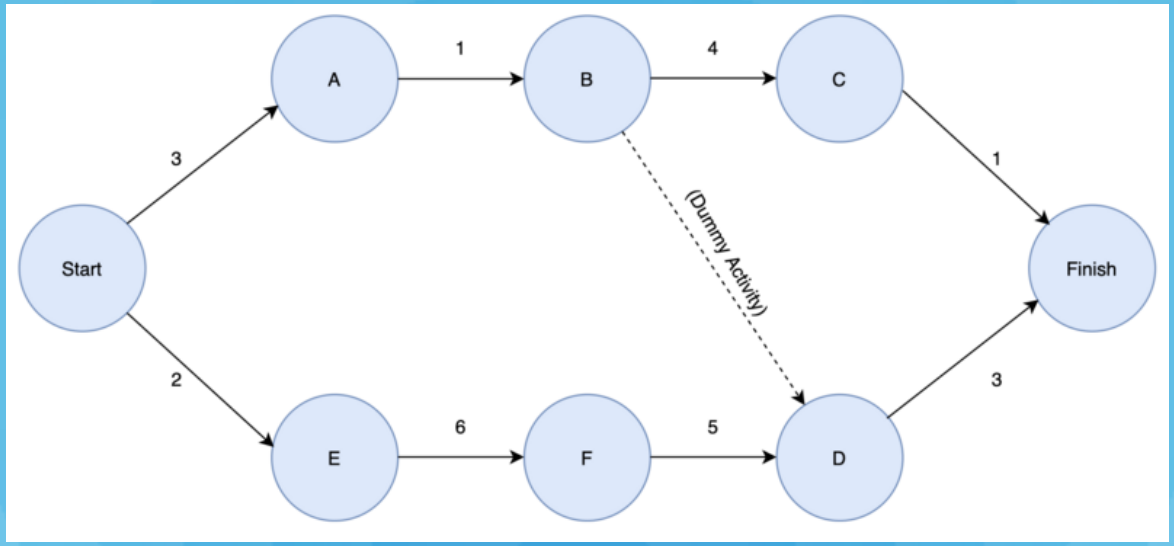
Network planning

Network planning (or project networking) is a generic name for methods that study projects as a set of interconnected activities with the purpose of assisting in planning, managing and controlling projects. These methods are based on models describing projects as activities networks and include well known techniques such as the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT).



Network planning

Event: In management each event represented by the circle containing the number or symbol, and it will not repeated in the different processes of the project. It’s important to know that each management network starts with one event and must ends with other one.

Activity: in management, the activity represented by arrow that need duration shown over it. There is no relation between the length of the arrow and the duration of activity. Each activity must begin from event and ended by an other. One or more activities may start from the same event and end in different events, also, different activities may starts from different events and end in the same event, but different activities never start and end at same events.

Network planning

Path: may be define as a sequence of activities starts with identified event and ends with an other. Each path is differ from the others by the number of events and activities where it has a duration that differ from the others. The main objectives of network planning are determining the project duration and the critical path. Moreover, find out how to speed up a project if that becomes necessary. As a result, it is a basis for scheduling.

Network planning

Description of Network Planning in Project Management

Network planning can research various issues such as project scheduling, risk analysis, cost minimization, or net present value maximization. Therefore, it can find the most appropriate balance between risk, quality, length, and cost. Moreover, using network planning in project management allows project teams to visualize all the tasks that need to be done during a project's lifecycle. It also provides essential context, such as length of the job, sequence, and dependence on the project schedule. Furthermore, it helps to find the critical path, free and total float, among other things.

Network planning

Network planning is a sequential categorization of the activities involved in the project's execution, accompanied by a graphical presentation of the actions required for the project as a whole. Therefore, network planning is a distributed model of work to be done in a project. A hierarchy of interdependent job elements, which are processes, tasks, and activities, is sequenced and prioritized to identify and describe the overall project effort. Typically, the project network is constructed and built using charts and hierarchical diagrams or often termed project network diagrams.

Network planning

Each terminal element represents an operation at the lowest level of the Work Breakdown Structure (WBS) related to a work package. However, although the WBS does not attempt to decide the sequence of events or the length of any activity, the network planning diagram attempts to determine the series of activities that take place and the other activities (if any) on which the activity depends. When conducting network planning diagram, there is a range of techniques used. Every terminal element (or activity) is represented by a node on a graph in some techniques, while it is characterized by an edge in others (the line connecting two nodes). Only one path for every terminal element must lie through the network.

Network planning

Once the WBS is complete, the project manager will have a list of tasks at different decomposition stages to accomplish the project's goal. To allow a schedule to be generated, the project manager now decides the task dependencies and each task's length. Project management software is now available to perform the scheduling for project managers, measure the total time needed to complete the project, and define the schedule's critical path. Merely what project managers have to do is determine each task's length and consider any task dependencies. Based on the data they provide, the program can generate network activity charts.

Network planning

Application:

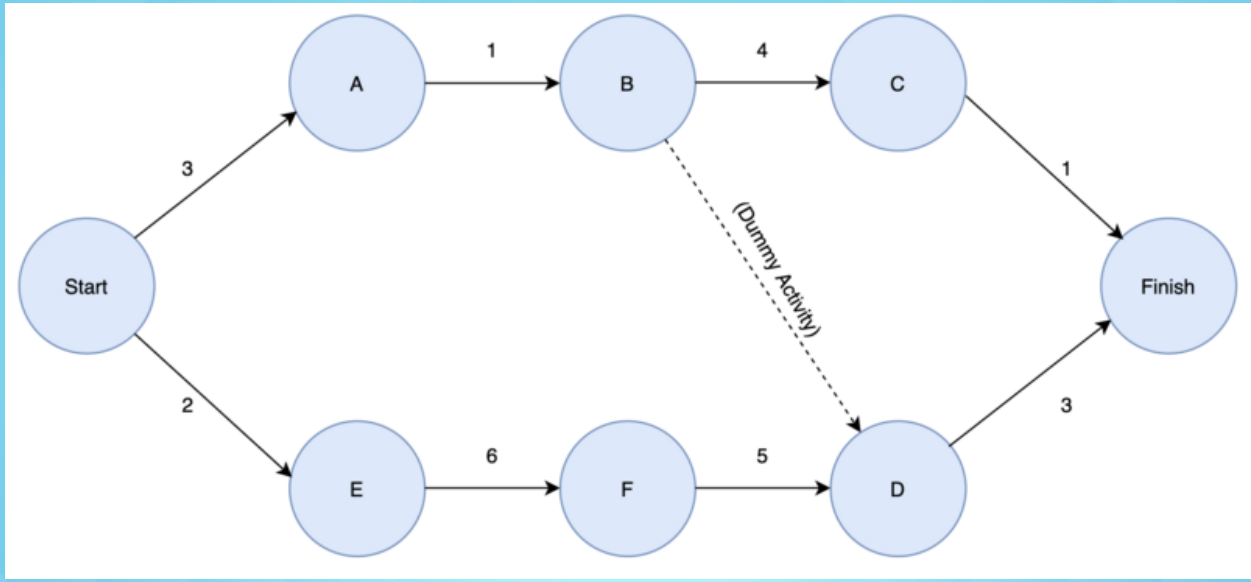
It is important to break down projects into smaller activities for projects to become achievable. Furthermore, to coordinate these interdependent activities and, finally, adapt the project and respond to changes. When the project has been broken down into smaller pieces and the activities defined, the scheduling of it can begin [1]. In project management, there are two primary types used when drawing network diagrams, which are the Arrow Diagramming Method (ADM) and the Precedence Diagramming Method (PDM).

Network planning

The arrow diagramming technique (ADM) refers to a schedule network diagramming technique in which arrows represent schedule activities within a specified project. The arrow's tail or base defines the start of the operation in the schedule. The pointed end of the arrow illustrates the endpoint of a selected process within the schedule. The duration of the arrow will loosely reflect the time between. The points to which these planning operations are connected are referred to as nodes. To illustrate the sequence or order in which these activities should occur, the relation of these schedule activities is performed. This link point, or node, is typically represented by a small circle or sphere.

Network planning

An operation with a length of zero can be seen in the ADM graph below. These operations are referred to as dummy operations and are usually represented using dotted lines. Dummy activities express dependencies between tasks. The activity B-D in the below diagram is a dummy activity. An example of why a project manager might need a dummy activity is if activity C is about tiling a floor. It can only start once the concrete is poured (Activity B) and the permits are gotten in activity D. In contrast, activities B and D are not directly linked, the project manager needs to draw a dummy activity between B and D to demonstrate that C is dependent on D being finished.



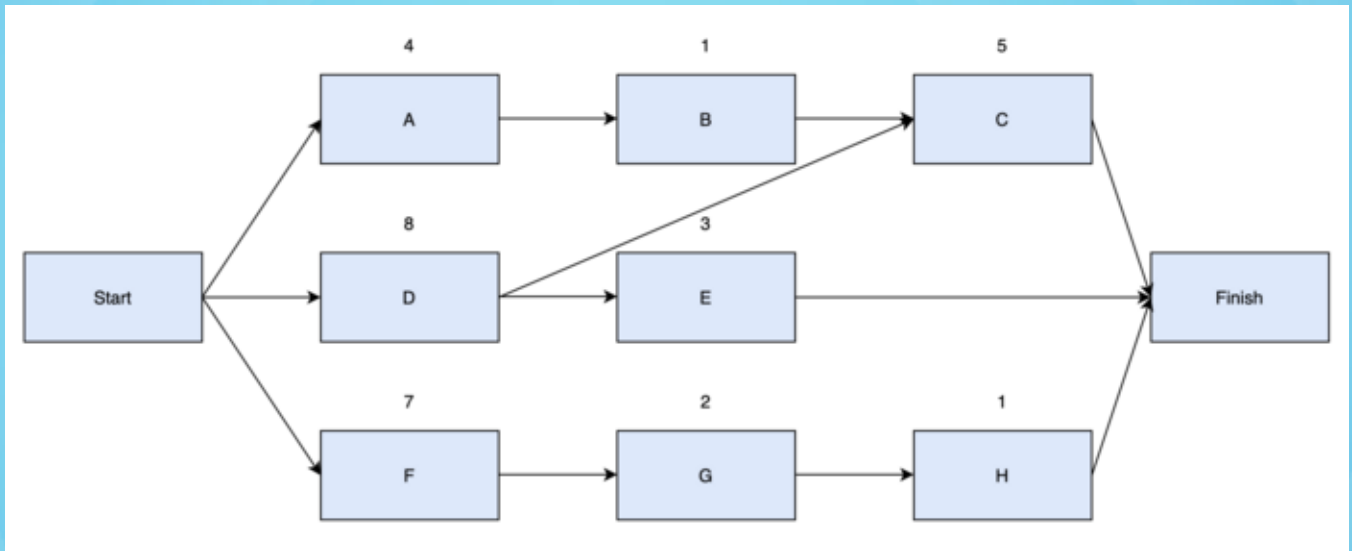
Network planning

The precedence diagramming method (PDM) refers to a selected project management technique. The project manager employs a schedule network diagramming technique to graphically represent any known and preexisting schedule activities via the utilization of boxes (which also can be mentioned as nodes). Once all of these basic schedule tasks have been graphically displayed in this box or node format, all of the individual boxes are connected using a line describing any logical relationship found to occur. The fundamental and most important advantage of using the precedence diagramming system's style methodology is that it helps the project manager view all plan tasks and their relationships with each other rapidly and efficiently.

Network planning

Critical Path

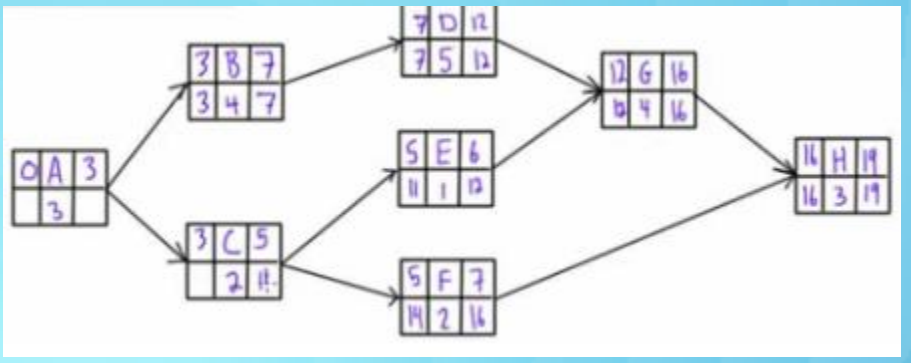
The critical path is the longest time needed to complete the project successfully. If the project manager uses the CPM for this project, then in figure below, there are four possible paths through the network diagram: A-B-C, D-C, D-E, and F-G-H. By calculating the duration for each of these paths, the path D-C has the longest total duration of 13 days, and therefore it is the critical path for this network diagram



Network planning

To calculate the time needed using the critical path method, it must be divided into two steps: the first is the forward pass in which the reaction starts from the beginning of each event and takes the earliest time in calculations, while the second is called backward pass which starts from the end event and pass to the start event as show in the following example:

Activity	Predecessor	Duration (days)
A	-	3
B	A	4
C	A	2
D	B	5
E	C	1
F	C	2
G	D,E	4
H	F,G	3



Network planning

Early Start (ES)

Project management formulas for Early Start (ES) if the convention that project starts on day one is adopted.

Early Start (ES) =

- 1 for the first activity
- ES of the next node is the earliest finish time of the immediately preceding activity plus 1 = EF + 1

Network planning

Early Finish (EF)

Project management formula for Early Finish (EF) if the convention that project starts on day one is adopted.

Early Finish (EF) =

- Early Finish (EF) = ES + Activity Duration (D) – 1

Network planning

Late Finish (LF)

Project management formula for Late Finish (LF) if the convention that project starts on day one is adopted.

Late Finish (LF) =

- On Critical Path LF of the last activity is equal to the EF of that activity
- The latest start time of the activity of previous node minus 1 = LS -1

Network planning

Late Start (LS)

Project management formulas for Late Finish (LS) if the convention that project starts on day one is adopted.

Late Start (LS) = LF – Activity Duration (D) + 1

Project Management Formulas for Critical Path Analysis
For Critical Path ES = LS and EF = LF
For Critical Path Total Float = 0

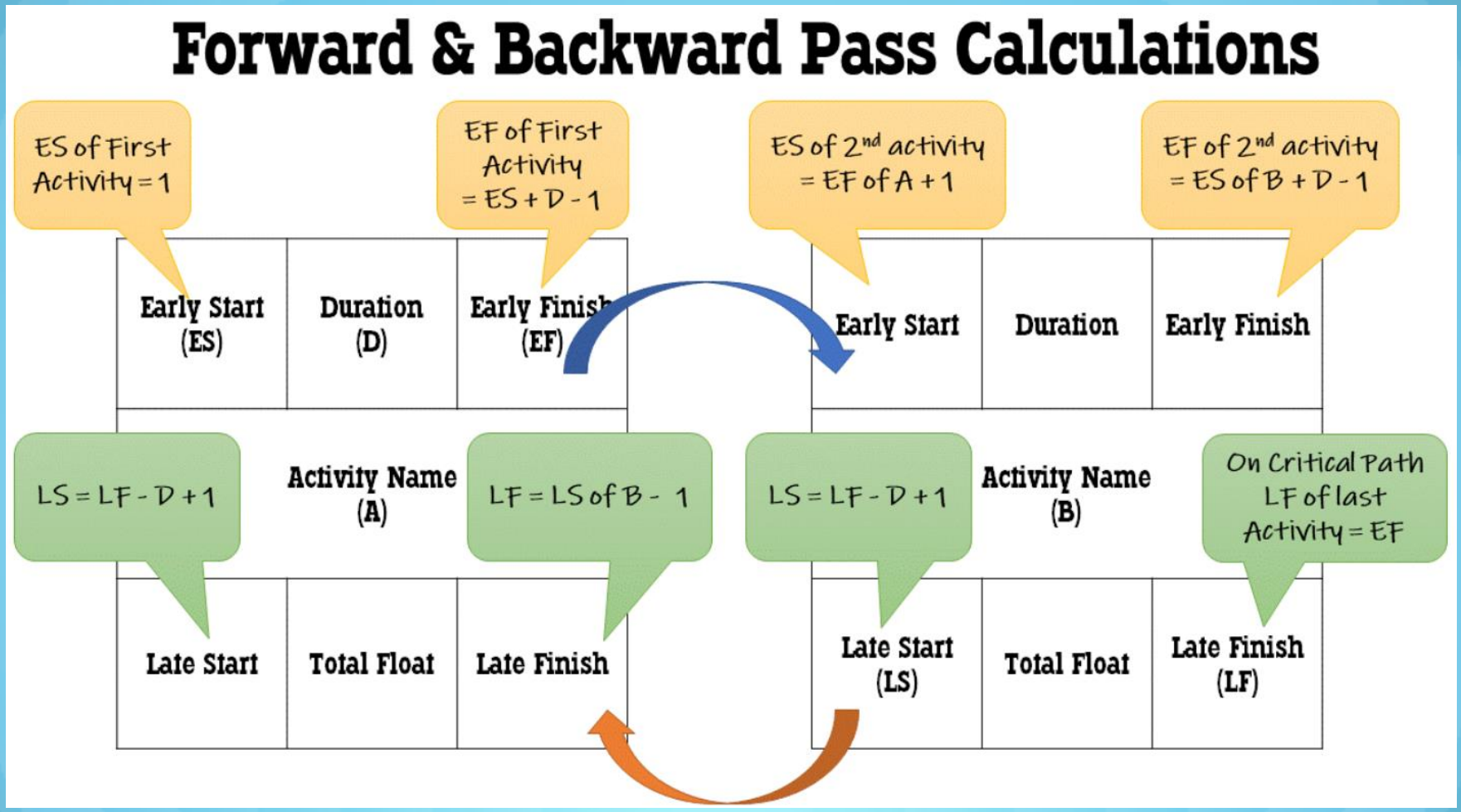
Network planning

Total / Free Float

Project management formulas to calculate total float / free float.

- Total Float = LS – ES or LF – EF
- Free Float = (ES)S – (EF)C – 1 [When Start = 1] Where S = Successor Activity and C = Current Activity

Network planning



Network planning

Late Start (LS)

Project management formulas for Late Finish (LS) if the convention that project starts on day one is adopted.

Late Start (LS) = LF – Activity Duration (D) + 1

Project Management Formulas for Critical Path Analysis
For Critical Path ES = LS and EF = LF
For Critical Path Total Float = 0

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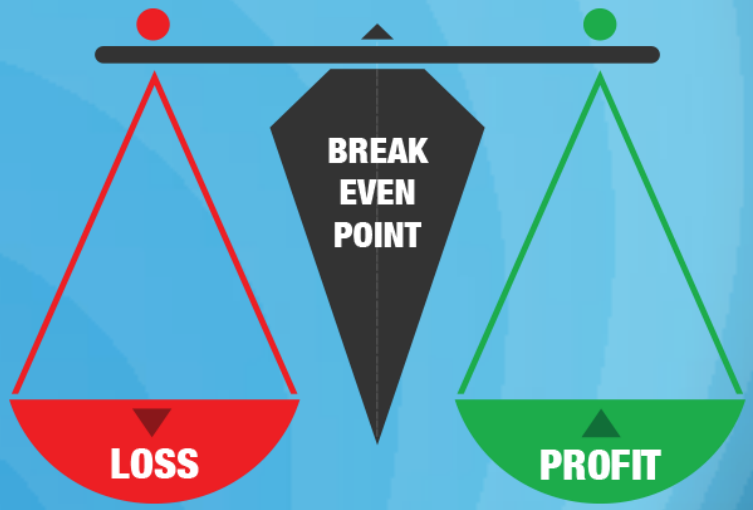
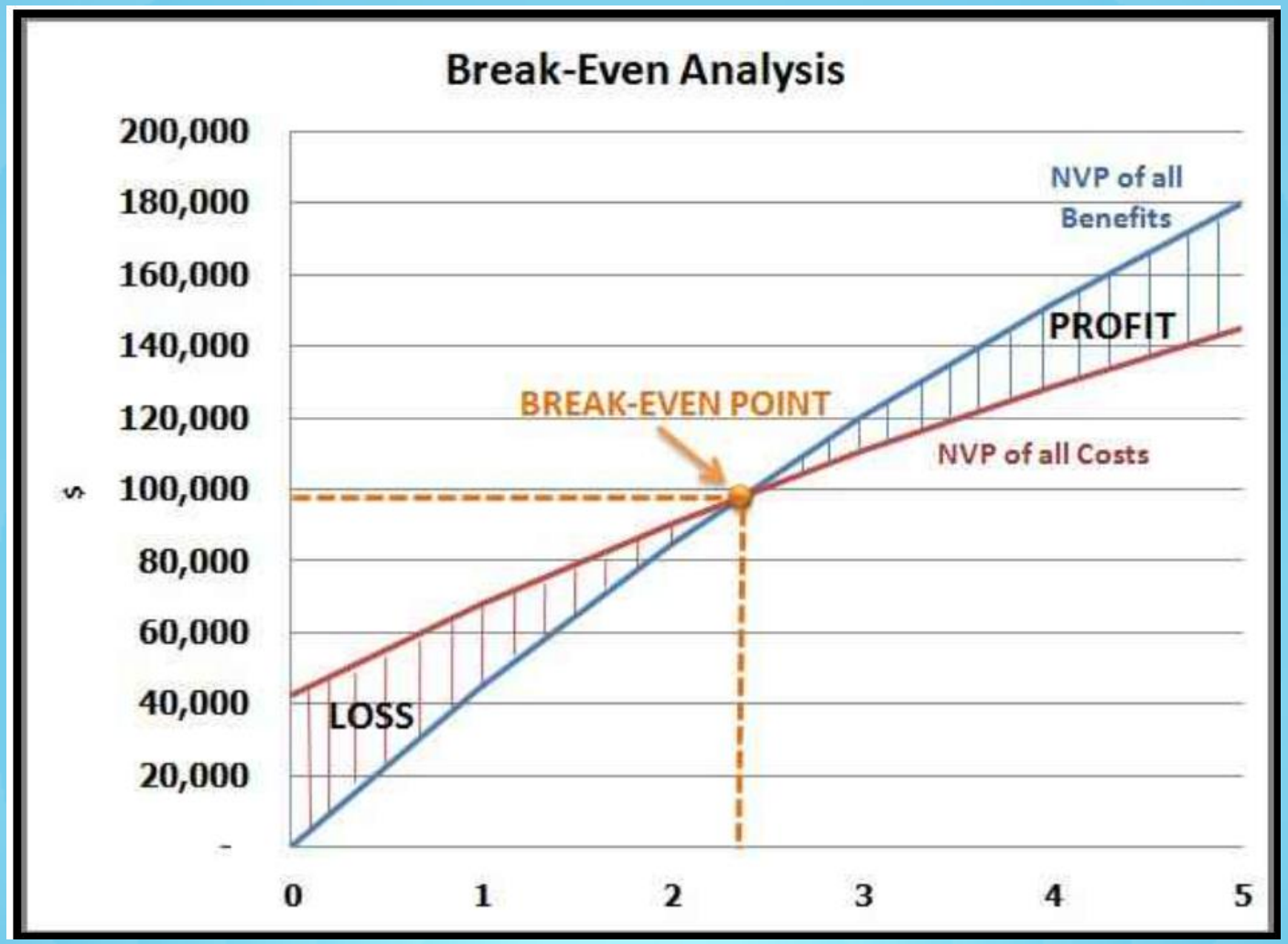
Break-Even Analysis

Break-even analysis is a type of cost benefit analysis to identify at what point (if ever) benefits equal costs. Break-even analysis is useful in determining the level of production or a targeted desired sales mix. This type of analysis involves a calculation of the break-even point (BEP).

The break-even point is usually expressed as the amount of revenue that must be realized for the firm to have neither profit or loss. It expresses a minimum revenue target. It can be expressed in numbers or by the use of graphs.



Break-Even Analysis



Break-Even Analysis

Example: A system analysts estimate the cost for the new system as $42,500 one time investment for developing, updating hardware, and user training. Also, firm needs to pay $28,500 each year for software maintenance, incremental communication cost, and supplies. On the other hand, the system will provide approximately $50,000 per year. Assume the expected rate of return (discount rate) is 12%.

Net economic benefit		50,000	50,000	50,000	50,000	50,000
Net cost	(42,500)	(28,500)	(28,500)	(28,500)	(28,500)	(28,500)
Net Cash Flow each year	**(42,500)**	**21,500**	**21,500**	**21,500**	**21,500**	**21,500**
Year	**0**	**1**	**2**	**3**	**4**	**5**

Source: (Adapted from Hoffer, George, and Valacich)

Break-Even Analysis

After determining costs and benefits of a new system, the system analysts evaluate the project using NPV, IRR, Break-even analysis, or other methods. Also, using a **time diagram** is helpful to illustrate the timing of cash flows, especially for situations involving cash flows at the different points in time that are not equal

$$NPV = \text{PV of total benefits} - \text{PV of total costs}$$

$$= -42500 + \frac{21{,}500}{1.12} + \frac{21{,}500}{1.12^2} + \frac{21{,}500}{1.12^3} + \frac{21{,}500}{1.12^4} + \frac{21{,}500}{1.12^5}$$

$$= 35{,}003 \quad \textit{(Accept this project as NPV > 0)}$$

Break-Even Analysis

$$\text{Break–Even Ratio} = \frac{\text{Yearly NPV Cash Flow} - \text{Overall NPV Cash Flow}}{\text{Yearly NPV Cash Flow}}$$

Break-Even analysis

Year	0	1	2	3	4	5
Yearly NPV	(42,500)	19,196	17,140	15,303	13,664	12,200
Overall NPV	– (42,500)	– (23,304)	– (6,164)	9,139	22,803	35,003

Thus, the project breakeven occurs around year 3.

Break-Even Ratio at year 3 = (15,303 - 9,139) / 15,303 = 0.403

Break-point calculations

Example: Let's assume that you're working on a case interview and your client is a well known t-shirt manufacturer. The client is considering producing sweaters as well but wants to figure out if this is a potentially profitable idea. As you work through the case, you are able to extract the following pieces of data:

- Fixed costs will be $100,000 per month
- Average variable costs per sweater will be $20
- Average price per sweater will be $70

Break- even point calculations

$$Break\ even\ point = \frac{Fixed\ Costs}{Price\ per\ unit\ - Variable\ Cost\ per\ unit}$$

Break even point = $100,000 / ($70 – $20) = 2,000 units

Thus, in order for your client to break even, it will need to sell 2,000 sweaters per month. If it seems possible that your client can sell more than that per month, it should go for the venture. If not, it would be better for your client to focus on using its resources elsewhere.