

**LECTURE NOTES ON
MANAGEMENT SCIENCE**

UNIT-1

INTRODUCTION TO MANAGEMENT

Introduction to Management: When human being started group activities for the attainment of same common objectives whenever a group is formed and a group activity is organized to achieve certain common objectives management is needed to direct, co-ordinate and integrate the individual activities of a group and secure teams work to accomplish organizational objectives. The objectives of all business are attained by utilizing the scarce resources like men, materials, machines, money etc.

In process of management, a manager uses human skills, material resources and scientific methods to perform all the activities leading to the achievement of goods.

Definition: “Management is knowing exactly what you want men to do and seeing that they do it the best and cheapest ways”.

or “Management is defined as the creation and maintenance environment in an enterprise where individuals working together in groups, can perform efficiently and effectively towards the attainment of ___ Koontz and O'Donell

Nature of Management: The study and application of management techniques in managing the affairs of the organization have changed its nature over the period of time.

Multidisciplinary: Management is basically multidisciplinary. This implies that, although management has been developed as a separate discipline, it draws knowledge and concepts from various disciplines. It draws freely ideas and concepts from such disciplines as psychology, sociology, anthropology, economics, ecology, statistics, operations research, etc. Management integrates the ideas and concepts taken from these disciplines and presents newer concepts which can be put into practice for managing the organization.

Dynamic nature of principle: Based on integration and supported by practical evidences, management has formed certain principles. However, these

principles are flexible in nature and change with the changes in the environment in which an organization exists.

Relative, not absolute principles: Management principle are relative, not absolute, and they should be applied according to the need of the organization. Each organization may be different from others. The difference may exist because of time, place, socio-cultural factors, etc.

Management Science or Art: There is a controversy whether management is science or art. However, management is both a science and art.

Management as profession: Management has been regarded as profession by many while many have suggested that it has not achieved the status of a profession.

Characteristics of Management:

Setting goals for organizations: Goals differ from organization to organization in business, the basic economic goal is to earn maximum profit, while in service organization like hospital and educational institution for the basic goal is to provide better service and better education.

Awareness of opportunities and resources: Management have awareness of opportunities and resources like men, materials, money which assembles and integrates by management.

Management is transformation process: Management is a transformation process

consisting of planning, organizing, staffing, directing and controlling. Management is

universal: The principles and techniques of management are universally applicable to all group activities performed at any level of organization.

System of authority: System of authority means a hierarchy of command and control. Managers at different levels possess varying degrees of authority.

Co – Ordination: Various human beings organized in formal groups are endeavoring to achieve the common organizational objectives, so various departments in the organization must work in harmony with one another.

Management is Dynamic: The ever changing social environment directly and

indirectly effect the group activity thus changing environments provide a challenge to management. Efficient management can not remain static it must adopt it self to changing conditions.

Management is decision making: The managers are decision makers the marketing managers decides about how to market, when to market, where to market how to collect funds for organization.

Management is a profession: Management is not only a science but also an art. Art means managers has to handle the person and things tactfully. Science means achieving objectives through procedures

Importance of Management: “No ideology, no ism, or political the greater output with less efforts from a given complex of human and materials resource only sound management And it is on such greater output that a higher standard of life, more leisure, more amenities for all.

Effective utilization of resources: Management tries to make effective utilization of various resources. The resources are scarce in nature and to meet the demand of the society, their contribution should be maximum for the general interests of the society. Management not only decides in which particular alternative a particular resource be used but also takes actions to utilize it in that particular alternative in the best way.

Development of resources: Management develops various resources. This is true with human as well as non-human factors. Most of the researches for resource development are carried on in an organization way and management is involved in those activities.

To incorporate innovations: Today changes are occurring at a very fast rate in both technology and social process and structure these changes need to be incorporated to keep the organizations alive and efficient. Therefore, they require high degree of specialization, high level of competence, and complex technology. All these require efficient management so that organizations work in the most efficient way.

Integrating various interest groups: In the organized efforts, there are various interest groups and they put pressure over other groups for maximum share in the combined output. For example, in the case of business organization, there are various pressure groups such as shareholders, employees, government etc. These interest groups have pressure on an organization.

Stability in the society: Management provides stability in the society by changing and modifying the resources in accordance with the changing environment of the society. In the modern age, more emphasis is on new inventions for the betterment of human beings. These inventions make old

systems and factors mostly obsolete and inefficient. Management provides integration between traditions and new inventions and safeguards, society from the unfavorable impact of these inventions so that continuity in social process is maintained.

Levels of Management:

1. Top Management
2. Upper Middle management
3. Middle Management
4. Lower Management
5. Operating Force or Rank and file workmen

Top Management includes:

- a) Board of directors b)
Managing directors c) Chief
executives d) General Manager
- e) Owners
- f) Shareholders

Functions:

- a) Setting basic goals and objectives
- b) Expanding or contracting activities
- c) Establishing policies
- d) Monitoring performance
- e) Designing/Redesigning organization system
- f) Shouldering financial responsibilities etc

upper Middle Management includes:

- a) Sales executives
- b) Production executives
- c) Finance executives
- d) Accounts executives
- e) R&D
executives

Functions:

- a) establishment of the organization
- b) Selection of staff for lower levels of management
- c) Installing different departments
- d) Designing operating policies and routines
- e) Assigning duties to their subordinates

Middle Management includes:

- a) Superintendent
- b) Branch Managers
- c) General foreman

etc. Functions:

- a) To cooperate to run organization smoothly
- b) To understand interlocking of department in major policies
- c) To achieve coordination between different parts of the organization
- d) To conduct training for employee development
- e) To build an efficient company team spirit

- a) Foremen
- b) Supervisors or charge-hands
- c) Office Superintendent
- d) Inspectors etc.

- a) Direct supervision of workers and their work
- b) Developing and improving work methods operations
- c) Inspection function
- d) Imparting instruction to workers
- e) To give finishing touch to the plans and policies of top management
- f) To act as link between top management and operating force
- g) To communicate the feelings of workers to the top management.

Operating force includes:

- a) Workers
- b) Rank and file workman

- c) Skilled and Semi-skilled workers
- d) Unskilled workers

Function:

- a) To do work on machines or manually, using tools etc.
- b) To work independently (incase of skilled workers) or under the guidance of supervisor.

Functions of Management:

Planning: Involves selecting the objectives and actions to achieves them planning stage involves decision making and choosing future courses of action from the various alternatives

Organizing: Role of each person in any organization is fixed. The concept of role is who will be doing what should be known, to achieve organizational targets efficiently. It is intended that all the tasks necessary to achieve targets are assigned to people who can do the best.

Staffing: Staffing function includes keeping the various organizational position fixed. This activity is done by identifying work force requirements, keeping the records of the performance of people working with the organization. So that suitable people can be prompted and at the same time people performing not up to the mark could be send for training. If all the above activities are taking place in nice way in any organization, it will give rise minimum work force turnover.

Directing: Directing means influencing people, so that they will contribute to the organization targets directing involves motivation, leadership styles and proper communication.

Controlling: It is the process of comparing the plans with the results. If there is deviation attain taken to be bridge the gap between plan and actual results. Coordinating: The essence of management is the achievement of coordination among people coordination is a complex process following the principles by which organization activity can be accomplished.

Coordinative is possible oniy if all the personnel working in the organization accept the target of the organization. This target must be clearly defined and concerned.

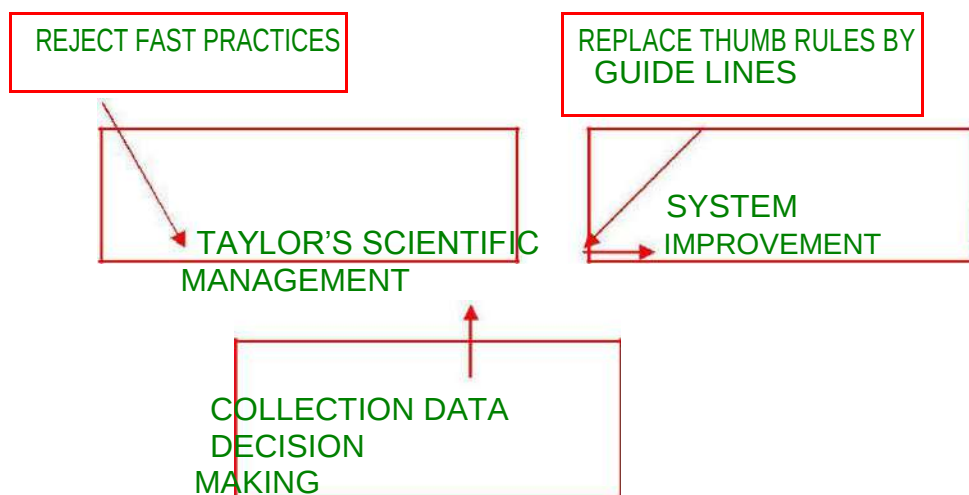
Evolution of Management Theory: Good management intends to achieve an objective with the least use of man, machine, money and material and at the same time maximum satisfaction of the participants.

Taylor's Scientific Management: The utility of scientific methods to problems of management was first introduced by F.W.Taylor

Definition: Scientific management may be defined as the “Art o what is to be done and the best way of doing it”.

Scientific management is the result of applying scientific knowledge and scientific methods to the various aspects of management and the problems that arise form them.

Principles of Scientific Management: Taylor through his principles of scientific management initiated a system in which there would be an effective and fruitful coordination and cooperation between the management and the workers.



Development of Science for each element of work: Analyze the work scientifically, rather than using thumb rule. It means that an attempt is made to find out what is to be done by a particular worker,

how he is to do it, what equipment will be necessary to do it. This information is provided to the worker, so as to reduce wastage of time, material etc. and improve the quality work Scientific selection, placement and training of workers: This principle states that select the workers best suited to perform the specific task, and then train them within the industry in order to attain the objectives of the enterprise workers

should also be trained from time to time to keep them informed of latest development in the techniques of production.

Division of Labour: division of work in smaller tasks and separation of thinking element of job from doing element of the job, this is the principle of specialization. It is essential for efficiency in all sphere of activities as well as in supervision work

Standardization of methods, procedures, tools and equipment:

Standardization helps in reducing time, labour and cost of production. The success of scientific management largely depends upon standardization of system, depends upon standardization of system, tools, equipments and techniques of production

Use of time and motion study: Taylor's introduced time and motion

determine standard work. Taylor's undertook, incurred by studying the on factory workers and the time necessary to complete task.

Differential wage system: Taylor's differential piece rate scheme incentive for a worker to achieve high level of optimum output. It distinguishes the more productive workers from less productive workers and motivates them to produce more.

Cooperation between labour and management: Mutual respect and cooperation between the workers and management helps in providing proper and effective leadership. The labour starts thinking that it is their work and they must put their heart in the work assigned to him.

Principle of Management by Exception: Taylor suggested that only major or significant deviations between the actual performance and standard

performance should be brought to the notice of top management. Top management should pay more attention to those areas of work where standards and procedures could not be established and where there is a significant variation between standard performance and actual performance.

Administrative Management Theory (Henri Fayol and Others):

Henri Fayol is called as father of Modern Management

He established the pattern of management and the pyramidal form of organization. He pointed out that technical ability is more dominating on the lower level of management managerial ability is more important on the higher level of management.

Henri Fayol analyzed the process of management and divided the activities of an industrial undertaking into six groups

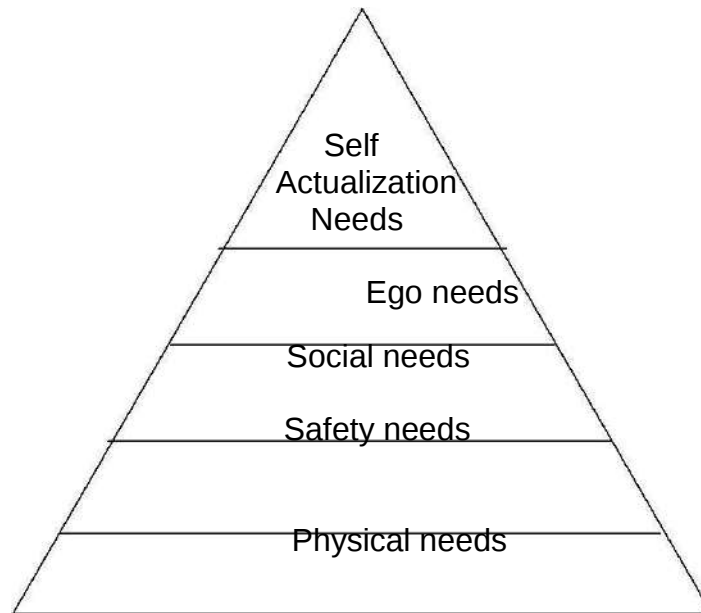
1. Technical activities
2. Commercial activities
3. Financial activities
4. Security activities
5. Accounting activities
6. Managerial activities

Elton Mayo: Elton Mayo generally recognized as father of human relations approach Mayo led the team which conducted the study psychological reaction of workers in on-the job situations Mayo concluded that work arrangements in addition to meeting the objective requirements of production must at the same time satisfy the employees subjective requirement of social satisfaction at his work place.

Maslow's level of hierarchy about human relations and approach, his assumptions are based mainly on theory of has defined five level of hierarchy of needs starting from the biological need and then coming to more intangible ones .

1. Physical needs like food, clothes and shelter
2. Safety needs freedom from fear of insecurity
3. Social needs include a sense of being accepted in the society or environment one finds himself in.

4. Ego needs include feeling of important and recognition
5. Self actualization needs include need or desire for personal fulfillment of individual potential and activity.



Douglas McGregor Theory: He divides leadership is two styles labeled theory “X” and theory “Y”. The traditional styles of leadership theory ‘X’ by McGregor, is exercised to managers on assumptions about human beings. These assumptions as laid down or observed by McGregor for theory ‘X’ are

Theory : “X”

1. An average human being does not like to work and he tries to avoid it as far as possible.
2. He avoids accepting responsible and challenging tasks, has no ambition but wants security above all.
3. Because of this, the employees are to be forced, concerned and threatened with punishments to make them put their best efforts.

These people would not work sincerely and honestly under democratic conditions.

However the above assumptions are not based on research findings. The autocratic style basically presumes that workers are generally lazy, avoid work and shirk responsibilities. It is believed that workers are more interested in money and security based on these assumptions the leadership styles developed, insists on tighter control and supervision.

Theory of "Y"

It focuses a totally different set of assumptions about the employees

1. Some employees consider work as natural as play or rest.
2. These employees are capable of directing and controlling performance on their own
3. They are much committed to the objectives of the organization
4. Higher rewards make these employees more committed to organization.
5. Given an opportunity they not only accept responsibility but also look for opportunities to outperform others.
6. Most of them highly imaginative, creative and display ingenuity in handling organizational issues.

System Approach to Management:

Modern approaches to understand management is the systems approach. Here the organization is viewed as a system. Every department is considered as a sub-system, it is also possible that every department can be viewed as a system and every section in the department can be viewed as a sub-system, system approach helps to study the basic feature and functions of the organization its minutest details.

The collection of interrelated parts called as sub-system which constitutes one whole unit. System approach facilitates the study of each of these parts in detail to have a close understanding of the whole system.

Ex: Every part of the study such as the eyes, brain, and heart can also be viewed as a sub-system, a study of each of the parts of the body is necessary to understand the whole body.

Herzberg's Two-factors Theory: Maslow's theory has been modified by Herzberg and he called it two-factors theory of motivation. According to him the first group of needs are such things as company policy and administration, supervision, working conditions, interpersonal relations, salary,

status, job security and personal life.

“Herzberg called these factors as ‘dissatisfiers’ and he means their presence or existence does not motivate in the sense of yielding satisfaction, but their absence would result in dissatisfaction. These are also referred to as ‘hygiene’ factors.

In the second group are the ‘satisfiers’ in the s motivators, which are related to ‘Job content’. He includ achievement, recognition, challenge work, advancement and growth in the job.

He says that their presence will yield feelings of satisfactory or no satisfaction, but not dissatisfaction.

Maintenance factors or dissatisfier

Job context

Company policy and Administration

Quality of supervision

Recognition

Relations with supervision Advancement

Relations with subordinates

Pay

Motivational factor or satisfier

Job content

Achievement

Possibility of growth

Responsibility

Leadership and Leadership Styles:

Leader:

One who leads a given group or team of people is called leader. If you can influence people to perform better in a given organizational setting, that means you are a leader.

Leadership is ability to influence people to achieve the given goals in an organization.

A true leader is one who shares success with followers and absorbs all failures.

A manager has to be a mini-leader (he has to inspire his subordinates and get work done) and leader to be a mega-leader (otherwise he does not understand the ground realities of functioning)

Leadership Styles: Leader has to ensure that people under his guidance are comfortable and their good work is recognized.

A good leader has to adopt such a style of working that takes care of people around him. There are also some leader who do not care for people and who care more for the task completion.

Types:

Autocratic leadership: Here, leader command the followers and expects compliance from them for all the instructions given, leaders are more dogmatic and positive. They lead by his ability to withhold or give rewards or punishments. Here, no suggestions from the followers are entertained and almost top-down approach is seen. They direct others. They do not allow any participation.

Democratic leadership: Here leaders consult subordinates and involve them in decision making. They encourage discussion with the group leaders believes in two-way communication. They listen to followers; try to facilitate the decision making.

Free – Rein leadership: Free – Rein leaders exercises little authority and give maximum freedom to subordinates while making decisions. It is a bottom-up

approach. Suggestions from the followers are encourage and rewarded. They give high degree of independence subordinates in their operations.

Social Responsibility: Social responsibility refers to the process which includes several activities from providing safe products and services to giving apportion of the company's profits to welfare organizations.

Responsibility towards shareholders: The business enterprise has the responsibility to provide fair return on capital to the shareholders. The firm must provide them regular,

accurate, and full information about the working of enterprise in order to fulfill and encourage their interest in the affairs of the company.

[Responsibility towards consumers](#): The management has to provide quality products and services to the customers at reasonable prices. It should consider customer suggestions and also plan its services more effectively through consumer satisfaction survey.

[Responsibility towards employees](#): Good working conditions motivate workers to contribute their best. It is the responsibility of the management to recognize their unions and respect their right to associate with a union of their choice.

[Responsibility towards creditors](#): The business has to repay the loans it has taken from the financial institutions as per the repayment schedule. Also, it should inform the creditors about the developments in the company from time-to-time.

[Responsibility towards Government](#): The business firm has to pay its taxes and be fair in its endeavours. It should also support the government in community development projects.

[Responsibility towards competitors](#): The business firm should always maintain the highest ethical standards and maintain cordial relations with each of the competitors, which is a critical and sensitive segment.

[Responsibility towards public](#): Business units have tremendous responsibility towards the general public to support the cause of community development. Most of the companies maintain public relations departments exclusively to maintain good relations with the community.

UNIT - 2

DESIGNING ORGANISATIONAL STRUCTURES

Organization:

Organization is form of organizing which is a part of management process Organization defined as collectivity of people for achieving common objectives

“Organization means the determination and assignment of work to people, and also the establishment and the maintenance of authority relationships among these grouped activities it is the structural frame work within which the various efforts are coordinated and related to each other”.

Definitions: “Organization are collectivities of people that established for the pursuit of relatively specific objectives on a more or less continuous basis”.

___William

Scott “Organization is the form of every human association for the attainment of a common purpose”.

___Mooney and Reilly “Organization is the grouping of activities necessary to accomplish goals and plans and the assignment of these activities to appropriate departments and positions to appropriate departments and positions for authority delegation and coordination”.

___Koontz

and O'Donnell Organization is used in the following ways with or without prefix or suffix

- g) as entity
- h) as group of people
- i) as structure
- j) as process

Process of Organization:

Determination of objectives, strategies, plans and policies: Objectives should be clear and precise, because the entire organization is to be built around the objectives of the enterprises.

Determination of activities: Determine activities needed to execute these plans and policies and accomplish the objectives. The work load is broken into component activities that are to be performed by all the employees. The activities are so split to determine the job which can be performed by an individual.

Separation and grouping of activities: To attain the benefits of specialization and division of labour, every company, will separate its activities on the basis of primary functions like finance, engineering, purchasing, production, sales and industrial relations. All the similar or directly related activities are grouped together in the form of departments.

Delegation of authority: Authority is necessary for the performance of the job and therefore authority is delegated to the subordinates for enabling them to carry out their work smoothly and efficiently.

Delegation of responsibility: Responsibility may be described as the obligation and accountability for the performance of delegated duties. A superior is always accountable for the acts of his subordinate. Therefore, responsibility always flows from subordinates to superiors.

Establish inter-relationships: The grouped activities are placed in the overall organization structure at appropriate level. It is necessary to integrate or the these groups of activities through.

- a) Authority relationship horizontally, vertically and diagonally
- b) Organized information or communication system i.e., with the help of effective coordination and communication.

Providing physical facilities and proper environment: Physical

facilities means provide machinery, tools equipments, infrastructure etc,
environment means provide proper lighting, ventilation, heating, cooling

arrangement at the work place, reasonable hours of work, safety devices, job security etc

Principles of Organization:

Principle of unity of objectives: An organization structure is effective if it enables individuals to contribute to entire objectives.

Principle of co-ordination: The aim of the objective can be achieved if proper co-ordination exists for different activities

Principles of organizational efficiency: An organization is efficient if it is structured to aid the accomplishment of enterprise objective with a minimum of unwanted consequences or costs.

Span of management principle: In each managerial position, there is a limit to the number of persons an individual can effectively manage but the exact number will depend on the impact of underlying variables.

Scalar principle: The clearer the line of authority from the ultimate management position in an enterprise to every subordinate position, the clearer will be the responsibility for decision making the more effective will be organization communication.

Principle of delegation by results expected: Authority delegated to all individual managers should be adequate enough to ensure their ability to accomplish the results expected.

Principle of responsibility: The responsibility of subordinates to their superiors for performance is absolute, and superiors can not escape responsibility for the organization activity of their subordinates.

Principle of parity of authority and responsibility: The responsibility for actions can not be greater than that implied by the authority delegated, nor should it be less.

Principle of unity command: The more complete an individual's reporting relationships to a single superior, the smaller the problem of conflicting instructions and the greater the feeling of personal responsibility for results.

Authority level principle: Maintenance of intended delegation requires

that decisions with in the authority of individual managers should be made by them and not be referred upward in the organization structure.

Principle of balance: The application of principles or technique must be balanced to ensure the over all effectiveness of the structure in meeting enterprise objectives.

Principle of flexibility: the more that provisions are made for building flexibility in to an organization structure can fulfill its purpose.

Principle of leadership facilitation: The more an organization structure and its delegations of authority enable managers to design and maintain an environment for performance, the more they will help the leadership abilities of those managers.

Design of Organization structure: The main objective of an organization structure is to ensure that efforts of all the people working in various sections are co-ordinate and integrated for achieving the task in the most efficient effective way with minimum consumption of resources i.e. economical ways

1) Formal organization structure 2) Informal organization structure

Formal organization structure: According to classical theorists the formal organization is built an four pillars

- 1) Division of labour
- 2) Scalar functional processes
- 3) Structure
- 4) Span of control

Definition: An organization is formal when the activities of two or more persons are consciously coordinated towards common objectives.

Informal organization: Informal organization arises spontaneously based on friendship or some common interest and not based on rules, regulation and procedures. It is developed by the employees themselves and not by the formal authority.

Definition: Informal organization brings cohesiveness to a formal organization, it brings to the members of formal organization a feeling

of belonging of status, of self-respect and of gregarious satisfaction.

Comparison between formal and informal organization:

Basis of comparison	Formal	Informal
Formation	Planned & deliberated	Spontaneous
Purpose	Well-set goals	Social interaction
Structure	Well structured	Un structured
Focus	Positions	Persons
Nature	Official	Unofficial
Leadership	Superior	Any one
Source of power	Delegated	Given by group
Guidelines for behaviour	Rules procedures	Group norms
Source of control	Rewards/Punishment	Sanctions

Type of organization: On the basis of authority relationships organization classified as follows

1. Line organization or Military organization or Scalar organization
2. Functional organization
3. Line and Staff organization
4. Project organization
5. Committee organization
6. Matrix organization

Where efforts of large number of people have to be controlled and discipline is of prime importance line type organization structure will serve the purpose. This is also one of the oldest structures. However, in present conditions this type of structure has lost the applicability. In line structure ten lines of instruction, directing is vertical. This means in this type boss is always right and his orders are to be obeyed at any cost.

Merits:

Simplicity: Line organization is very simple to establish and can be easily understand by the employees

Discipline: Since each position is subject to control by its immediate superior position, often the maintenance of discipline is easy unity of command and unity of direction foster discipline among the people in the organization.

Co-ordination: The hierarchy in management helps in achieving effective coordination

Effective communication: There will be a direct link between superior and his subordinate; both can communicate properly among himself or herself.

Economical: Line organization is easy to operate and less expensive

Unity of command: In line organization every person is under the command of one boss only.

Prompt decision: Only one person is in charge of one division or department. This enables manager to take quick decisions.

Over all development of the managers: The departmental head has to look after all the activities of his department; therefore, it encourages the development of all round managers at the higher level of authority.

Demerits:

Undue reliance: The success of the enterprise depends upon the caliber and ability of few departmental heads, loss of one or two capable men may put the organization in difficulties.

Personnel limitations: In this type of organization an individual executive is suppose to discharge different types of duties. He cannot do justice to all

different activities because he cannot be specialized in all the trades.

Overload of work: Departmental heads are overloaded with various routine jobs hence they can not spare time for important managerial functions like planning, development budgeting etc.

Dictatorial way: In line organization, too much authorities centre on line executive. Hence it encourages dictatorial way of working.

Duplication of work: Conflicting policies of different departments result in duplication of work.

Unsuitable for large concerns: It is limited to small concerns

General interest of enterprise may be over looked: Departments may work for their self-interest and may sacrifice the general interest of the enterprise.

Scope of favourism: As the departmental heads has the supreme authority, there is chance of favourism.

Functional organization: This structure most widely used, in the medium and large organizations having limited number of products.

This was introduced by F.W.Taylor and is logical extension of the division of labour cover departments as well as men. In this authority is delegated to an individual or department to control specified processes, policies or other matter relating to activities under taken by persons in other departments.

Head Quarters

In this system planning is separated from performance since the direction of work is divided by various function in the factory. It has been found that this type of structure becomes ineffective when the work of departments and individuals increases in variety and complexity.

Merits:

Separation of work: In functional organization, work has been separated from routine work. The specialist has been given the authority and responsibility for

supervision and administration pertaining to their field of specialization unnecessary over loading of responsibilities is thus avoided.

Specialization: Specialization and skilled supervisory attention is given to workers the result is increase in rate of production and improved quality of work. Narrow range with high depth: The narrow range of activities enable the functional expert to developing in depth understanding in his particular area of activity

Ease in selection and training: Functional organization is based upon expert knowledge. The availability of guidance through experts makes it possible to train the workers properly in comparatively short span of time.

Reduction in prime cost: Since for every operation expert guidance is there, wastage of material is reduced and thus helps to reduce prime cost.

Scope of growth and development of business: This type of organization presents ample scope for the growth and development of business.

Demerits:

Indispline: Since the workers receive instructions from number of specialist it leads to confusion to whom they should follow. Therefore, it is difficult to maintain discipline

Shifting of responsibility: It is difficult for the top management to locate responsibility for the unsatisfactory work every body tries to shift responsibility on others for the faults and failure.

Kills the initiative of workers: As the specialized guidance is available to the workers the workers will not be using their talents and skills therefore their initiative cannot be utilized.

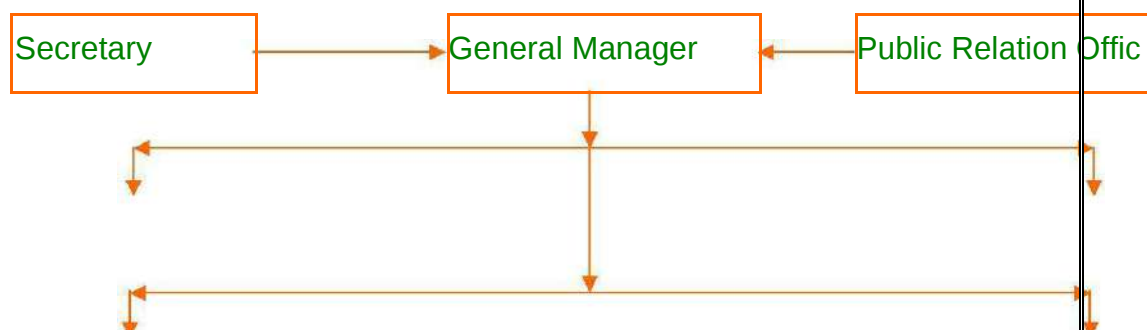
Overlapping of authority: The sphere of authority tends to overlap and gives rise to friction between the persons of equal rank.

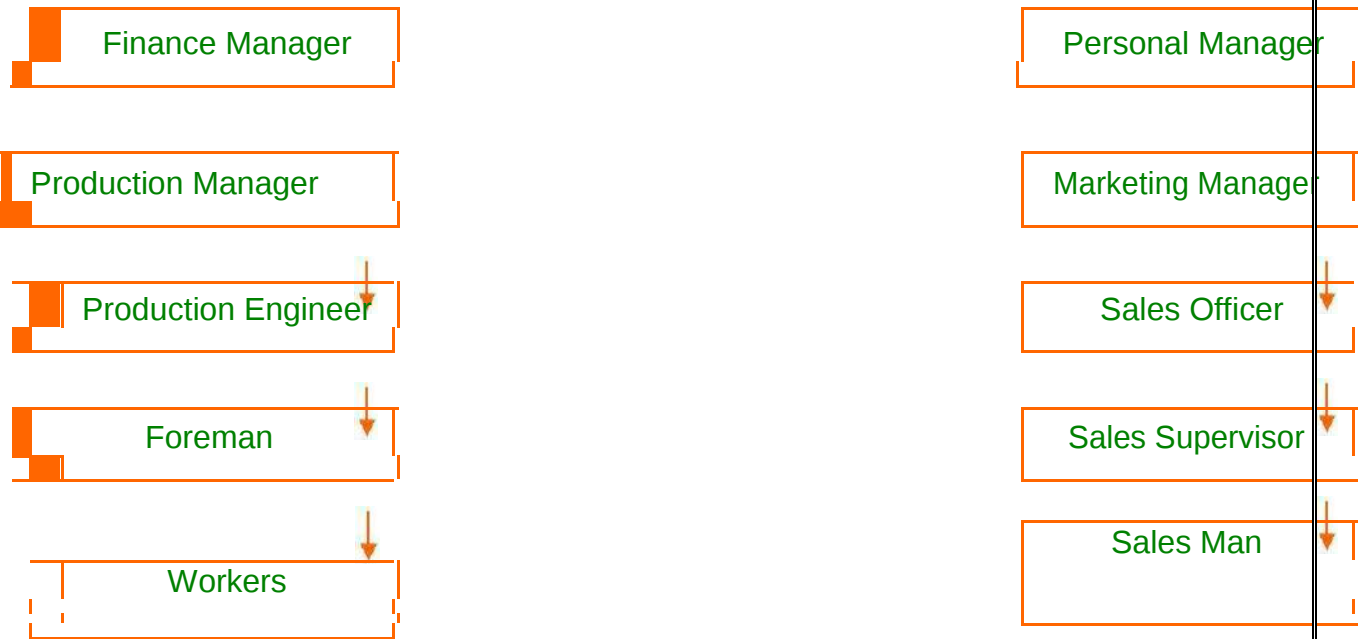
Lack of co-ordination between functions: except the function in which he is specialized he is absolutely indifferent to other functions. Therefore, there is a lack of coordination of function and efforts.

Line and Staff Organization: Line and Staff organization is the in which the line heads are assisted by specialist staff.

If the firm is of large size, manager cannot give careful attention to every aspect of management. They are busy with ordinary task of production and selling. Hence staff is deputed to do the work of investigation, research, recording, and advising to managers. Thus the staff brings advising to managers. Thus the staff brings specialization by assisting the line officers.

“Line” means-Operating
means - Service





Merits:

Planned specialization: The line and staff structure is based upon the principle of specialization. The line managers are responsible for operations contributing directly to the achievement of organizational objectives where as staff people are there to provide expert advice on the matters of their concerns.

Quality decisions: Decisions come after careful consideration and thought each expert gives his advise in the area of his specialization which is reflected in the decisions.

Prospect for personal growth: Prospect for efficient personal to grow in the organization not only that, it also offers opportunity for concentrating in a particular area, there by increasing personal efficiency

Less wastage: There will be less wastage of material.

Training ground for personnel: It provides training ground to the personnel in two ways. First, since everybody is expected to concentrate training needs can easily be identified. Second, the staff with expert knowledge provides opportunities to the line managers for adopting rational multi-dimensional approach towards a problem.

Demerits:

Chances of Misinterpretation: Although the expert advice is available, yet it reaches the workers through line supervisors. The line officers may fail to understand the meaning of advice and there is always a risk of misunderstanding and misinterpretation.

Chances of friction: There are bound to be occasions when the line and staff may differ in opinion may resent in conflict of interests and prevents harmonious relations between the two.

Ineffective Staff in the absence of authority: The staff has no authority to execute their own advice. Their advice is not a binding on the line officers. Therefore the advice given by specialist may be ignored by line heads.

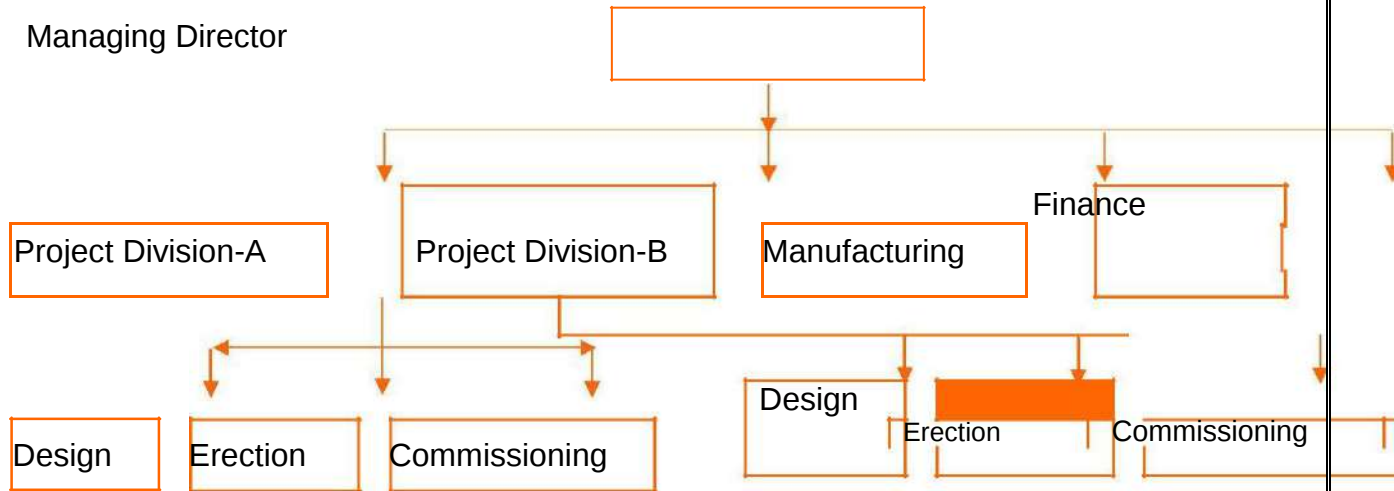
Expensive: The overhead cost of the product increases because of high salaried specialized staff.

Loss of initiative by line executives: If is they start depending too much on staff may loose their initiative drive and ingenuity.

Project Organization: A project organization is a special case where common service like finance, purchase etc. are organized at the functional level. But project resources are allocated to the project manager. Since the business responsibility rests with the project manager, necessary authority is given to him with the requisite resources. This type of organization structure helps in making decisions for project control in terms of cost, resource and time. In a project

organization some of the functions are corporate responsibility and some of them are project manager's responsibility.

Managing Director



Merits:

- c) This calls for quick divisions
- d) Organizing all functional
- e) Proper coordination of work of different departments

f) Demerits:

- 1. It tends to increase the problems of control for top management
- 2. It is special case of product organization
- 3. The organization may get disintegrated with increasing focus on departments

Committee Organization: A committee is formed when two or more persons are appointed to work as a team to arrive at a decision on the matters referred to it. It is intended to utilize the knowledge, skills, and experiences of all the concerned parties. Particularly, in large organizations, problems are too big to be handled by one single expert.

organizational resources in terms of knowledge skills and experiences.

2. It represents all interested groups and thus, facilitates group decision.
3. It yields good results if the committee are headed by taskmaster like chairman and time bound in terms of decision-making.
4. It minimizes the fear of too much authority vested in one person
5. It motivates all the concerned or effected groups to participate.

Demerits:

1. Responsibility of decisions cannot be fixed on a particular person.
2. It calls for high degree of coordination.
3. It involved high cost in terms of time and money.

Matrix Organization: This is also called as project organisation it is a combination of all relationships in the organization in vertical, horizontal and diagonal. It is mostly used in complex projects. It provides a high degree of operational freedom, flexibility and adoptability for both the line and staff managers in performing their respective roles. The main objective of matrix organization is to secure a higher degree of coordination than what is possible from the conventional organizational structure as the line and staff.



- ### Demerits:

- 14

MODERN TRENDS IN ORGANISATIONAL STRUCTURE DESIGNS:

Organizations in the recent times have been gearing themselves to suit to the growing demands from their stakeholders in terms of responsiveness, flexibility, agility, adaptability etc. In this process, they are following organic structure, which are more agile, flexible and adaptable to the changing circumstances. Virtual organizations, cellular organizations, team structure, boundaryless organization and inverted pyramid and different forms of organic structure that are widely seen among most of the sun-rise sectors such as financial services, Information Technology (IT) and IT enabled services. These structures have been contributing to the organic growth of the organization.

The focus of organic structures is to do away with those activities which do not directly contribute to the growth of the organization and focus only on those activities which directly lead the organization for the achievement of the given goals.

These are discussed below:

Virtual Organisation:

Virtual organizations facilitate competitiveness particularly when these organizations are part of the global economy. Here, there can be alliances and partnerships with other organizations almost all over world. It is a flexible organization structure that removes the traditional boundaries. It allows easy reassignment and reallocation of resources to take quick advantage of shifting opportunities in global markets. To avoid disintegration and to attain the effective needed focus, the lead virtual organizations must have a shared vision,, strong brand and high trust culture.

The virtual organization is a temporary network of companies that come together quickly to exploit fast changing opportunities. Virtual organizations appear to be bigger than traditional organizations. As virtual organizing required a strong information technology

(IT) platform, The boundaries that traditionally separate a firm from its suppliers, customers and even competitors are largely eliminated, temporarily

and in respect to a given transaction or business purpose. Virtual organizations

come into being 'as needed' when alliances are called i specific operating needs and objectives.

When the task is complete, the

alliances rests until next called into action. Each partner in the alliance

contributes to the virtual organization what it is best as-its core competence.

Cellular Organization:

Organizations structured around the units/cells that complete the entire assembly process are called cellular organizations. In the modern organizations, cellular organizations have been replacing the continuous line or linear production process system. In cellular organizations, workers manufacture total product or sub-assemblies in teams (cells). Every team (cell) of workers has the responsibility to improve or maintain the quality and quantity of its products. Each team is free to recognize itself to improve performance and product quality. These cells comprise self-managed teams. They monitor themselves and also correct where necessary on their own. Cellular organizations are characterized by much smaller staff all over the organization with middle management positions reduced and lean management members at the top. It is both a lean and flat structure.

Team Structure:

A structure in which the entire organization is made up of work groups or teams is known as team structure. Team structures are both permanent and temporary in nature as situation demands. Traditional organizations are characterized by vertical structures and modern organizations are identified by the horizontal i.e., team structures. 'We report to each other' is the main fe It leads to boundary less organsiation in a borderless world. In team structures, we find cross-functional teams meant for improving lateral relations, solving problem, completing special projects and accomplishing routine tasks. A cross-functional team comprises members from different functional departments such as marketing, finance, HR, production etc. Project teams are convened for a particular task or project and these get dissolved once task is completed. The intention here is to quickly bring together the people with the needed talents and

focus their efforts intensely to solve a problem or take advantage of a special

opportunity. Here employees are more involved and empowered because of reduced barriers among functional areas. Sometimes, when there is pressure on teams to perform and there is no clear chain of command, team structure fails to deliver results.

Boundaryless Organization:

At the name indicates, a boundary less organization eliminates internal boundaries among subsystems and external boundaries with external environment. It is a combination of team and network structures with the addition of temporariness. Such type of organization structure is characterized by spontaneous teamwork and communication. This replaces formal chain of command. It is a dynamic organization structure wherein organizational needs are met through a judicious mix of outsourcing contracts and alliances as and when needed. The key features of boundary less organization include knowledge-sharing, absence of hierarchy and bureaucracy, empowerment voluntary participation of expert members, technology utilization and temporariness. The focus is on mustering necessary talent and competencies required for the achievement of a task without any bureaucratic restrictions. Creativity, quality, timeliness, increase in speed and flexibility are the benefits the boundary less organization yields. It also reduces inefficiencies. The boundary less organization is highly flexible and responsive. These draw on talent wherever it is found. Sometimes, they are ineffective due to problems in communication.

Inverted Pyramid:

This is an alternative to the traditional chain of command. This is a structure, which is narrow at the top and wide at the base. It includes a few levels of management. For instance, sales people and sales support staff sit on the top as the key decision makers for all the issues related to sales and dealing with the customers. Since the sales staffs are in touch with the customer and aware of the requirements of the customers, they are given all the freedom to follow their own best judgment at all levels.

Departmentation: On the basis activity or departmentation Industrialisation has created problems, which are complex in nature. It created a necessity of large-scale industries to meet the increased demand. In large scale, industries there are large number of employees. For the sake of efficient supervision and control, the factory/enterprise is divided into different

departments. Each department is entrusted with a particular function for carrying out particular activity each departmental head is expected to control and supervise the work in his department.

Definition: The process of dividing the work and then grouping them into units and submits or departments for the purpose of administration.

Method of Departmentation:

By function: It is divided into primary function to be performed such as, finance, marketing, production, personnel etc. each function separate departments

By product: All activities related to a particular product line may be grouped together. This basis of departmentation has become increasingly important, especially for complex organizations producing different types of products.

By process: In this method, the manufacturing activity are sub divided on the basis of their process of production, similar machines such as all laths, milling machines, grinding machines, milling machine etc. are grouped into separate section, such as lathe department, milling department, drilling department.

By geographical region: This method may be adopted when the enterprise produces and sells in the wide market, often in international markets.

UNIT - 3

INTRODUCTION TO OPERATIONS MANAGEMENT

Plant location: Plant location is a strategic decision several factors influence this decision. The main objective of any business is to optimize its cost and revenue that is, minimize its costs and maximize its returns.

The degree of significance for the selection of location for any enterprise mainly depends on its size and nature large scale industries requiring huge amount of investment there are many considerations other than the local demand in the selection proper plant location these plants cannot be easily shifted to other place and an error of judgment in the selection of site can be vary expensive to the organization. However, small-scale industry mainly selects the site where in accordance with its capacity; the local market is available for its products. It can easily shift to other place when there is any change in the market.

Factors affecting plant location:

Nearness to Market: If the plant is located close to the market the cost of transportation can be minimized. This also helps the producers to have direct knowledge of the requirements of the customers.

Nearness to supply of raw materials: As far as possible the site selected should be near the source of raw materials, so that the cost of transportation can be minimized and storing cost can be reduced due to shorter lead time.

Availability of labour: Availability of right kind of labour force in required number at reasonable rates is also a deciding factor in selection of site

Transport and communication facilities: Generally, industries have a tendency to locate the industrial units near the railway station, highway or port areas. **Availability of power and fuel:** Coal, electricity, oil and natural gas are the important sources of power in the industries.

Ex: Tata iron and steel industry is established near the coalmines of Bihar.

Climatic conditions: Climatic conditions largely affect certain production processes and also the efficiency of the employees.

Ex: Textile mills require moist climate that why these plant located at Mumbai and Ahmedabad.

Availability of water: Water is used in industries for processing as in paper in chemical industries, for generation of power in hydroelectric power, plants and also required for drinking sanitary purpose also.

Ancillary industries: Many industries such as processing and assembly industries are not producing all the parts of their product but purchase some of the parts from ancillary industries producing it.

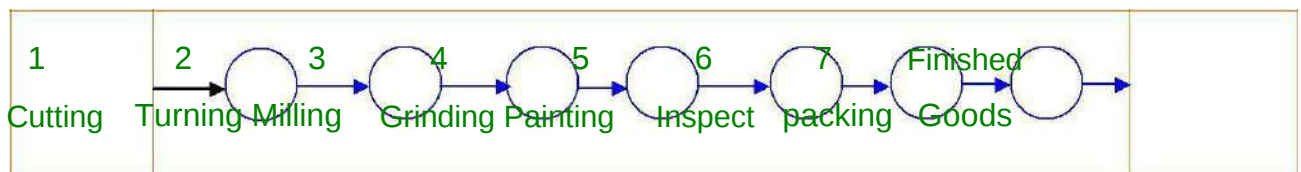
Financial and other aids: For the development of backward regions central as well as state government provide certain incentives and facilities such as cash-subsides, concession financial assistance, land, power and other facilities at cheaper rates, tax concession etc.

Plant Layout: A technique of locating machines, processes and plant services within the factory in order to secure the greatest possible output of high quality at the lowest possible total cost of production

Type of plant layout:

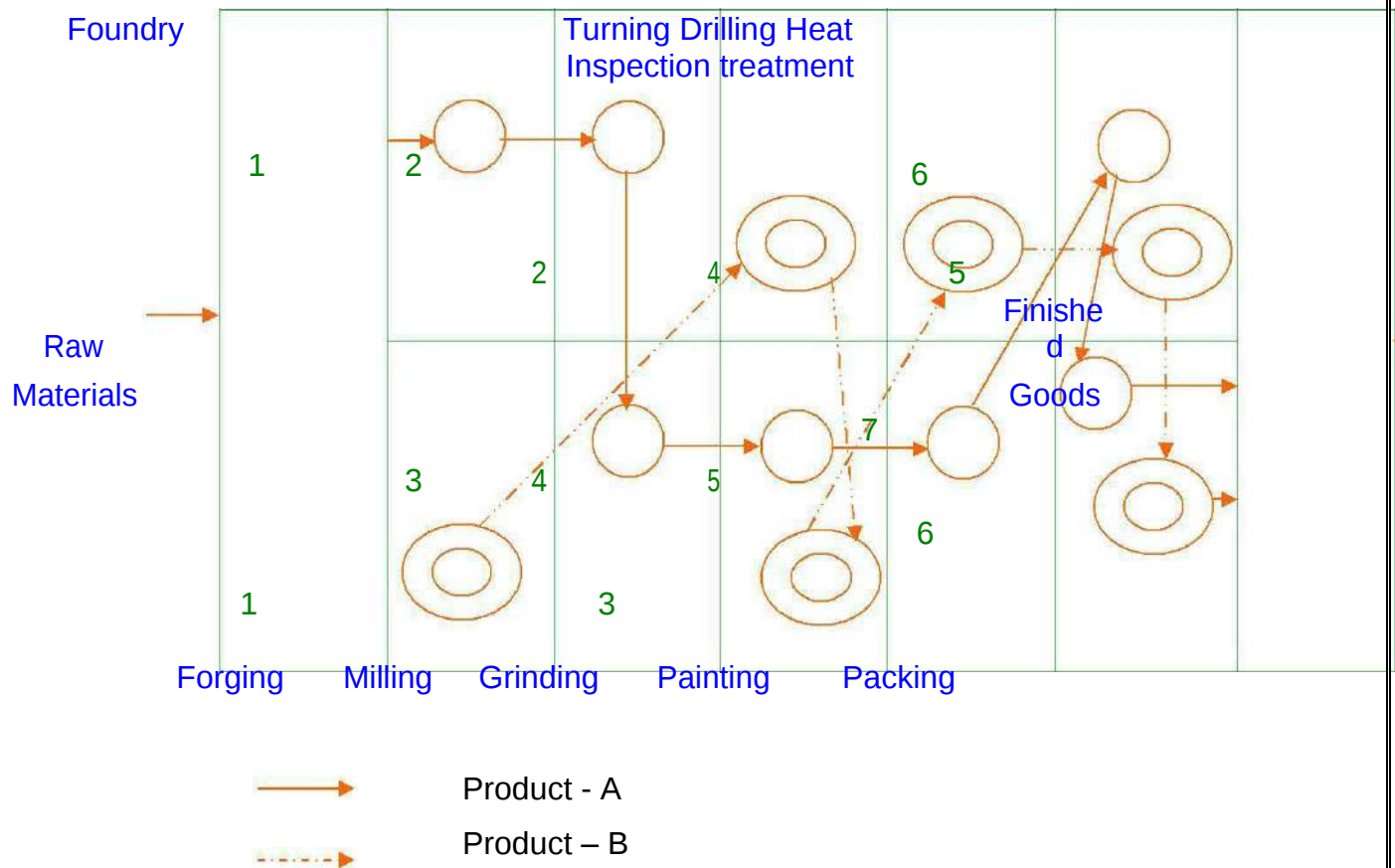
Product or line layout: This type of layout is developed for product-focused systems. In this type of layout only one product, or one type of product, is produced in a given area. In case of product being assembled, this type of layout is popularly known as an assembly line layout.

The work centers are organized in the sequence of appearance. The raw material centre at one end of the line and goes from one operation to another rapidly with minimum of work-in-process storage and material handling



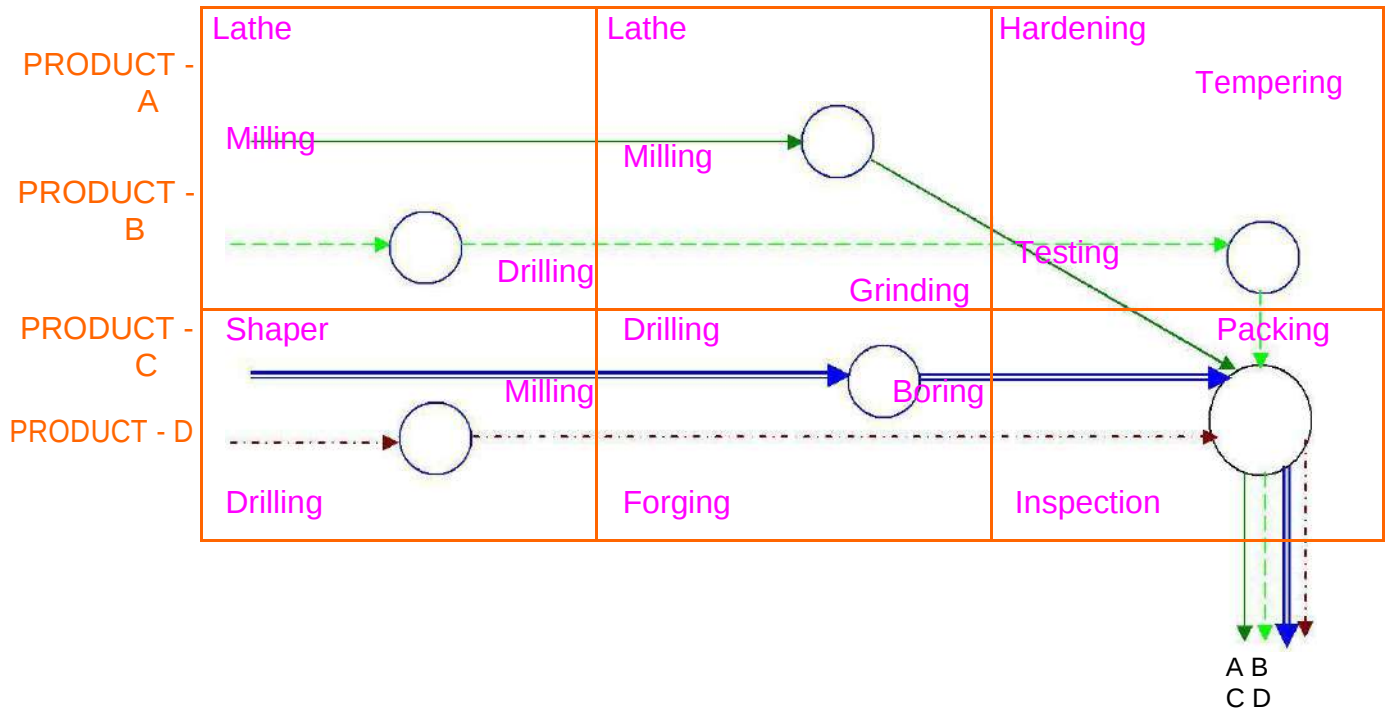
Process or Functional layout: This type of layout is developed for process focused systems. The processing units are organized by functions into departments on the assumption that certain skills and facilities are available in each department similar equipments and operations are grouped together, e.g., milling, foundry, drilling, plating, heat treatment etc.

The use of process-focused systems is very wide in both manufacture and other service facilities such as hospitals, large offices, municipal services, etc.



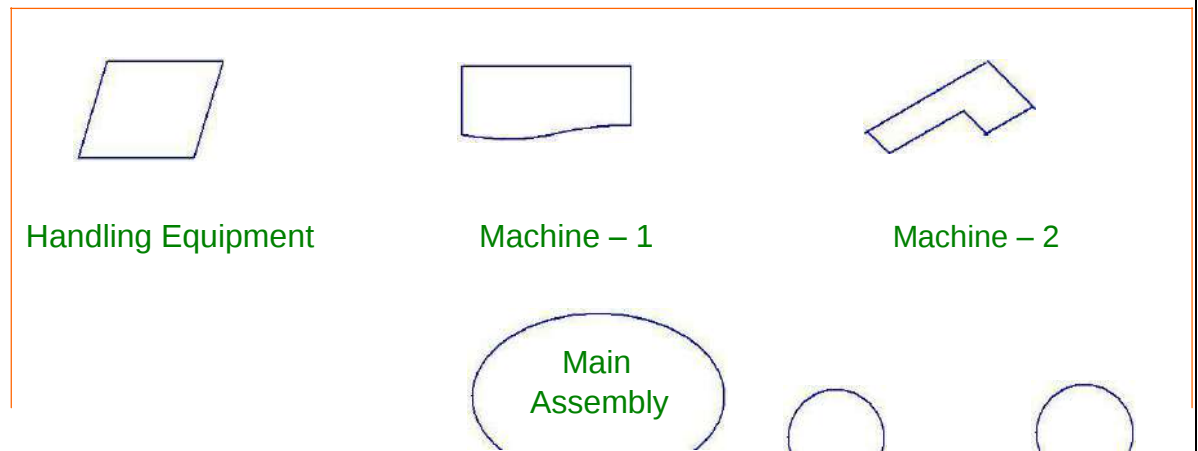
Cellular or group layout: It is special type of functional layout in which the facilities are clubbed together into cells. This is suitable for systems designed to use the concepts, principles and approaches of 'group tech' offers the advantages of mass production with high degree of automation even if

the numbers of products are more with flexible requirement. In such a system the facilities are group in to cells which are able to perform similar type of functions for a group of products.



Job Shop Layout: It is a layout for a very general flexible system that is processing job production, The preparation of such a layout is dependent on the analysis of the possible populations of orders and is a relatively, complex affair.

Project or Fixed position Layout: This is the layout for project type systems in which the major component is kept at a fixed position and all other materials, components, tools machines, work etc. are brought and assembly or fabrication is carried out. This type of layout is now not used very commonly as the machines required for manufacturing work are big and complicated. The fixed position layout is used only when it is difficult to move the major component and fabrication is to be carried out. Ex: production of ships.\



tools

Worker – 1 Worker – 2

Factors influencing plant layout:

Management policy: Management has to decide on many matters e.g. nature and quality of products, size of the plant, integration of production process, plans for expansion, amount of inventory in stock, employee facilities

Manufacturing process: The type of manufacturing process e.g. synthetic/analytical, continuous/intermittent and repetitive/non-repetitive, will govern the type of plant layout.

Nature of product: Small and light products can be moved easily to the machines, whereas for heavy and bulky products the machines may have to be moved. Type of equipment: The use of single

purpose and multi-purpose machine substantially affects the plant layout. Similarly, noisy and vibrating machines require special attention in the plant layout decision.

Types of buildings: The plant layout in a single storey building will be different from that in a multi storey building. The covered areas, elevators and stairs, parking and storage area all affect the layout.

Availability of total floor area: The allocation of space for machines, work-benches, sub-store aisles etc., is made on the basis of the available floor area use of overhead space is made in case of shortage of space.

Arrangement of materials handling equipment: Provide sufficient aisles for free movement of material handling equipment such as hand truck, fork truck etc. Service facilities: The layout of factory must include proper service facilities required for the comfort and welfare of workers. These include canteen, lockers, drinking water, first aid etc.

Possibility of future expansion: Plant layout is made in the light of future requirement and installations of additional activities.

Principles of plant layout:

Principle of integration: The best layout is one which integrates the men, materials, machinery, supporting activities and any other such a factors that results in the best compromise.

Principle of minimum movement: The number of movement of workers and

materials and the distance moved should be minimized. The materials should be transported in bulk rather than in small amounts.

Principle of smooth and continue flow: It states that bottlenecks, congestion points and bulk tracking should be removed by proper line balancing techniques. Principle of cubic space: Space of a room, if the ceiling height is also utilized, more materials can be accommodated in the same space.

Principle of satisfaction of safety: Working places-safe, well-ventilated and free from dust, noise fumes, odors and other hazardous conditions, help to increase the efficiency of the workers and improve their morale.

Principle of flexibility: It means the best layout in one which can be adopted and re-arranged at a minimum cost with least inconvenience.

Productivity:

Definition: Productivity is defined as the rate at which the goods and services are produced.

It refers to the relationship between the inputs and the output. It is calculated as a ratio between the amount produced and the amount of resources (land, labour, capital, technology etc.) used in the course of production in otherwords

And also defined productivity as human efforts to produce more and more with less and less inputs of resources as a result of which the benefits of production are distributed among maximum number of people.

Method of Production:

Job production: In this system, goods are produced according to the orders with this method, individual requirements of the consumers can be met. Each job order stands alone and is not likely to be repeated. This type of production has a lot of flexibility of operation and hence general purpose machines are required. Factories adopting this type of production, are generally small in size.

Advantages:

6. It is the only method, which can meet the individual requirement.
 7. There is no managerial problem, because of very less number of workers, and small size of concern.
 8. Such type of production requires less money and is easy to start.
- Disadvantages:

- k) There is no scope for continuous production and demand

- l) As the purchase of raw materials is less, hence cost of raw materials per unit will be slightly more.
- m) For handling different type of jobs, only skilled and intelligent workers are needed, thus labour cost increases.

Batch production: This type of production is generally adopted in medium size enterprise. Batch production is in between job production and mass production. Batch production is bigger in scale than the job production. While it is smaller than that of mass production, batch production requires more machines than job production and fewer machines than the of mass production.

- c) While comparing with mass production it requires less capital
 - d) Comparing with job production, it is more advantageous commercially.
 - e) If demand for one product decrease then production, for another product may be increased, thus the risk of loss is very less.
- Disadvantages:**
- 5) Comparing with mass production cost of scales and advertisement per unit is more

- 7. Raw materials to be purchased are in less quantity than that in mass production; therefore it is slightly costlier than that of mass production because less quantity discount is available.

Mass production: This method of production is used by concerns where manufacturing is carried on continuously in anticipation of demand though demand of the product may not be uniform through the year.

In mass production, simplification and standardization of products are made with the help of specialized (one purpose) machine, articles of standardized nature can easily and economically be produced on a large scale.

There is a small difference between mass production and continuous production. This is mainly in the kind of product and its relation to the plant. In mass production plant and equipment are flexible enough to deal with other products, involving same production process. Where as in continuous or process

production only standardized product in a sequence produced. In this method layout and requirement of additional tools and equipment

- f) A smooth flow of materials from one work station to the next in logical order.
 - g) Since the work from one process is fed directly into the next, small in process inventories result
 - h) Total production time per unit short
 - i) Simple production planning control system are possible
 - j) Little skill is usually required by operations at the production line, hence training is simple, short and inexpensive.
4. A breakdown of one machine may lead to a complete stoppage of the line that follows the machine. Hence maintenance and repair is challenging job.
5. Since the product dictates the layout, changes in product design may require major changes in the layout.
6. Generally high investment are required owing to the specialized nature of the machines and their possible duplication in the line

Work Study: Work study is one of the most important management techniques which is employed to improve the activities in the production. The main objective of work study is to assist the management in the optimum use of the human and material resources.

Definition: Work study refers to the method study and work measurement, which are used to examine human work in all its

contexts by systematically investigating into all factors affecting its efficiency and economy to bring forth the desired improvement.

Method Study:

Definition: The systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective methods and reducing cost it is also called motion study.

Work Measurement:

Definition: Work measurement is the application of techniques designed to establish time for a qualified worker to carry out a specified job at a defined level of performance.

Work study has two parts, Method Study and Work Measurement. Method study deals with the techniques of analyzing the way to do a given job better, Work Measurement seeks to measure the time required to perform the job.

Basic procedure for Method Study:

Select: The work to be studied

Record: All the relevant facts of the present or proposed method study by observation

Examine: The recorded facts critically every thing that is done, considering in turn, the purpose of the activity, the place where it is performed, the sequence in which it is done, the person who is doing it and the means by which it is done.

Develop: The most practical, economical and effective method considering all the circumstances.

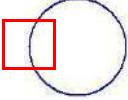
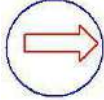
Define: The new method so that it can always be identified.

Install: The method as standard practice

Maintain: That standard practice by regular routine checks.

Recording: The current process of doing the job has to be recorded, while doing so every detail however small it may be, has to be identified.

Where the process is too long, involving many stages of production, inspection or transportation, the present process of doing the job is recorded sufficiently together with all the relevant information, using the process chart symbols.

Symbol	Meanings
	<u>Operation</u> : Operation involving changes in the condition of a product Ex: Assembly of spare parts
	<u>Transport</u> : Something from the location to another Ex: Assemble PC is moved to inspection section
	<u>Storage</u> : (permanent) To store the materials, goods etc. Ex: When PC is put into the store after inspection
	<u>Delay</u> : (Temporary storage) Arises when the product waits for next stage in the process Ex: Machinery breakdown etc.
	<u>Inspection</u> : To check whether the quality and quantity of the product is satisfactory or not
	<u>Operation – cum – Inspection</u> : Inspection is taken place during the production process
	<u>Operation – cum – Transportation</u> : Assemble is taking place while the belt conveyer transports the spares.

Recording Techniques: The recording techniques are of three types

a) Process chart b) Diagrams c) Motion and film analysis d) Models

A) Process Charts:

1) **Out line process chart:** This chart outlines the main events sequence wise considering only operations and inspections in the given job

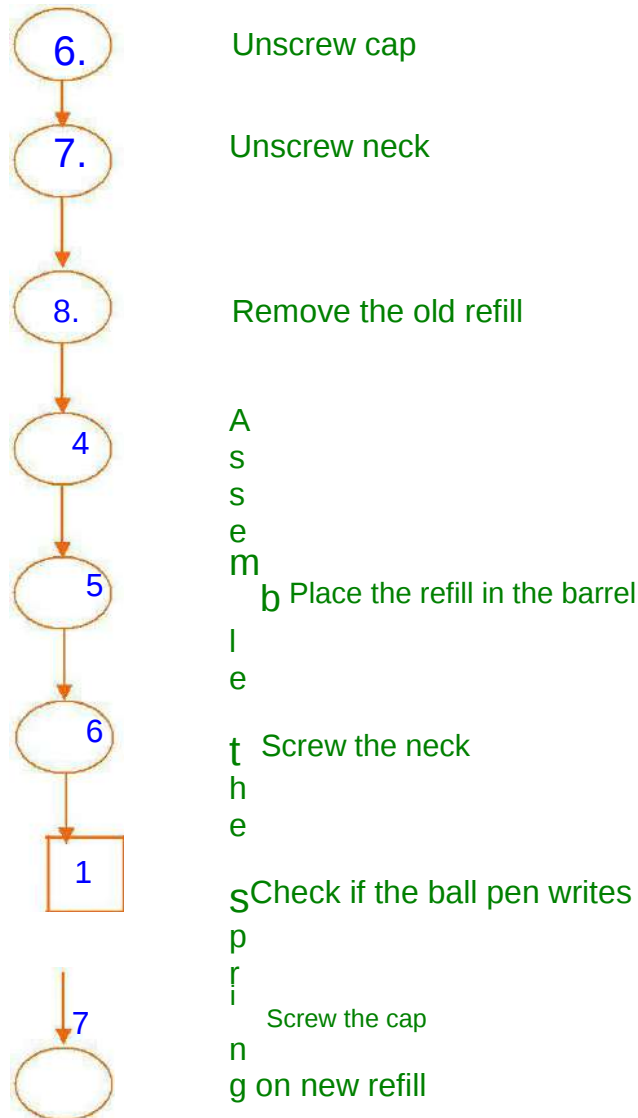
Ex: TASK : Changing refill of a Ball Point pen

Chart begins : Unscrew the cap

Chart ends : Screw the cap

Chart by : -----

Chart Ends : -----



No. of operations	7
No. of inspections	1
Total No. of activities	8

2) Flow process chart: These are scale drawings of the work place, which indicate where each activity takes place. This chart is capable of reflecting undue delays in transferring work between workstations duplication of work, and unfair work assignment, which may delay the completion process. It classified into three types

Man Type : It records what the worker does

Materials Type : It records what happens to the materials

Equipment Type : It records how the equipment used.

a) Man Type

Ex:

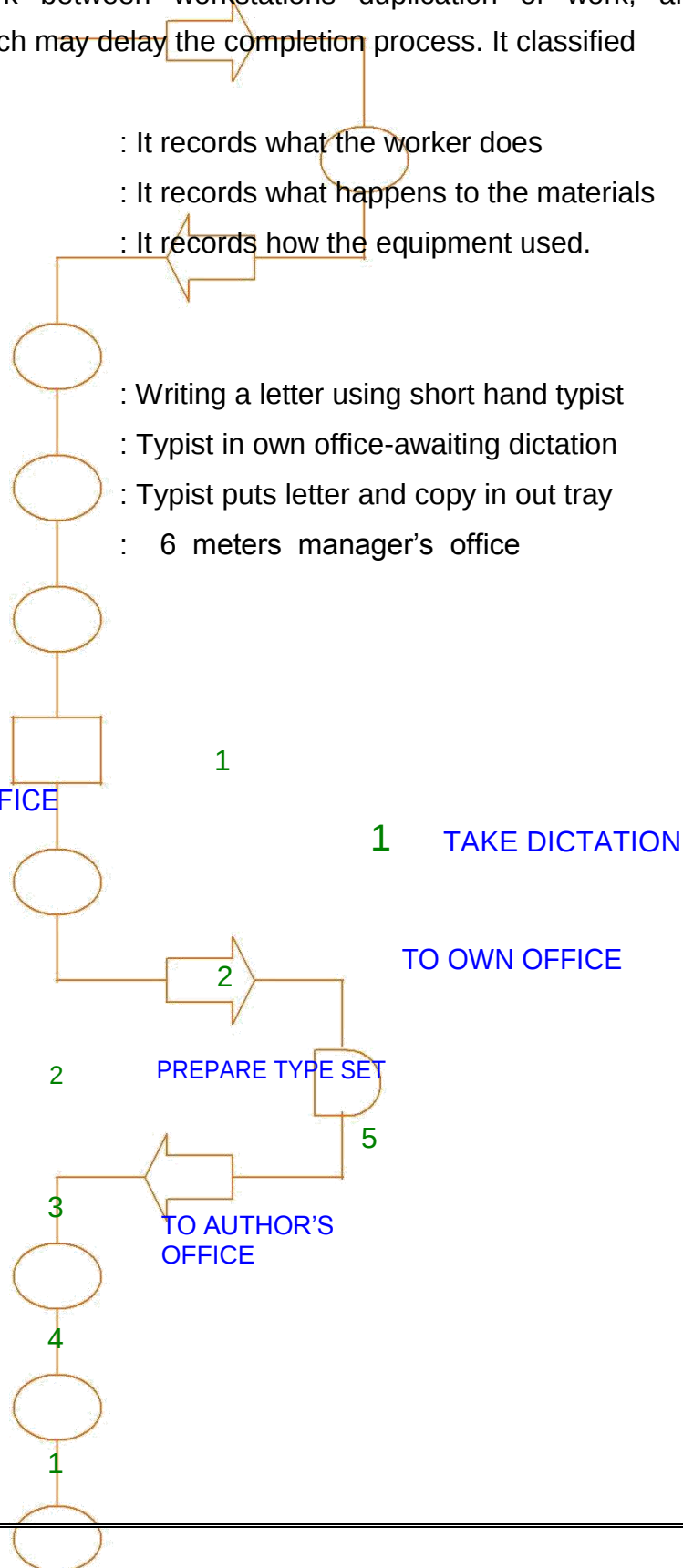
Job : Writing a letter using short hand typist

Chart begins : Typist in own office-awaiting dictation

Chart ends : Typist puts letter and copy in out tray

Typist office : 6 meters manager's office

TO AUTHOR'S OFFICE



TYPE LETTER AND COPY

DELAY FOR SIGNATURE

TO OWN OFFICE

REMOVE FROM MACHINE AND SEPARATE COPY

CHECK THE COPY

PLACE IN A FILE FOR SIGNATURE

3

1

4

TYPE ENVELOPES

LETTER TO ENVELOPES

SUMMARY

	8		
	1		
	4		
	1		
			24 METERS

LETTER AND COPY ASIDE TO OUT TRAY

b) Material Type:

Ex: Job : Making the casting ready for machining

Chart begins : Casting lying in foundry

Chart ends : Casting ready for machining

Activity	Operations	Distance moved mts	Time	Remarks
Costing laying in foundry store		-	-	-
Moved to gas cutting machine		10	3	By Trolley
Wait, cutting machine being set		-	5	-
Rises cut		-	20	-
Wait for trolley		-	10	-
Moved to inspection department		6	2	-
Inspection before machining		-	15	By Trolley
Move to machine shop		10	3	-

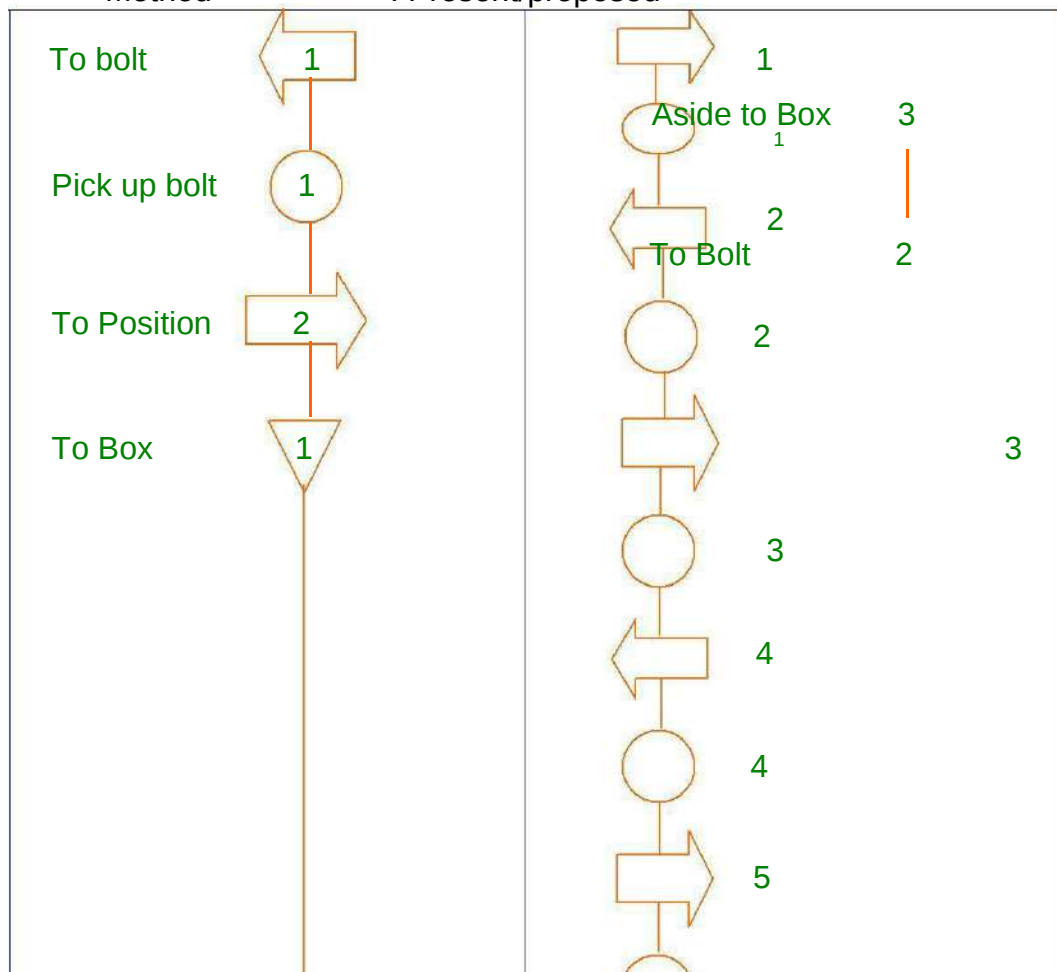
Summary

Event	No.	Time	Distance
	1	20	-
	1	15	-
	1	-	-
	2	15 (5+10)	-

○			
□			
△			
D			
➡	3	8	26

3) Two handed process chart: The two hand process chart is a chart in which the activities of a worker's hands are recorded, in their relationship to one another. It is commonly used for repetitive and short operations.

Ex: Job : Assemble to washers and nut to bolt
Chart begins : Hand empty material in boxes
Part No. : -----
Chart ends : Completed assembly aside to box
Operation No. : -----
Method : Present/proposed



4) Multiple activity chart: A multiple activity chart is a chart in which the activities of more than one item (worker, machine or equipment) are recorded on a common time scale to show their inter relationship.

By using separate vertical columns to represent the activities of different operators or machines on a common time scale, the chart shows very clearly the period of idleness on the part of any items during the process.

Chart No.-----

Sheet No. -----

Department -----

Material : B201 casting

Job : Making a slot on the casing

Machine : Slotted

Operation : XYZ

Charted
by : -----

Date : -----

Time (min.)	Man			Machine	Time (min.)
0.2	Removes finished casting cleans with compressed air			Idle	0.2
0.4	Gauges depth of slot on surface plate			Idle	0.4
0.6	Breaks sharp edges with file cleans with compressed air			Idle	0.6
0.8	Place in a box obtains new casting			Idle	0.8
1.0	Cleans machine with compressed air			Idle	1.0
1.2	Locates casting in fixture, starts machine and automatic fee			Idle	1.2
1.4	Idle			Cutting slot	1.4
1.6	Idle			Cutting slot	1.6
1.8	Idle			Cutting slot	1.8



Summary:

Cycle time : 2 min.

Working Time:

a) Man : 1.2 min.

b) Machine : 0.8 min.

Idle time:

a) Man : 0.8 min.

b) Machine : 1.2 min.

Utilization:

a) Man : 60%

b) Machine : 40%

B) Diagrams:

4. Flow diagrams: Flow process chart only shows the sequence of various activities necessary for performing the specified work. It does not show clearly the path of movement of men and materials from one location to another.

Definition: It is a diagrams, drawn to scale, intended to show the relative position of the production machinery and marks the route followed by the machines, materials and men.

5. String diagrams: The workers are moving at irregular intervals between a number of points in a working area with or without materials in many industrial activities.

Definition: The string diagram is a scale plan or model on which a tread its used to trace and measure the path of workers, materials or equipment during a specified sequence of events.

6. Cycle graph: In this method a small electric bulb is attached to each part of the body, which makes the movement for carrying out an operation. The path of movement is photographed by high-speed camera.

7. Chronocycle graph: This is a photographic record, which traces the path of movement onto a photographic plate. In principle, it is similar to the string diagram, and is most effective when recording short, rapid movements.

C) Micro motion Study and film analysis: Micro motion study is a set of techniques intended to divide human activity into groups of movements or micro motions (therbiligs) and the study of such movements help to find for an operator one best pattern of movements that consumes less time and requires less effort to accomplish the task.

Film analysis: Once the activity has been filmed and the film processed, a projector runs the film very slowly and the film can be stopped or reversed whenever required.

1) SIMO Chart (simultaneous motion cycle chart): A SIMO chart is based on film analysis, it is a graphic representation of the coordinated activities of an operator's body members. The activities are described in terms of basic or

fundamental motions. The time required for completion of these motions is also recorded on the chart.

D) Models: Sometimes the picture of the existing conditions is not clear by the use of flow process chart or flow diagram. In such cases instead of the scales plans of the shop facilities models are used to provide visual representation of the proposed layout before proceeding with actual rearrangement of the work place.

Work Measurement: Work measurement is the application of technique to establish the time for a qualified worker to carry out a specified job at a defined level of performance.

Procedure for Work Measurement:

6. Sect: The work to be studied and determine the objectives of the study
7. Record: All the relevant data relating to circumstances in which the work is being done, the methods to be used breakdown the job into its elements
8. Examine: The recorded data and the detailed breakdown critically to ensure the most effective method and motions are being used and that unproductive elements are separated from productive elements.
9. Measure: The time required to complete each element using the appropriate work measurement techniques and calculate the time required to complete the work cycle which is known as basic time.
10. Compile: The standard time for the operation or work place, in case of stop watch time study the various allowances to cover relation, personal needs etc. are added to the basic time to estimate the standard time.

Techniques of work

- measurement: i) Time study
j) Synthesis from standard data
k) Predetermined Motion Time System (PMTS) l) Analytical estimating
m) Work Sampling

1) Time study: It is defined as the art of observing and recording the time required to do each detailed element of all industrial operation.

Time study equipment: Time study equipment can be broadly grouped two categories

A) Time measuring device B) Time study boards and time study chart

A) Time measuring devices:

- h) Stop Watch b) Motion picture camera c) Time recording machine
e) Electronic timer.

c) Stop Watch:

7.Decimal minute stop watch: In this type of watch the movements is started and

stopped by moving the slide “A”, forward and backward complete revolution of large hand represents 1 minute and since the dial is divided into 100 parts reading to within 0.01 minutes can be obtained. Every time the large hand make one revolution the small hand will register 1 minute and is able to register up to 30 minutes.

5. Decimal hour stop watch: The dial in this watch is divided into 100 parts. The needle completes 10 revolutions in one hour. The least count in this watch is 0.001 hours. The small dial of this watch is divided into 30 equal spaces (representing 0.01 hour) and the small needle makes $3\frac{1}{3}$ revolutions in one hour.

6. Motion picture camera: Every element of the operation involving motion of the workers is made into film through motion picture camera when this film is run at a slow speed through a projector; the time of each element is recorded using a stopwatch.

7. Time recording machine: A moving tape is run in this machine at a uniform velocity of 10 inches/minutes with the help of electric motor. The machine has two keys: one key, when pressed, indicates starting of an operation, and the other key used to take a print on the scaled tape at the end of elements.

8. Electronic timer: The timing of starting and ending of an operation of an element is automatically recorded through electronic timers.

B) Time study boards and time study charts:

Time study board: These are simple and handy hard wood boards equipped with stopwatch holders and clamps for holding the observation sheets and time study forms. These boards help to see and record the observation and time at the same instant.

Observations forms: Printed or cyclostyled forms are used for recording the observation during that time study. It ensures that time study are made in a

standard manner and that no essential data are omitted. These forms are attached to the study board by means of clip provided

4. Synthesis from standard data: This one technique of work measurement to obtained synthetic times that are synthesis from element times previously obtained from direct time studies. The analysis and measurement stage are thus conducted prior to the actual study.

5. Predetermine motion time system (PMTS): Every element of work is composed of some combination of basic human motions. Apart from mental activity all works can broken down into elements that usually a fundamental movement of the body or body members. After this analysis stage the basic motions that have been isolated have a time allotted to them on the basis of predetermine motion times.

6. Analytical estimation: Analytical estimating serves as best for measuring work. In the analysis stage we find the usually these basic elements or much larger as compared to the elements in PMTS or time study. For measuring stages the time, which will be occupied by the element at a specific speed of working is estimated.

7. Work Sampling: It is work measurement technique which large number of instantaneous observation are made random interval over a specified period of time of a group of workers, machine and processes. Each observation records what is happening at that instantant and the present observations recorded for a particular activity or delay is a measure of the percentage of time during which that activity or delay occurs.

It can also defined as a method of finding the percentage occurrence of a certain activity by statistical sampling and random observations.

Procedure for conducting time study: For conducting time study average workers and average machines are selected. This study id conducted by the time study expert, who should be familiar with all the information related to the job and the conditions in which it is being done.

Time study is performed in the following stages.

- A) Analysis of work
- B) Standardization of methods
- b) Making time study

7. Analysis of work: It includes all the tasks performed by the workers, not just the effective work. In the end, time required for job preparation, cleaning of machine, etc. should also be included.

8. Standardization of methods: Related to materials, equipment, tools, working conditions to ensure an acceptable method which is easy, safe and the fastest.

9. Making time study: Time study is done on a printed time study record sheet, which is fixed on a board known as time study board. On one corner, a stopwatch is placed.

Different time readings of element are recorded in the corresponding column of the record sheet. Several sets of reading are taken to arrive at an accurate result after noting all these readings, average time is calculated, neglecting abnormal values, if any.

Standard time: it is the time, which is taken by a normal worker for a specific task or job, working under moderate conditions and including other allowances. Such as fatigue setting of tool and job, repairing of tool and checking of job etc

Standard time is the basis for the calculation of wages and incentives.

Standard time = Average time * Rating factor + other allowances

Rating factor: the study engineer multiplies actual time with a factor known as Rating factor or leveling factor to set the average time which a normal worker would take. This is expressed as a percentage of the efficiency of representative operator, which is in comparison to some of his average fellow workers.

Performance rating: performance rating is that process, during which the time study engineer compares the performance of the operator of normal performance.

$$\text{Performance rating} = \frac{\text{OBSERVED PERFORMANCE}}{\text{NORMAL PERFORMANCE}} \cdot 100$$

The rating can be

Standard rating: A qualified worker will naturally work if he is motivated to apply himself to his work at the average rate of pace.

Normal rating: It is the average rate or pace at which a qualified worker will

naturally work even if he has no specific motivation to apply himself to this work.

Rating techniques:

1) Speed rating : Speed rating consists of determining the speed of the operator's movements in relation to a normal pace as a fa each element so as to get the normal time for the element.

OBSERED TIME · RATING

Normal or basic time =

STAN DARD RATING

Rating = Worker's speed

Standard rating = Speed expected from the worker

2) Westing-house system of rating: It is based upon four factors- system comprising skill, effort, conditions and consistency and arrives at cumulative rating.

3) Synthetic rating: It is the ratio of the standard tome for the element to that of observed time.

4) Objective rating; It is determined in two stages- first the speed rating and second the adjustment for job difficulties.

5) Psychological evaluation of performance level: In this rating we consider the amount of oxygen consumed, change of heart rate etc to determine rating factor. Types of allowances in time study:

1) Process allowances: Process allowances to compensate for enforced idleness due to no work power failure, faulty material or tools and equipment.

2) Personal allowances: It comprises personal needs and fatigue. Fatigue allowance contains, in turn, a constant portion and a variable portion.

3) Interference allowances: When a worker is attending more than one machine

4) Contingency allowances: These allowances are to meet legitimate but irregular or infrequent items of work or delays.

5) Special allowances: Special allowances decided as a policy matter, covering activities that are essential for satisfactory performance of work but may not be part of the job, like start up, shut down, change over, cleaning, set up, tool changing etc.

STATISTICAL QUALITY CONTROL

Introduction: Quality is the determining factor the success of any product or service large resource are committed in every organization to ensure quality

Definition: It is defined as customer satisfaction in general and fitness for use in particular. Both the external consumer who buy the product and services and the internal consumers that is, all divisions or departments of the business organization are equally interested in the quality.

Statistical quality control: The process of applying statistical principles to solve the problem of controlling the quality control of a product or service is called statistical quality control.

Quality elements: a) Quality design b) Quality conformance

a) Quality design: Quality of design refers to product feature such as performance, reliability durability, ease of use, serviceability

b) Quality conformance: Quality conformance means whether the product meets the given quality specification or not

Inspection: The process of measuring the out put and comparing it to check whether it meets the given specified requirements or not, is called inspection.

Inspection Methods: The following are the methods of inspection based on merits

1) Incoming inspection: In this method, the quality of the goods and services arriving into the organization is inspected. This ensures that the material suppliers adhere to the given specifications with this defective material cannot enter into the production process. This focuses on the vendor's quality and ability t materials.

2) Critical point inspection: Inspecting at the critical points of a product manufacture

gives valuable insight into the completely functional process. At the points of manufacture that involve high costs or which offer no possibility for repair or rework, inspection is crucial further operation depend on these results critical point inspection helps to drop the defective production, and thereby, facilitate avoiding unnecessary further expenditure on them.

3) Process inspection: This is also called patrolling inspection or floor inspection or roving inspection. Here the inspector goes around the manufacturing points in the

shop floor to inspect the goods produced on random sample basis from time to time.

4) Fixed inspection: It provides for a centralized and independent where work is brought for inspection from time to time. This method is followed where the inspection equipment cannot be moved to the points of productions.

5) Final inspection: This is centralized inspection making use of special equipment. This certifies the quality of the goods before they are shipped.

Elements of statistical Quality Control: The technique under SQC can be divided in to two parts a) Process control b) Acceptance sampling

a) Process control: Process control is a technique of ensuring the quality of the products during the manufacturing process itself. If a process consistently produces items with acceptable or tolerable range of specification. It is said to be statically under control. Process control is achieved through control charts. Process control aims to control and maintain the quality of the products in the manufacturing process.

Statistical control charts: A control chart compares graphically the process performance data to computed statistical control limits. These control limits act as limit lines on the chart control charts are the tools to determine whether the process is under control or not.

The quality of the production process may be affected by chance cause or assignable cause.

Chance cause: such causes, which may or may not affect the manufacturing process are called chance cause, chance cause cannot even be identified. It is not possible to always maintain the given specification.

Assignable Cause: Assignable causes affect the quality of the production process. These causes can be identified and specified. Causes such as change in the labour shift, power fluctuations, or excessive tool wear are said to be assignable causes as they affect the quality of manufacturing process in different ways.

Process capability: Process capability refers to the ability to achieve measurable results from a combination of machines, tools, methods, materials and people engaged in production.

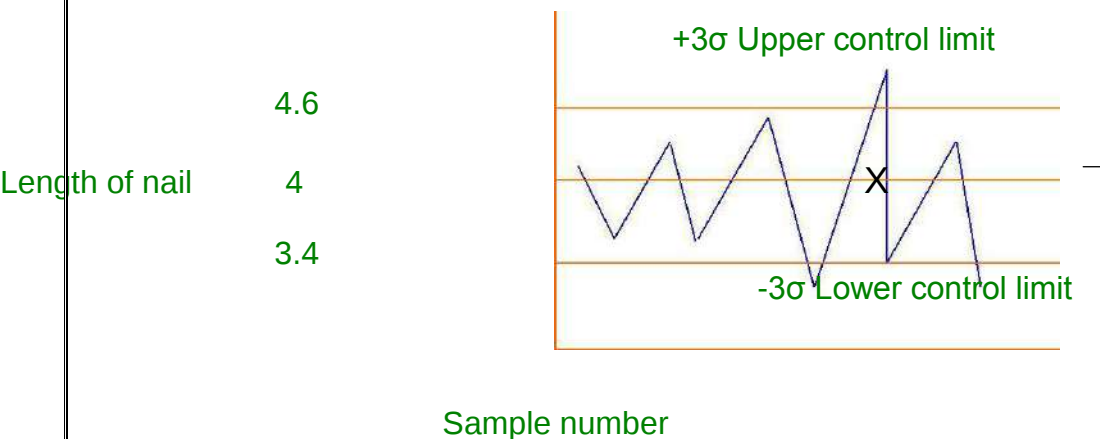
Confidence limits and control limit:

Confidence limit: It indicates the range of confidence level. A confidence level refers to the probability that the value of measurement or parameter, such as length of screw, is correct.

Ex: If a component is required with measurement of 50 mm. across, then the buyer accepts all components measuring between 48 mm and 52 mm across, considering a five percent confidence level.

Control limit: Control limits are found in the control charts. There are two control limits: 1) Upper control limit (UCL) and 2) Lower control limit (LCL). These are determined based on the principles of normal distribution.

Ex: In a pilot investigation of the length of the nails produced in the shop floor, it is found that the mean length $\bar{X}$ is cm, the S.D 3σ , the measure of variability of the nails produced 0.2 cm. How do you construct the control chart for this data.



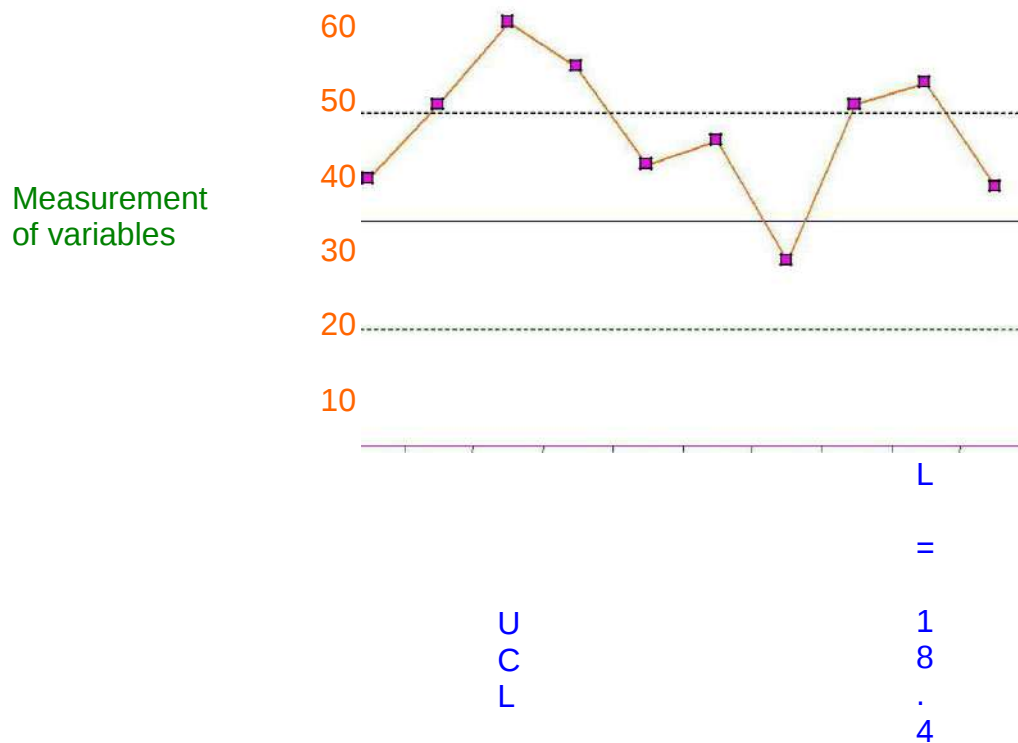
Control charts for variables: A variable is one whose quality measurement changes from unit to unit. The quality of these variables is measured in terms of hardness, thickness, length, and so on. The control charts for variables are drawn using the principles of normal distribution. There are two types of control charts for variables: $\bar{X}$ and R chart.

X and R Chart: The X chart is used to show the process variations based on the average measurement of samples collected. It shows more light on diagnosing quality problem when read along with R chart. It shows the erratic or cyclic shifts in the

manufacturing process. It can also focus on when to take a remedial measure to set

right the quality problems. However, collecting data about all the variables involves a large amount of time and resources.

The R chart is based on the range of the items in the given ample. It highlights the changes in the process variability. It is a good measure of spread or range. It

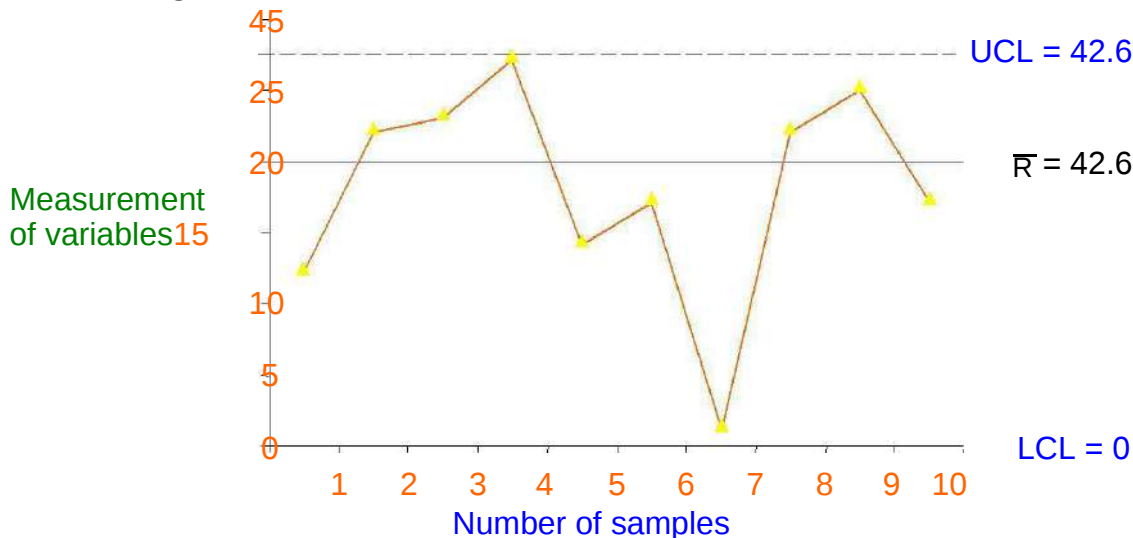


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R Chart: R chart UCL and LCL compute at sample size 5, D₄ table value is 2.11 and D₃ table value is 0

$$UCL = \bar{R} + D_4 R = 2.11 \times 20 = 42.2$$

$$LCL = \bar{R} - D_3 R = 0 \times 20 = 0$$



Therefore 3, 7 points the process is out of control.

Control charts for attributes: The quality of attributes can be determined on the basis of 'Yes' or 'No', 'Go' or 'No go'. In other words, even if there is one scratch it is not considered to be a quality mirror, in such a case quality is decided base on whether the mirror has any scratch or not.

The control charts for attributes are 'C' chart and 'P' chart. 'C' chart is use where there a number of defects per unit. This control defects per charts controls the number of defects per unit. Here the sample size should be constant. This calculate as below.

$$UCL = \bar{C} + 3 \sqrt{\bar{C}} \text{ and } LCL = \bar{C} - 3 \sqrt{\bar{C}}$$

Where the $\bar{C} = \frac{\text{Total number of defects in all the samples}}{\text{Total number of samples inspected}}$

Ex:

Sample Number	No. of defects	Sample Number	No. of defects
1	5	11	4
2	4	12	6
3	9	13	7
4	7	14	3
5	8	15	5
6	9	16	3
7	4	17	3
8	5	18	1
9	2	19	7
10	6	20	2

Total number of defects

$$\bar{c} = \frac{100}{20} = 5$$

$\bar{c}$

$$UCL = \bar{c} + 3\sqrt{\bar{c}} = 5 + 3\sqrt{5} = 11.69$$

$$LCL = \bar{c} - 3\sqrt{\bar{c}} = 5 - 3\sqrt{5} = 0$$

LCL = 0 means, LCL got negative value, take it as equal to zero

2
0
15 _____ UCL = 11.69

10

8

6

5

4

2

0

$\bar{c} = 5$

LCL = 0

No. defects
per each
sampled
unit

4 6 8 10 12 14 15 18 Number of samples

'P' Chart: 'P' Chart is used where there is data about the n per sample. It is also called fraction defective chart or percentage defectives chart. Here each item is classified on 'go or no go' basis. Hence if the sample size is larger, the results could be better.

UCL =

LCL =

Where average defective ($\bar{p}$) =
$$\frac{\text{Total no. of defective found}}{\text{Total no. of pieces inspected}}$$

'n' = Number of pieces inspected per day

Ex: For each of the 14 days a number of magnets used in electric relays are inspected and the number of defectives is recorded. The total number of magnets tested is 14,000. The following are the particulars of the number of defectives found every day.

Day number	Number of defective	Day number	Number of defective
1	100	8	120
2	50	9	60
3	150	10	140
4	200	11	50
5	150	12	70
6	50	13	1
7	80	14	4

Solution:

Total number of defectives = 14000

The average sample size(n) per day= 14000/14 days = 1000

$$\text{Percentage of defective per day} = \frac{\text{Total no. of defective found per day}}{\text{Total no. of pieces inspected per day}}$$

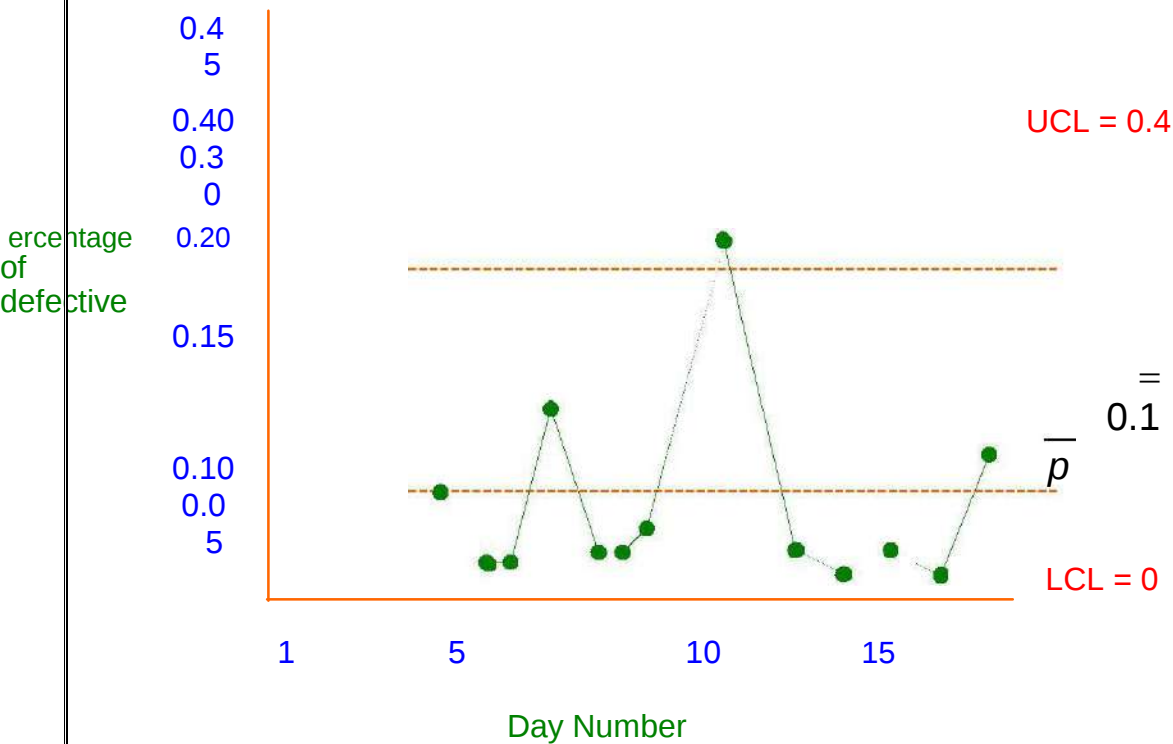
Day number	Percentage of defectives	Number of defective	Percentage of defectives	number	Day defective	Number of
1	100/1000=0.10 50/100 =0.05	100	120/1000=0.12 60/100	8	120	
2		50	0 =0.06	9		60
3	150/1000=0.15 200/1000=0.20	150	140/1000=0.14 50/100	10	140	
4		200	0 =0.05	11		50
5	150/1000=0.15 50/100 =0.05	150	70/1000 =0.07 40/100	12	70	
6	0 5	50	0 =0.04	13		40
7	80/1000 =0.08	80	140/1000=0.14	14	40	

$$\bar{p} = \frac{\text{Total no. of defective found}}{\text{Total no. of pieces inspected}}$$

$$1400/14000 = 0.1$$

$$UCL = 0.1 + 3 \sqrt{\frac{0.1(1-0.1)}{1000}} = 0.4$$

$$LCL = 0.1 - 3 \sqrt{\frac{0.1(1-0.1)}{1000}} = 0$$



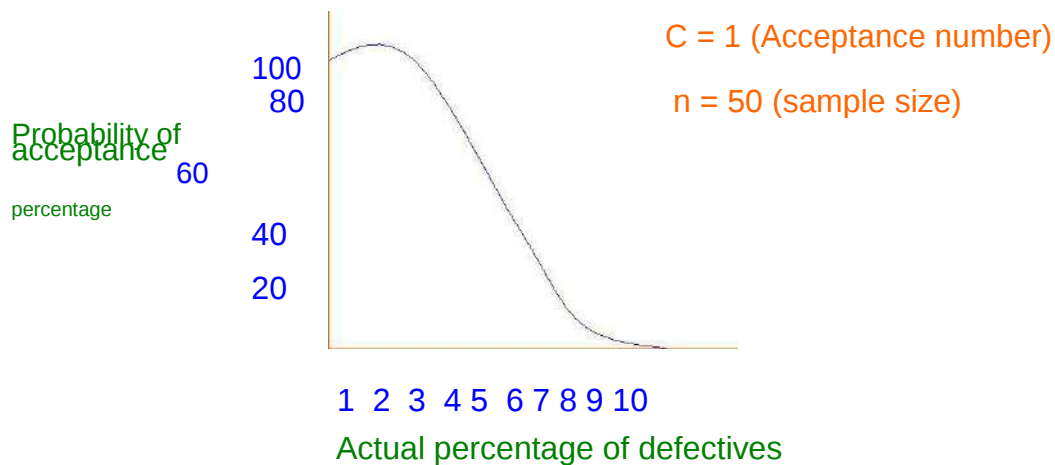
Acceptance Sampling: Acceptance sampling is a technique of deciding whether to accept the whole lot or not based on the number of defectives from a random drawn sample.

It is widely use in buying food products, such as rice, wheat etc. Before buying the random samples drawn from the bags of say rice are tested. If the quality of sample drawn looks good or free from defects then according to the

requirement the entire bag or part of it can be brought

The process of acceptance sampling through operating characteristic curve (OCC)

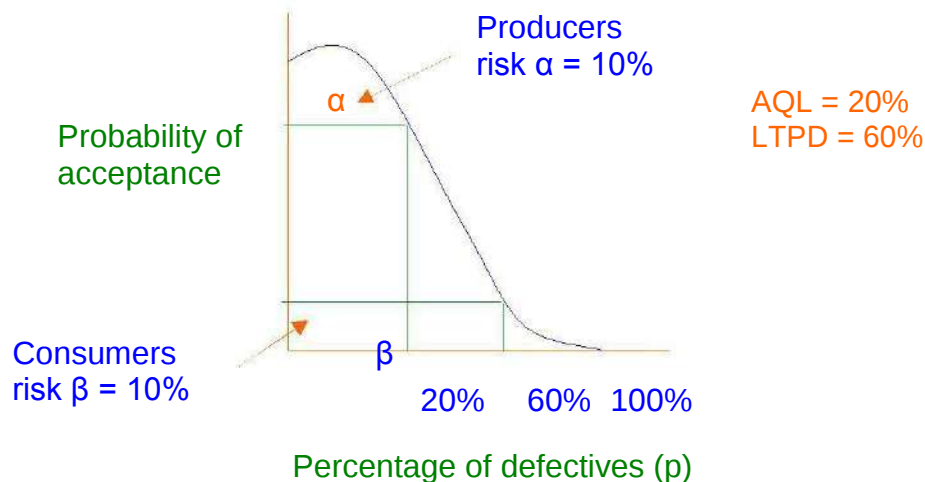
Operating characteristic curve (OCC): The graphical relationship between percentage defective in the lots being submitted for inspection and the probability acceptance is termed as “operating characte sampling plan”



It gives a clear picture about the probability of acceptance of lot for various values of percent defectives in the lot. The probability of acceptance of a lot is high for low values of actual percentage decrease and it is low for high values of actual percentage defectives.

Construction of OC curve: To develop a sampling plan for acceptance sampling, an appropriate O.C curve must be selected to construct an OC curve an agreement has to be reached between the producer and the consumer on the following four point.

- 1) Acceptable quality level (AQL): This is the maximum proportion of defectives that will make the lot definitely acceptable.
- 2) Lot tolerance percentage defective (LTPD): This is the maximum proportion of defectives that will make the lot definitely unacceptable.
- 3) Producers risk (α): This is the risk, the producer is willing to take that lots of the quality level AQL will be rejected, even though, they are acceptable usually $\alpha = 5\%$
- 4) Consumer risk (β): This is the risk, the consumer is willing to take that lots of the quality level LTPD will be accepted, even though, they are actually unacceptable usually $\beta = 10\%$.



Sampling plans: Based on the number of samples drawn for taking accept/ reject decisions, the sampling methods are used. There are four methods of acceptance samplings.

- 1) Single sampling plan: A lot is accepted or rejected on the basis of a single sample drawn from that lot
- 2) Double sampling plan: If it is not possible to decide the fate of the lot on the basis of first sample, a second sample is drawn and the decision is taken on the basis of the combined results of first and second sample.
- 3) Multiple sampling plan: A lot is accepted or rejected based upon the result obtained from several samples (of parts) drawn from the lot.
- 4) Sequential sampling plan: (Item by item analysis)

Sequential sampling involves increasing the sample size by one part at a time till the sample becomes large enough and contains sufficient number of defectives to decide intelligently whether to accept or reject the lot.