OPERATION MANAGEMENT

UNIT 1

operation management

Operation management is the process in which resources are converted into more useful product or service

Operation management refers to the administration of business practices to create the right the highest level of efficiency possible within an organization. OM is concerned with converting materials and labor into goods and services as efficiently as possible to maximize the profit of an organization.

Nature of production and operation management

- It deals with the design and management of products, process of services and supply chains.
- It considers the acquisition development and utilization of recourses that firms need to the good and services their client want.
- The purvey OM refers from strategic to tactical and operational levels.
- Representative strategic issues include determining the size and location of manufacturing plant, deciding the structure of services or telecommunications net work and designing technology supply chains.
- Tactical issues include plant layout and structure, project management methods, and equipment selection and replacement.
- Operational issues include production scheduling and controlling, inventory management, quality control and inspection, traffic and material handling and equipment maintenance polices.

Scope of production and operation management

Basically OM is generate to customer satisfaction at optimum cost as such these are certain

long term strategic and decision involved influencing substantially whole system.

- Production selection and design.
  - Choosing the right product keeping mission and overall objectives in the value.

- Design the product which give enough functional value.

- Process selection and planning
  - Taking decision about technology, machine and equipment.
  - optimize output from a given process.
- Facilities location
  - Commits us for a long time.
  - It should as for as possible cut down the production cost.
- plant lay out and material handling
  - Arrangement of machine and plat.
  - Should not be over lapping duplicate flow.
- capacity planning
  - Procurement of productive resources, capacity is planned for short or long range some tools to help capacity planning are managerial costing , learnig curves , leaner programming and decision trees.

Evaluate Historical perspective of operation management

THE HISTORICAL EVOLUTION OF OPERATIONS MANAGEMENT

Systems for production have existed since ancient times. The production of goods for sale, at least in the modern sense, and the modern factory system had their roots in the Industrial Revolution.

The Industrial Revolution

The Industrial Revolution began in the 1770s in England and spread to the rest of Europe and to the United States during the 19th century. Prior to that time, goods were produced in small shops by craftsmen and their apprentices. Under that system, it was common for one person to be responsible for making a product, such as a horse-drawn wagon or a piece of furniture, from start to finish. Only simple tools were available; the machines in use today had not been invented.

Scientific Management

The scientific management era brought widespread changes to the management of factories. The movement was spearheaded by the efficiency engineer and inventor Frederick Winslow Taylor, who is often referred to as the father of scientific management.

Taylor believed in a “science of management” based on observation, measurement, analysis and improvement of work methods, and economic incentives. He studied work methods in great detail to identify the best method for doing each job.

Taylor also believed that management should be responsible for planning, carefully selecting and training workers, finding the best way to perform each job, achieving cooperation between management and workers, and separating management activities from work activities.

Henry Gantt recognized the value of nonmonetary rewards to motivate workers, and developed a widely used system for scheduling, called Gantt charts.

Harrington Emerson applied Taylor’s ideas to organization structure and encouraged the use of experts to improve organizational efficiency. He testified in a congressional hearing that railroads could save a million dollars a day by applying principles of scientific management.

Henry Ford, the great industrialist, employed scientific management techniques in his factories.

The Human Relations Movement

During the 1930s, Elton Mayo conducted studies at the Hawthorne division of Wester Electric.Hi studies revealed that in addition to the physical and technical aspects of work, worke motivation is critical for improving productivity.

During the 1940s, Abraham Maslow developed motivational theories, which Frederick Hertzberg refined in the 1950s. Douglas McGregor added Theory X and Theory Y in the 1960s. These theories represented the two ends of the spectrum of how employees view work.

Decision Models and Management Science

The factory movement was accompanied by the development of several quantitative techniques. F. W. Harris developed one of the first models in 1915: a mathematical model for inventory order size.

In the 1930s, three coworkers at Bell Telephone Labs, H. F. Dodge, H. G. Romig, and W. Shewhart, developed statistical procedures for sampling and quality control. In 1935, L.H.C. Tippett conducted studies that provided the groundwork for statistical-sampling theory.

During the 1960s and 1970s, management science techniques were highly regarded; in the 1980s, they lost some favor. However, the widespread use of personal computers and user-friendly software in the workplace contributed to a resurgence in the popularity of these techniques.

The Influence of Japanese Manufacturers

A number of Japanese manufacturers developed or refined management practices that increased the productivity of their operations and the quality of their products, due in part to the influence of Americans W. Edwards Deming and Joseph Juran.

This made them very competitive, sparking interest in their approaches by companies outside Japan. Their approaches emphasized quality and continual improvement, worker teams and empowerment, and achieving customer satisfaction.

The Japanese can be credited with spawning the "quality revolution" that occurred in industrialized countries, and with generating widespread interest in lean production.

The influence of the Japanese on U.S. manufacturing and service companies has been enormous and promises to continue for the foreseeable future. Because of that influence, this book will provide considerable information about Japanese methods and successes.

Approximate Date	Contribution/Concept	Originator
1776	Division of labor	Adam Smith
1790	Interchangeable parts	Eli Whitney
1911	Principles of scientific management	Frederick W. Taylor
1911	Motion study, use of industrial psychology	Frank and Lillian Gilbreth
1912	Chart for scheduling activities	Henry Gantt
1913	Moving assembly line	Henry Ford
1915	Mathematical model for inventory ordering	F. W. Harris
1930	Hawthorne studies on worker motivation	Elton Mayo
1935	Statistical procedures for sampling and quality control	H. F. Dodge, H. G. Romig, W. Shewhart, L.H.C. Tippett
1940	Operations research applications in warfare	Operations research groups
1947	Linear programming	George Dantzig
1951	Commercial digital computers	Sperry Univac, IBM
1950s	Automation	Numerous
1960s	Extensive development of quantitative tools	Numerous
1960s	Industrial dynamics	Jay Forrester
1975	Emphasis an manufacturing strategy	W. Skinner
1980s	Emphasis on flexibility, time-based competition, lean production	T. Ohno, S. Shingo, Toyota
1980s	Emphasis on quality	W. Edwards Deming, J. Juran, K. Ishikawa
1990s	Internet, supply chain management	Numerous
2000s	Applications service providers and outsourcing	Numerous

TYPES OF MANUFACTURING/PRODUCTION SYSTEMS

Production

Production is the basic activity of all the industrial units production is the process by which raw

material and other inputs are converted in finished goods.

Production as system

Production system : - To convert a set of inputs into a set of desired outputs.

Conversation system : - Where Inputs are converted into outputs.

Control system : - where a proration of the output is maintained for feedback to provide corrective action if required.

Types of Production / Manufacturing

The production system of a company mainly uses facilities equipments and operating material to produce goods that satisfy customers demand. The classification of production system is summarized below.

Flow shop system : - The system is a straight line flow. Here the output of one operation becomes the input of the subsequent operation. Here the problems faced are machinery maintenance, raw material feeding balanced work load. **Ex: -** bottling factories mass production of clothing…

Job shop system : - This shop accepts the order from the customer and executives the work according. It does not have its product win. The problems were no short processing time simulation techniques are help full to rectify them. **Ex: -** Furniture Company and machine manufacturing **….**

Batch manufacturing : - A batch of certain quality is made on machine the same machine is used for their product manufacturing. The problems here are deciding the size of product, scheduling the product. **Ex: -** pharmacy companies …

Project system : - A project requires a process of creating a complex one of a king product or service with a set of well defined tasks in terms if resources required and time phasing. **Ex: -** constructions, fabrications, ships & aero plain manufacturing ….

Between Product And Services Operations

Basics	**Goods /products**	**Services**
Production	Time Speed	Spontaneous

Customer Involvement	Can Below	High
Standardization	Possible Allowed	Only For Routine Services
Facility Location	Near Supply	Close To Customer
Facility Design	To Enhance Production	To Accommodate Physical And Psychological Needs Of Customers
Scheduling	As Per Complete Dates	As Customers Interests
Inventory	Raw Materials	Personnel
Quality Control	Fixed	Varied Quality Standards
Quality Objective	'0' Defect	'0' Defection
Worker Skills	Technical	Interaction Communication Skills
Time Standards	Tight	Loose
Capacity Planning	Average	Fluctuating

Duties and Responsibility, Role of the Production And Operation Manager

Duties and Responsibility of Production Manager in Manufacturing

- ✓ Planning the geographical location of the factory.
- ✓ Purchasing production equipment.
- ✓ Layout of equipments within the factory.
- ✓ Designing production process and equipment.
- ✓ Product design.
- ✓ Designing production work and establishing work standards.
- ✓ Capacity planning.
- ✓ Production planning and scheduling.

- ✓ Production controlling.
- ✓ Inventory management.
- ✓ Supply chain management.
- ✓ Quality control.
- ✓ Production equipment and maintenance and repair.
- ✓ Measurement and monitoring of production.
- ✓ Industrial relations.
- ✓ Healthy and safety.
- ✓ Staff selection and liaising.
- ✓ Budgeting and capacity planning.

Role of the Production And Operation Manager

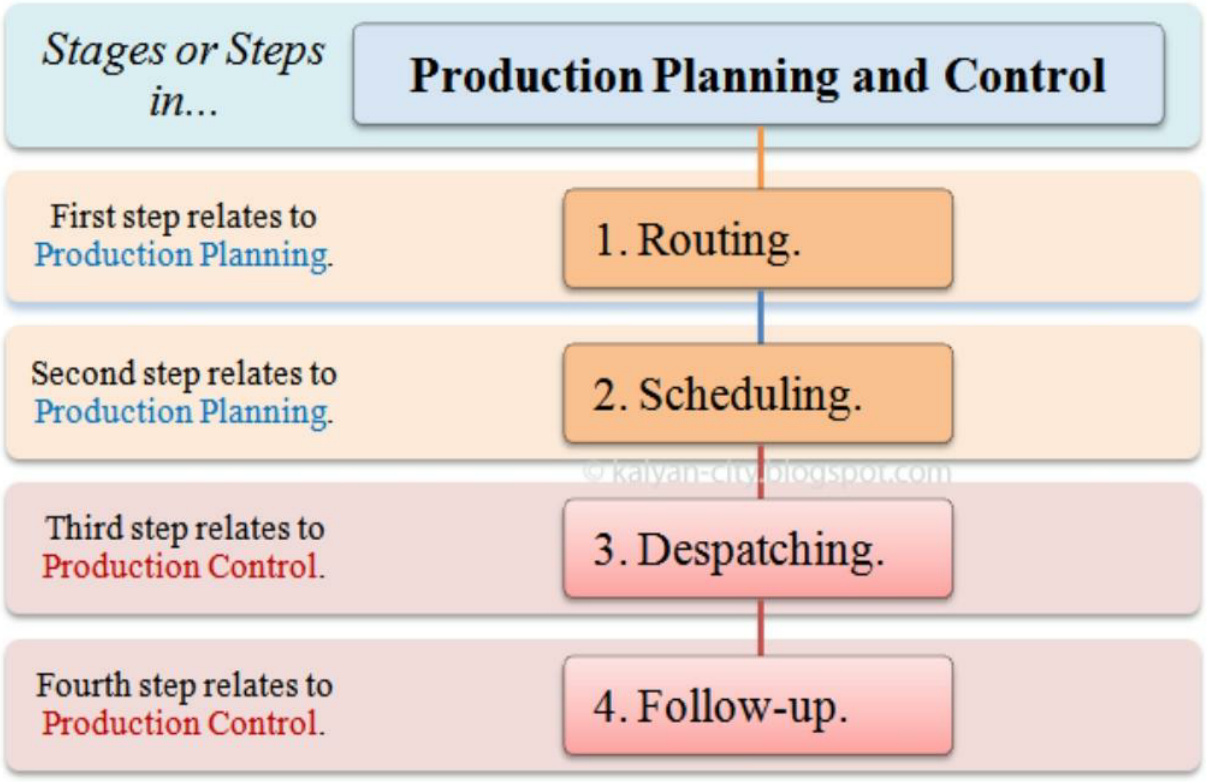
- ➢ Take part in strategic decision making of the company.
- ➢ Take part in implementation and of ERP (enterprise resource planning) in the company
- ➢ Automate process as the requirement of the company.
- ➢ Enhance the R&D effect in developing self relevant new technologies.
- ➢ Reduce lag implementation of project due to increased competition.
- ➢ Project the environment by implementing environment and pollution Norms established by the Govt. forms time to time.
- ➢ Act as member of the concurrent engineering teams in new product design and old product development.
- ➢ Give more attention to technological management in view of joint ventures of multinational companies with domestic companies.
- ➢ Be an internal quality auditor in quality certification performing such as ISO 9000 and series ISO 14000.

UNIT-2

PRODUCTION PLANNING AND CONTROL

Production planning and control (PPC) is a term that combines two strategies: production planning and production control. In the manufacturing world, production planning and control are defined by four stages: Routing, Scheduling, Dispatching, and Follow -Up. The first two stages relate to production planning while the second two relate to production control.

The Four Stages of Production Planning and Control



Routing

The first stage of production planning is to determine the path of production from raw materials to finished goods. Here, you will determine the equipment, resources, materials and sequence to be used.

Scheduling-

The second stage of production planning is to determine when operations are scheduled. Here, the goals may be to increase throughput, reduce lead time, or increase profits. Many strategies can be used to create the most efficient schedule.

Dispatching-

The third stage of production control starts when production is initiated. That is, when the scheduling plan is implemented, materials and work orders are released, and work is flowing down the production line.

Follow-Up -

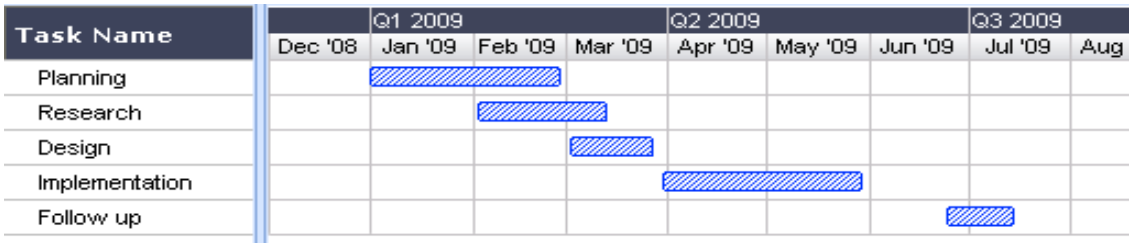
The fourth stage of production controls is to determine whether there are any bottlenecks or inefficiencies in the process. Here, you can compare the predicted run hours and quantities with the actual values reported to determine whether processes can be improved.

GANTT CHART

A Gantt chart, commonly used in project management, is one of the most popular and useful ways of showing activities (tasks or events) displayed against time. On the left of the chart is a list of the activities and along the top is a suitable time scale. Each activity is represented by a bar; the position and length of the bar reflects the start date, duration and end date of the activity. This allows you to see at a glance:

- What the various activities are
- When each activity begins and ends
- How long each activity is scheduled to last
- Where activities overlap with other activities, and by how much
- The start and end date of the whole project

To summarize, a Gantt chart shows you what has to be done (the activities) and when (the schedule).



A simple Gantt chart

Advantages:

1. This is a simple and very inexpensive method and can be developed even by supervisory staff with some amount of training
2. These charts clearly show the decided time and work schedules for every job
3. Monitoring and control are easier and can be done within a minimum time frame and at the lowest cost
4. These charts can be changed and updated quickly at a lower cost
5. There is no need to develop the customized Gantt chart boards as the standard chart boards are available in the market

Disadvantages:

In spite of the above-mentioned advantages, there are certain disadvantages.

1. They do not show job interrelationships and interdependence
2. Cost implications cannot be shown
3. With these charts, it is not possible to depict other alternatives for project completion
4. The shape and form of Gantt charts can differ according to the nature of the requirement.

Shown below is a very simple Gantt load chart:

Production System in Production and Operation Management

The production system of an organization is that part, which produces products of an organization. It is that activity whereby resources, flowing within a defined system, are combined and transformed in a controlled manner to add value in accordance with the policies communicated by management. A simplified production system is shown above.The production system has the following *characteristics*:

Production is an organized activity, so every production system has an objective.

The system transforms the various inputs to useful outputs.

It does not operate in isolation from the other organization system.

There exists a feedback about the activities, which is essential to control and improve system performance.

Classification of Production System

Production systems can be classified as Job Shop, Batch, Mass and Continuous Production systems.

JOB SHOP PRODUCTION

Job shop production are characterized by manufacturing of one or few quantity of products designed and produced as per the specification of customers within prefixed time and cost. The distinguishing feature of this is low volume and high variety of products.

A job shop comprises of general purpose machines arranged into different departments. Each job demands unique technological requirements, demands processing on machines in a certain sequence.

Characteristics

- High variety of products and low volume.
- Use of general purpose machines and facilities.
- Highly skilled operators who can take up each job as a challenge because of uniqueness.
- Large inventory of materials, tools, parts.

- Detailed planning is essential for sequencing the requirements of each product, capacities for each work centre and order priorities.

Advantages

- Because of general purpose machines and facilities variety of products can be produced.
- Operators will become more skilled and competent, as each job gives them learning opportunities.
- Full potential of operators can be utilized.
- Opportunity exists for creative methods and innovative ideas.

Limitations

- Higher cost due to frequent set up changes.
- Higher level of inventory at all levels and hence higher inventory cost.
- Production planning is complicated.
- Larger space requirements.

BATCH PRODUCTION

Batch production is defined by American Production and Inventory Control Society (APICS) “as a form of manufacturing in which the job passes through the functional departments in lots or batches and each lot may have a different routing.”It is characterized by the manufacture of limited number of products produced at regular intervals and stocked awaiting sales.

Characteristics

- When there is shorter production runs.
- When plant and machinery are flexible.
- When plant and machinery set up is used for the production of item in a batch and change of set up is required for processing the next batch.
- When manufacturing lead time and cost are lower as compared to job order production.

Advantages

- Better utilization of plant and machinery.
- Promotes functional specialization.

- Cost per unit is lower as compared to job order production.
- Lower investment in plant and machinery.
- Flexibility to accommodate and process number of products.
- Job satisfaction exists for operators.

Limitations

- Material handling is complex because of irregular and longer flows.
- Production planning and control is complex.
- Work in process inventory is higher compared to continuous production.
- Higher set up costs due to frequent changes in set up.

MASS PRODUCTION

Manufacture of discrete parts or assemblies using a continuous process are called mass production. This production system is justified by very large volume of production. The machines are arranged in a line or product layout. Product and process standardization exists and all outputs follow the same path.

Characteristics

- Standardization of product and process sequence.
- Dedicated special purpose machines having higher production capacities and output rates.
- Large volume of products.
- Shorter cycle time of production.
- Lower in process inventory.
- Perfectly balanced production lines.
- Flow of materials, components and parts is continuous and without any back tracking.
- Production planning and control is easy.
- Material handling can be completely automatic.

Advantages

- Higher rate of production with reduced cycle time.

- Higher capacity utilization due to line balancing.
- Less skilled operators are required.
- Low process inventory.
- Manufacturing cost per unit is low.

Limitations

- Breakdown of one machine will stop an entire production line.
- Line layout needs major change with the changes in the product design.
- High investment in production facilities.
- The cycle time is determined by the slowest operation.

CONTINUOUS PRODUCTION

Production facilities are arranged as per the sequence of production operations from the first operations to the finished product. The items are made to flow through the sequence of operations through material handling devices such as conveyors, transfer devices, etc.

Characteristics

- Dedicated plant and equipment with zero flexibility.
- Material handling is fully automated.
- Process follows a predetermined sequence of operations.
- Component materials cannot be readily identified with final product.
- Planning and scheduling is a routine action.

Advantages

- Standardization of product and process sequence.
- Higher rate of production with reduced cycle time.
- Higher capacity utilization due to line balancing.
- Manpower is not required for material handling as it is completely automatic.
- Person with limited skills can be used on the production line.

- Unit cost is lower due to high volume of production.

Limitations

- Flexibility to accommodate and process number of products does not exist.
- Very high investment for setting flow lines.
- Product differentiation is limited.

AGGREGATE PLANNING

Learning Objective:

To take the first steps in translating forecasts for demand into a production plan.

AGGREGATE PLANNING:

Attempts to match the supply of and demand for a product or service by determining the appropriate quantities and timing of inputs, transformation, and outputs. Decisions made on production, staffing, inventory and backorder levels.

Definition

Aggregate planning is an intermediate range capacity planning technique, usually covering a time frame of 2-12 months for a production process ,in order to keep the cost of operations at a minimum.

Characteristics of aggregate planning:

- Considers a "planning horizon" from about 3 to 18 months, with periodic updating
- Looks at aggregate product demand, stated in common terms
- Looks at aggregate resource quantities, stated in common terms
- Possible to influence both supply and demand by adjusting production rates, workforce levels, inventory levels, etc., but facilities cannot be expanded.

Firm Resource Objectives Of Aggregate Planning

Objective of aggregate planning frequently is to minimize total cost over the planning horizon.
Other objectives should be considered:

- maximize customer service
- minimize inventory investment
- minimize changes in workforce levels
- minimize changes in production rates
- maximize utilization of plant and equipment.

Objectives Of Aggregate Planning

- to balance conflicting objective involving customer service work force stability , cost and profit.
- to establishing company wide strategic plan for allocating resources.
- to develop economic strategy to meet customer satisfaction.

Aggregate Planning Strategies

Active strategy:

- Attempts to handle fluctuations in demand by focusing on demand management
- Use pricing strategies and/or advertising and promotion
- Develop counter-cyclical products
- Request customers to backorder or advance-order
- Do not meet demand

Passive strategy (reactive strategy):

- Attempts to handle fluctuations in demand by focusing on supply and capacity management
- Vary size work force size by hiring or layoffs
- Vary utilization of labour and equipment through overtime or idle time
- Build or draw from inventory
- Subcontract production
- Negotiate cooperative arrangements with other firms
- Allow backlogs, back orders, and/or stock outs.

Steps In Aggregate Planning

- Determine the (sale forecast)for each product for each time period(week/month/quarter) over the planning horizon(2-12 months)

- Determine the aggregate demand by summing up the demand for individuals.

- Transform the aggregate demand for each time period in to workers, materials, machines required to satisfy aggregate demand.

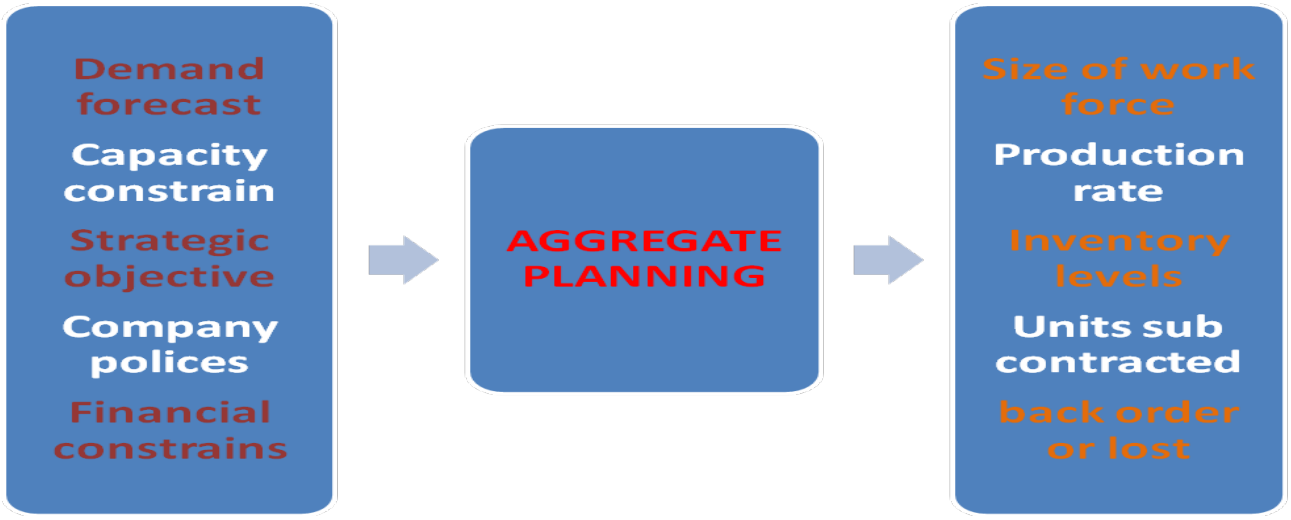
- Identify company policies that are pertinent police regarding safety stock maintenance maintain stable work force.

- Determine the unit cost for regular time , out time subcontracting , holding inventories back orders , lay off
- Develop alternative resource plans for providing necessary production capacity to support the cumulative aggregate demand and compute the cost of each alternative.

- Elect the resources plan from among the alternative considered that objective of the firm.

INPUTS TO OUTPUTS FROM AGGREGATE PLANNING

INPUTS	OUTPUTS



Maintenance Management

Maintenance Management includes importing enhancement and support packages, and implementing critical SAP Notes. This function allows you to perform multiple functions for system Landscape.

The following work areas come under Maintenance Management –

System Recommendations – You can use this work area to implement Security notes, Performance notes and correction notes for technical systems. This work area comes under Change Management Work Center.

Maintenance Planner – You can use Maintenance Planner to create maintenance plans and stack XML files for installation using Software Update Manager SUM. IT replaces Maintenance Optimizer in Solution Manager to perform updates, and upgrades installation.

Maintenance Optimizer – Maintenance optimizer can be used to start maintenance process in production system. This provides you detailed instruction for downloading and installing maintenance files in the system.

License Management – To download SAP Support Packages, you need license and maintenance certificates. This function is available under Change Management Work Center.

Scope and Effort Analyzer – This work area is used to analyze and calculate the scope and effort required to implement support and Enhance packages on Technical systems. This work area can be started from the following Work Centers –

- Change Management Work Center

- Test Management Work Center
- Custom Code Management Work Center

INDUSTRIAL SAFETY

Industrial safety refers to the management of all operations and events within an industry in order to protect its employees and assets by minimizing hazards, risks, accidents, and near misses.

Industrial safety covers a number of issues and topics affecting safety of personnel and the integrity of equipment in a particular industry.

The following topics are generally discussed:

- General Safety – General aspects of safety which are common to all industries
- Occupational Safety and Health – Particularly associated with the occupation
- Process and Production Safety
- Material Safety
- Workplace Safety – Safety issues directly related to the workplace setting
- Fire Safety
- Electrical Safety – Arising from the equipment used
- Building and Structural Safety – Including installations as per existing building code
- Environmental Safety – Concerns the direct and indirect environmental impact of the industry

UNIT-3

PLANT LOCATION

Every entrepreneur is faced with the problem of deciding the best site for location of his plant or factory. Plant location refers to the choice of region and the selection of a particular site for setting up a business or factory.

But the choice is made only after considering cost and benefits of different alternative sites. It is a strategic decision that cannot be changed once taken. If at all changed only at

considerable loss, the location should be selected as per its own requirements and circumstances. Each individual plant is a case in itself. Businessman should try to make an attempt for optimum or ideal location.

LOCATIONAL ANALYSIS

Location analysis is a dynamic process where entrepreneur analyses and compares the appropriateness or otherwise of alternative sites with the aim of selecting the best site for a given enterprise.

It consists the following:

(a) Demographic Analysis:

It involves study of population in the area in terms of total population (in no.), age composition, per capita income, educational level, occupational structure etc.

(b) Trade Area Analysis:

It is an analysis of the geographic area that provides continued clientele to the firm. He would also see the feasibility of accessing the trade area from alternative sites.

(c) Competitive Analysis:

It helps to judge the nature, location, size and quality of competition in a given trade area.

(d) Traffic analysis:

To have a rough idea about the number of potential customers passing by the proposed site during the working hours of the shop, the traffic analysis aims at judging the alternative sites in terms of pedestrian and vehicular traffic passing a site.

(e) Site economics:

Alternative sites are evaluated in terms of establishment costs and operational costs under this. Costs of establishment is basically cost incurred for permanent physical facilities but operational costs are incurred for running business on day to day basis, they are also called as running costs.

PLANT LAYOUT

The efficiency of production depends on how well the various machines; production facilities and employee's amenities are located in a plant. Only the properly laid out plant can ensure the smooth and rapid movement of material, from the raw material stage to the end product stage. Plant layout encompasses new layout as well as improvement in the existing layout.

DEFINITION

Plant layout refers to the arrangement of physical facilities such as machinery, equipment, furniture etc. within the factory building in such a manner so as to have quickest flow of material at the lowest cost and with the least amount of handling in processing the product from the receipt of material to the shipment of the finished product.

According to Riggs, "the overall objective of plant layout is to design a physical arrangement that most economically meets the required output – quantity and quality."

ESSENTIALS

An eficient plant layout is one that can be instrumental in achieving the following objectives :

- Proper and efficient utilization of available floor space
- To ensure that work proceeds from one point to another point without any delay
- Provide enough production capacity.
- Reduce material handling costs
- Reduce hazards to personnel
- Utilise labour efficiently
- Increase employee morale
- Reduce accidents
- Provide for volume and product flexibility
- Provide ease of supervision and control
- Provide for employee safety and health
- Allow ease of maintenance
- Allow high machine or equipment utilization

TYPES OF LAYOUT

As discussed so far the plant layout facilitates the arrangement of machines, equipment and other physical facilities in a planned manner within the factory premises.

From the point of view of plant layout, we can classify small business or unit into three categories:

1. Manufacturing units
2. Traders
3. Service Establishments

1. Manufacturing units

In case of manufacturing unit, plant layout may be of four types:
(a) Product or line layout
(b) Process or functional layout
(c) Fixed position or location layout
(d) Combined or group layout

(a) Product or line layout:

Under this, machines and equipments are arranged in one line depending upon the sequence of operations required for the product. The materials move from one workstation to another sequentially without any backtracking or deviation. Under this, machines are grouped in one sequence. Therefore materials are fed into the first machine and finished goods travel automatically from machine to machine, the output of one machine becoming input of the next,

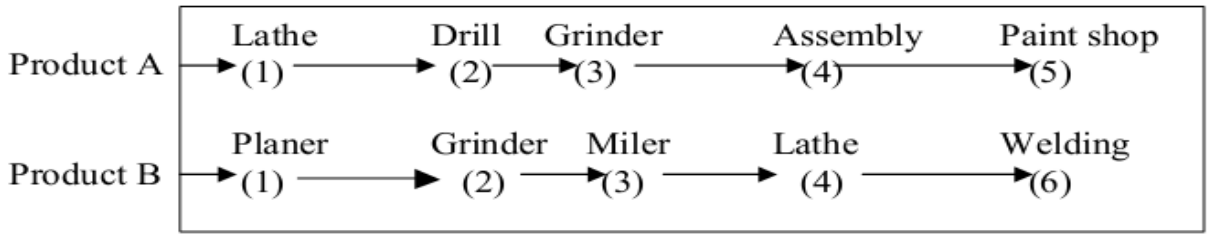
E.g. in a paper mill, bamboos are fed into the machine at one end and paper comes out at the other end.

The raw material moves very fast from one workstation to other stations with a minimum work in progress storage and material handling.

The grouping of machines should be done keeping in mind the following general principles.

a) All the machine tools or other items of equipments must be placed at the point demanded by the sequence of operations
b) There should no points where one line crossed another line.
c) Materials may be fed where they are required for assembly but not necessarily at one point.
d) All the operations including assembly, testing packing must be included in the line

A line layout for two products is given below.



Advantages:

a) Low cost of material handling, due to straight and short route and absence of backtracking
b) Smooth and uninterrupted operations
c) Continuous flow of work
d) Lesser investment in inventory and work in progress

Disadvantages:

a. High initial capital investment in special purpose machine
b. Heavy overhead charges
c. Breakdown of one machine will hamper the whole production process
d. Lesser flexibility as specially laid out for particular product.

Process layout:

In this type of layout machines of a similar type are arranged together at one place. E.g. Machines performing drilling operations are arranged in the drilling department, machines performing casting operations be grouped in the casting department. Therefore the machines are installed in the plants, which follow the process layout.

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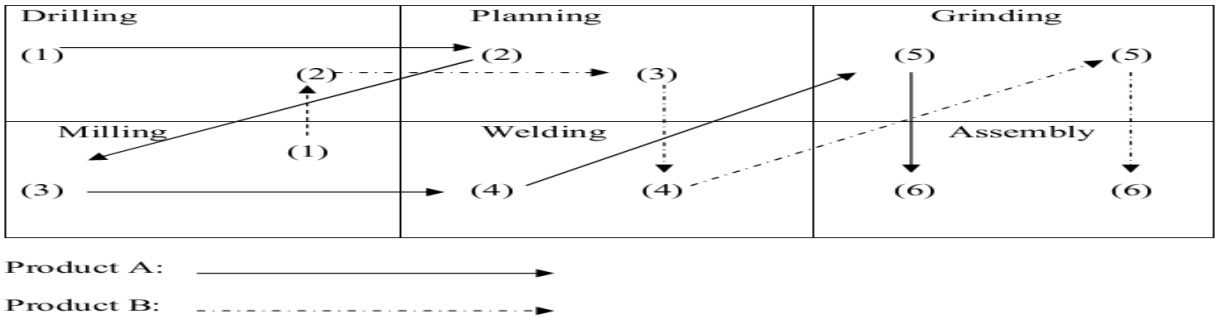


Process layout showing movement of two products

The grouping of machines according to the process has to be done keeping in mind the following principles

a) The distance between departments should be as shorts possible for avoiding long distance movement of materials
b) The departments should be in sequence of operations
c) The arrangement should be convenient for inspection and supervision

Advantages:

a) Lower initial capital investment in machines and equipments. There is high degree of machine utilization, as a machine is not blocked for a single product
b) The overhead costs are relatively low

Disadvantages:

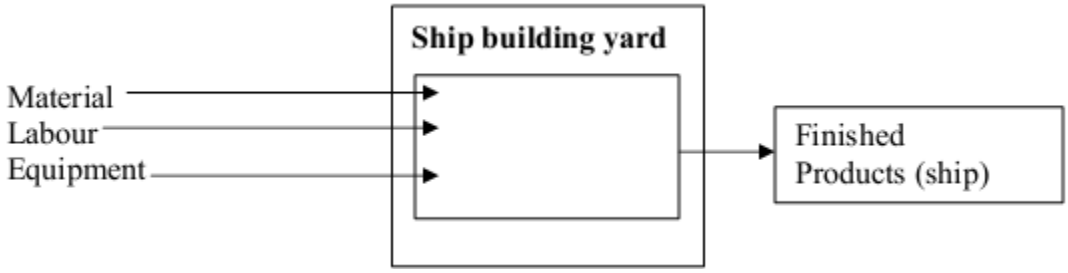
a. Material handling costs are high due to backtracking
b. More skilled labor is required resulting in higher cost.

(c) Fixed Position or Location Layout

In this type of layout, the major product being produced is fixed at one location. Equipment labor components are moved to that location. All facilities are brought and arranged around one work .

This type of layout is not relevant for small scale entrepreneur.

The following figure shows a fixed position layout regarding shipbuilding.



Advantages:

a) It saves time and cost involved on the movement of work from one workstation to another.
b) The layout is flexible as change in job design and operation sequence can be easily

incorporated.

Disadvantages:

a. Production period being very long, capital investment is very heavy

b. Very large space is required for storage of material and equipment near the product.

(d) Combined layout

Certain manufacturing units may require all three processes namely intermittent process (job shops), the continuous process (mass production shops) and the representative process combined process [i.e. miscellaneous shops]. In most of industries, only a product layout or process layout or fixed location

2. Traders

When two outlets carry almost same merchandise, customers usually buy in the one that is more appealing to them. Thus, customers are attracted and kept by good layout i.e. good lighting, attractive colours,good ventilation, air conditioning, modern design and arrangement and even music. All of these things mean customer convenience, customer appeal and greater business volume.

1. Self service or modified self service layout
2. Full service layout
3. Special layouts

3. Services centers and establishment

Services establishments such as motels, hotels, restaurants, must give due attention to client convenience, quality of service, efficiency in delivering services and pleasing office ambience. In today's environment, the clients look for ease in approaching different departments of a service organization and hence the layout 106should be designed in a fashion, which allows clients quick and convenient access to the facilities offered by a service establishment.

MATERIAL HANDLING EQUIPMENT

Material handling cannot be avoided in logistics, but can certainly be reduced to minimum levels. The productivity potential of logistics can be exploited by selecting the right type of handling equipment.

MATERIAL HANDLING GUIDELINES

The material handling function reflects on the efficiency and speed of warehouse operation, which ultimately result in elongated or compressed order completion cycles• Designing the system for continues flow of material, i.e. idle time should be zero.

• Going in for standard equipment, which ensures low investment and flexibility in case of changes in material handling requirements in the future.

• Incorporating gravity flow in material flow system
•• Volumes to be handled
• Speed in handling
• Productivity
• Product characteristics (weight, size, shape)
• Nature of the product (hazardous, perishable, crushable)

MATERIAL HANDLING PRINCIPLES

PLANNING

All material handling should be the result of a deliberate plan where the needs, performance objectives and functional specification of the proposed methods are completely defined at the outset.

A material handing plan defines the material (what) and the moves (when and where); together they define the method (how and who).

STANDARDIZATION

Material handling methods, equipment, controls and software should be standardized within the limits of achieving overall performance objectives and without sacrificing needed flexibility, modularity and throughput, anticipation of changing future requirements.

WORK

Material handling work should be minimized without sacrificing productivity or the level of service required of the operation.

ERGONOMIC

Human capabilities and limitations must be recognized and respected in the design of material handling tasks and equipment to ensure safe and effective operations.

Definition: Ergonomics is the science that seeks to adapt work or working conditions to suit the abilities of the worker.

UNIT LOAD

Unit loads shall be appropriately sized and configured in a way which achieves the material flow and inventory objectives at each stage in the supply chain.

SPACE UTILIZATION

Effective and efficient use must be made of all available space.

SYSTEM

Material movement and storage activities should be fully integrated to form a coordinated, operational system which spans receiving, inspection, storage,production, assembly, packaging, unitizing, order selection, shipping, transportation and the handling of returns.

AUTOMATION

Material handling operations should be mechanized and/or automated where feasible to improve operational efficiency, increase responsiveness, improve consistency and predictability,

ENVIRONMENTAL

Environmental impact and energy consumption should be considered as criteria when designing or selecting alternative equipment and material handling systems.

LIFE CYCLE COST

A thorough economic analysis should account for the entire life cycle of all material handling equipment and resulting systems.

UNIT-4

PRODUCTIVITY

Productivity is the ratio of outputs (goods and services) divided by the inputs (resources, such as labor and capital). Improving productivity means improving efficiency

Factors Affecting Productivity

Factors that affect or influence Productivity.

The eight main factors that affect productivity are
:

- ★ Technical factors,
- ★ Production factors,
- ★ Organizational factor,
- ★ Personnel factors,
- ★ Finance factors,
- ★ Management factors,
- ★ Government factors, and
- ★ Location factors

.

- ★ **Technical factors :** Productivity largely depends on technology. Technical factors are the most important ones. These include proper location, layout and size of the plant and machinery, correct design of machines and equipment, research and development, automation and computerization, etc.
- ★ **Production factors :** Productivity is related to the production-factors. The production of all departments should be properly planned, coordinated and controlled.
- ★ **Organizational factor :** Productivity is directly proportional to the organizational factors. A simple type of organization should be used. Authority and Responsibility of every individual and department should be defined properly.
- ★ **Personnel factors :** Productivity of organization is directly related to personnel factors. The right individual should be selected for suitable posts. After selection, they should be given

proper training and development.

- ★ **Finance factors :** Productivity relies on the finance factors. Finance is the life-blood of modem business. There should be a better control over both fixed capital and working capital.
- ★ **Management factors :** Productivity of organization rests on the management factors. The management of organization should be scientific, professional, future-oriented, sincere and competent.
- ★ **Government factors :** Productivity depends on government factors. The management should have a proper knowledge about the government rules and regulations. They should also maintain good relations with the government.
- ★ **Location factors :** Productivity also depends on location factors such as Law and order situation, infrastructure facilities, nearness to market, nearness to sources of raw-materials, skilled workforce, etc.

JOB DESIGN

Specialization

Specialization relates with different work that concentrates on some aspect of a product or service. Similarly, it emphasizes the ability to concentrate one's efforts on a type of work and thereby becoming proficient in it.

Examples of specialization include college professors teaching certain courses, medical doctors working in a specific field, and bakers who specialize in wedding cakes.

Your learning objectives

Identify the main decisions in job design.

Describe how job design affects the performance objectives of the operation.

Describe the main principles of each of the major influences on job design.

Indicate how the different approaches to job design differ in terms of control and commitment.

The objectives of job design

There are clearly many alternative designs for any given job. For this reason, an understanding of what the job design is supposed to achieve is particularly important. As before, the five performance objectives give us a guide to what is relevant in job design decisions.

1. Quality

The ability of staff to produce high-quality products and services can be affected by job design.

2. Speed

Sometimes speed of response is the dominant objective to be achieved in job design.

3. Dependability

Dependable supply of goods and services is usually influenced, in some way, by job design.

4. Flexibility

Job design can affect the ability of the operation to change the nature of its activities. New product or service flexibility, mix flexibility, volume flexibility and delivery flexibility are all dependent to some extent on job design.

5. Cost

All the elements of job design described above will have an effect on the productivity, therefore the cost, of the job. In addition, job design will influence two other particularly important objectives.

6. Health and safety

Whatever else a job design achieves, it must not endanger the well-being of the person who does the job, other staff of the operation, the customers who might be present in the operation, or those who use any products made by the operation.

7. Quality of working life

The design of any job should take into account its effect on job security, intrinsic interest, variety, opportunities for development, stress level and attitude of the person performing the job.

- Division of labour
- Scientific management
- Behavioural approaches to job design
- Empowerment
- Team-working and job design

Process Chart

The **Process Chart** provides a visual representation of steps in a process. It is also referred to Flow Charts or Process Mapping or Flow Diagrams. Constructing a process chart is one of the initial activities of a process improvement. It consists of the following benefits.

- A clear picture about the process

- Helps to identify non value added operations.
- Helps to work in a team and develop communication
- Keeps everyone on the same page.

Process Symbols:

A variety of process charts has designed to meet the needs of a particular stage of analysis; they can be used at a detailed level for a process.

The different kinds of **process chart** which shares a set of symbols, though few additional symbols for specific and specialized process steps. The common symbols were first published by the American Society of Mechanical Engineers and known as ASME symbols.

- **Operation:** This symbol denotes the main step of a process. It is represented as circle.

- **Inspection:** This symbol evaluates the quality check and represented through rectangles
- .
- **Transport:** The exact movement of workers, material or equipments. It is denoted as arrows.

- **Storage:** Storage is denoted as inverted triangle. It controls the storage received into or issued from a store or an item is retained for reference purposes.

- **Delay or Temporary Storage:** This indicates the delay in the process which is denoted as 'D' symbol.
- These symbols are linked together in a vertical chart representing the key stages in a process.

Outline Process Chart:

The simplest form of process chart is known as an outline **process chart. It** records an overview or outline of a process. The steps of a process that can be represented by the ASME symbols of operation and inspection are recorded. Process charts may also be used to represent a micro level of analysis.

Work Measurement

Definition

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

The Purpose of Work Measurement

Method study is the principal technique for reducing the work involved, primarily by eliminating unnecessary movement on the part of material or operatives and by substituting good methods for poor ones. Work measurement is concerned with investigating, reducing and subsequently eliminating ineffective time, that is time during which no effective work is being

performed, whatever the cause.

Work measurement, as the name suggests, provides management with a means of measuring the time taken in the performance of an operation or series of operations in such a way that ineffective time is shown up and can be separated from effective time. In this way its existence, nature and extent become known where previously they were concealed within the total.

The Uses of Work Measurement

Revealing existing causes of ineffective time through study, important though it is, is perhaps less important in the long term than the setting of sound time standards, since these will continue to apply as long as the work to which they refer continues to be done. They will also show up any ineffective time or additional work which may occur once they have been established.

In the process of setting standards it may be necessary to use work measurement:

- ★ To compare the efficiency of alternative methods. Other conditions being equal, the method which takes the least time will be the best method.
- ★ To balance the work of members of teams, in association with multiple activity charts, so that, as nearly as possible, each member has a task taking an equal time to perform.
- ★ To determine, in association with man and machine multiple activity charts, the number of machines an operative can run.
- ★ To provide information on which the planning and scheduling of production can be based, including the plant and labour requirements for carrying out the programme of work and the utilisation of available capacity.
- ★ To provide information on which estimates for tenders, selling prices and delivery promises can be based.
- ★ To set standards of machine utilisation and labour performance which can be used for any of the above purposes and as a basis for incentive schemes.
- ★ To provide information for labour-cost control and to enable standard costs to be fixed and maintained.

Techniques of work measurement

The following are the principal techniques by which work measurement is carried out:

1. Time study

2. Activity sampling

3. Predetermined motion time systems

4. Synthesis from standard data

5. Estimating

6. Analytical estimating

7. Comparative estimating

1. Time Study

Time Study consists of recording times and rates of work for elements of a specified job carried out under specified conditions to obtain the time necessary to carry out a job at a defined level of performance.

In this technique the job to be studied is timed with a stopwatch, rated, and the Basic Time calculated.

2. Activity Sampling

Activity sampling is a technique in which a large number of instantaneous observations are made over a period of time of a group of machines, processes or workers. **3. Predetermined Motion Time Systems**

A predetermined motion time system is a work measurement technique whereby times established for basic human motions are used to build up the time for a job at a defined level of performance.

4. Synthesis

Synthesis is a work measurement technique for building up the time for a job at a defined level of performance by totaling element times obtained previously from time studies on other jobs containing the elements concerned, or from synthetic data.

5. Estimating

The technique of estimating is the least refined of all those available to the work measurement practitioner.

6. Analytical estimating

This technique introduces work measurement concepts into estimating. In analytical estimating the estimator is trained in elemental breakdown, and in the concept of standard performance.

7. Comparative estimating

This technique has been developed to permit speedy and reliable assessment of the duration of variable and infrequent jobs, by estimating them within chosen time bands.

ENGINEERING AND BEHAVIOURAL APPROACH

Behavioral engineering has been used to increase safety in organizations (see Behavior-based safety)

- Other areas include performance in organizationand lessening problems in prison
- In addition, it has had some success in social service systems,
- the long-term effects of humans in space the human landscape
- understanding political behavior in organizations how organizations function.
- It has also been successful in helping individuals to set goals.and manage pay systems.
- engineering has also been applied to social welfare policy.

UNIT-5

Materials Management

Material management is an approach for planning, organizing, and controlling all those activities principally concerned with the flow of materials into an organization.

The scope of Materials Management varies greatly from company to company and may include material planning and control, production planning, Purchasing, inventory control, in-plant materials movement, and waste management.

It is a business function for planning, purchasing, moving, storing material in a optimum way which help organization to minimize the various costs like inventory, purchasing, material handling and distribution costs.

The fundamental objectives of the Materials Management function, often called the famous 5 Rs of Materials Management, are acquisition of materials and services:

- Of the right quality
- In the right quantity
- At the right time
- From the right source
- At the right price

From the management point of view, the key objectives of MM are:

- ★ To buy at the lowest price , consistent with desired quality and service
- ★ To maintain a high inventory turnover , by reducing excess storage , carrying costs and inventory losses occurring due to deteriorations , obsolescence and pilferage
- ★ To maintain continuity of supply , preventing interruption of the flow of materials and services to users
- ★ To maintain the specified material quality level and a consistency of quality this permits efficient and effective operation.
- ★ To develop reliable alternate sources of supply to promote a competitive atmosphere in performance and pricing
- ★ To minimize the overall cost of acquisition by improving the efficiency of operations and procedures
- ★ To hire, develop, motivate and train personnel and to provide a reservoir of talent
- ★ To develop and maintain good supplier relationships in order to create a supplier attitude and desire furnish the organization with new ideas , products, and better prices and service
- ★ To achieve a high degree of cooperation and coordination with user departments
- ★ To maintain good records and controls that provide an audit trail and ensure efficiency and honesty
- ★ To participate in Make or Buy decisions

Quality circle

A group of employees who perform similar duties and meet at periodic intervals, often with management, to discuss work-related issues and to offer suggestions and ideas for improvements, as in production methods or quality control, called quality circle.

Therefore quality circle is nothing but a small group of employees who come together to discuss with the management issues related to either quality control or improvement in production methods form a Quality Control Circle (QCC). These employees usually work in the same areas, and voluntarily meet on a regular basis to identify, analyze and solve their problems.

Key Characteristics of quality circle:

• A circle, usually consisting of 6-8 members, from the same section.
• Membership of a Quality Circle is voluntary.
• Circle members should meet regularly, ideally once a week, in particular place also in particular time.
• Circle members select a name for their circle in the first meeting and elect a leader to conduct the meetings.
• Members are specially trained in problem solving and analysis techniques in order to play their role effectively.
• Circle works on a systematic basis to identify and solve work – related problems for improving quality and productivity not just discussing them.
• The management must ensure that solutions are implemented quickly once they have been accepted

• The management must give appropriate and proper recognition to solution

ISO

ISO originated from the union of two organisations – the ISO (International Federation of the National Standardizing Associations) and the UNSCC (United Nations Standard Coordinating Committee).

In 1946 over 25 countries met at the Institute of Civil Engineers in London to create a new international organisation, where the objective was to 'facilitate the international coordination and unification of industrial standards' From this the new organisation ISO began operations in February 1947.

The word ISO is derived from the Greek ISOS meaning 'equal'. As the International Organization for Standardization would translate differently across different languages it was decided that the short form name for the organisation would be ISO.

Benefits of Certification

Each standard supports its own benefits within every industry, however the common benefits across the certifications include: widened market potential, compliance to procurement tenders, improved efficiency and cost savings, higher level of customer service, and therefore satisfaction, and heightened staff moral and motivation. By having a recognised management standard it tells your customers that you are serious about their needs.

Standards That We Can Certificate

Here are some of the standards that we can certificate:

ISO 9001 is a quality management system, implementing a systematic and process driven approach to managing your business.

ISO 14001 is an environmental management system for controlling the aspects of your business that have a significant impact on the environment.

BS EN 15713 is a framework of key conditions to be adhered to for companies that destroy confidential information on behalf of their customers; the security of this information being integral to this.

BS OHSAS 18001 is a health and safety management system for controlling and monitoring risks that can arise from the company's day to day activities.

ISO 27001 is an information security management system for effectively manage risks to the security of your company's confidential information.

ISO 9000

Quality is something every company strives for and is often times very difficult to achieve.

Complications concerning efficiency and quality present themselves everyday in business, whether an important document cannot be found or a consumer finds a product not up to their expectations. How can a company increase the quality of its products and services? The answer is ISO 9000.

As standards go, ISO 9000 is one of the most widely recognized in the world. ISO 9000 is a quality management standard that presents guidelines intended to increase business efficiency and customer satisfaction. The goal of ISO 9000 is to embed a quality management system within an organization, increasing productivity, reducing unnecessary costs, and ensuring quality of processes and products.

ISO 9001:2008 is applicable to businesses and organizations from every sector. The process oriented approach makes the standard applicable to service organizations as well. Its general guidelines allow for the flexibility needed for today's diverse business world.

ISO 9000 important

The importance of ISO 9000 is the importance of quality. Many companies offer products and services, but it is those companies who put out the best products and services efficiently that succeed. With ISO 9000, an organization can identify the root of the problem, and therefore find a solution. By improving efficiency, profit can be maximized.

ISO 9000 Principles

1. A Customer Focus

As stated before, the customer is the primary focus of a business. By understanding and responding to the needs of customers, an organization can correctly targeting key demographics and therefore increase revenue by delivering the products and services that the customer is looking for. With knowledge of customer needs, resources can be allocated appropriately and efficiently

.2. Good Leadership

A team of good leaders will establish unity and direction quickly in a business environment. Their goal is to motivate everyone working on the project, and successful leaders will minimize miscommunication within and between departments. Their role is intimately intertwined with the next ISO 9000 principle.

3. Involvement of people

The inclusion of everyone on a business team is critical to its success. Involvement of substance will lead to a personal investment in a project and in turn create motivated, committed workers.

4. Process approach to quality management

The best results are achieved when activities and resources are managed together. This process approach to quality management can lower costs through the effective use of resources, personnel, and time

5. Management system approach

Combining management groups may seem like a dangerous clash of titans, but if done correctly can result in an efficient and effective management system.

6. Continual Improvement

The importance of this principle is paramount, and should a permanent objective of every organization. Through increased performance, a company can increase profits and gain an advantage over competitors.

7. Factual approach to decision making

Effective decisions are based on the analysis and interpretation of information and data. By making informed decisions, an organization will be more likely to make the right decision.

8. Supplier relationships

It is important to establish a mutually beneficial supplier relationship; such a relationship creates value for both parties.

TOTAL QUALITY MANAGEMENT

Total Quality Management is a management approach that originated in the 1950s and has steadily become more popular since the early 1980s. Total Quality is a description of the culture, attitude and organization of a company that strives to provide customers with products and services that satisfy their needs.

The culture requires quality in all aspects of the company's operations, with processes being done right the first time and defects and waste eradicated from operations.

Total Quality Management, TQM, is a method by which management and employees can become involved in the continuous improvement of the production of goods and services. It is a combination of quality and management tools aimed at increasing business and reducing losses due to wasteful practices.

Some of the companies who have implemented TQM include Ford Motor Company, Phillips Semiconductor, SGL Carbon, Motorola and Toyota Motor Company.[1]

TQM Defined

TQM is a management philosophy that seeks to integrate all organizational functions (marketing, finance, design, engineering, and production, customer service, etc.) to focus on meeting customer needs and organizational objectives.

TQM views an organization as a collection of processes.

TQM is now becoming recognized as a generic management tool, just as applicable in service and public sector organizations. There are a number of evolutionary strands, with different sectors creating their own versions from the common ancestor. TQM is the foundation for activities, which include:

- Commitment by senior management and all employees
- Meeting customer requirements
- Reducing development cycle times
- Just in time/demand flow manufacturing
- Improvement teams
- Reducing product and service costs
- Systems to facilitate improvement
- Line management ownership
- Employee involvement and empowerment
- Recognition and celebration
- Challenging quantified goals and benchmarking
- Focus on processes / improvement plans
- Specific incorporation in strategic planning

Principles of TQM

The key principles of TQM are as following:

Management Commitment

- Plan (drive, direct)
- Do (deploy, support, participate)
- Check (review)
- Act (recognize, communicate, revise)

Employee Empowerment

- Training
- Suggestion scheme
- Measurement and recognition
- Excellence teams

Fact Based Decision Making

- SPC (statistical process control)
- DOE, FMEA
- The 7 statistical tools
- TOPS (Ford 8D – team-oriented problem solving)

Continuous Improvement

- Systematic measurement and focus on CONQ
- Excellence teams
- Cross-functional process management
- Attain, maintain, improve standards

Customer Focus

- Supplier partnership
- Service relationship with internal customers
- Never compromise quality
- Customer driven standards

ZERO DEFECTS PROGRAMMES

Improving quality is a major ingredient to success in any business, especially in manufacturing organizations. A method of improving quality, is to employ the philosophy of "Zero Defects." Zero Defects was first introduced by American businessman, Philip Crosby, in his "14 Step Quality Improvement Process". This philosophy is really a mentality or movement, as it has no defined set of steps or rules to follow. The aim of zero defects is to mimimize the number of defects in manufactured products and service as much as possible and relies on each company to customize their own set of rules to follow. This may make zero defects more difficult to define than other set processes, but also makes it very effective because it is adaptable to any situation, business, and industry.

The Principles of Zero Defects programs are:

Quality is defined as conformance to the requirements

Every product or service should have a requirement (a description of what the customer expects to see). A product achieves quaility when it meets those requirements. Individual products will have its own set of standards to meet, so there is still a wide range of product standards in various products, but each product must meet ITS set of requirements to achieve zero defects.

Defects prevention is beter than quality inspection and correction

In other words, it's better to find a defect in the process and fix it, rather than find the defect in the finished products. If you spend time and money fixing the process instead of inspecting products for defects, it is time and money well spent.

Quality standard means zero defects

Simply stated, any product that does not meet the requirements set forth for that product will not be accepted by the customer and does not satisfy the customers need. If a product does satisfy the customer need even if it doesn't meet all of the requirements, then the requirements need to be reviewed and changed to reflect reality.

Quality is measured in terms of money (i.e. the price of non-conformance: PONC)

This philosophy assumes that every defect represents a hidden cost: inspection time, rework, revenue, wasted material, labor, and customer dissatisfaction. When properly identified, the costs can be measured and can provide justification for spending money on steps to improve quality. This provides a monetary way to measure the Zero Defect Management Process, which is a concrete and essential way to maintain management commitment in ensuring company goals are met.

Meaning of Acceptance Sampling or Sampling Inspection:

One method of controlling the quality of a product is 100% inspection which requires huge expenditure in terms of time, money and labour. Moreover due to boredom and fatigue involved in repetitive inspection process, there exists a possibility to overlook and some defective products may pass the inspection point.

Also when the quality of a product is tested by destructive testing (e.g., life of a candle or testing of electrical fuses) then 100% inspection shall destroy all the products.

The alternative is statistical sampling inspection methods. Here from the whole lot of products/items to be inspected, some items are selected for inspection.

If that sample of items conforms to be desired quality requirements then the whole lot is accepted, if it does not, the whole lot is rejected. Thus the sample items are considered to be the representative of the whole lot. This method of acceptance or rejection of a sample is called Acceptance Sampling.

In general acceptance sampling method proves to be economical and is used under the assumption when the quality characteristics of the item are under control and relatively homogeneous.

Classification of Acceptance Sampling:

Depending upon the type of inspection acceptance sampling may be classified in two ways:

(i) Acceptance sampling on the basis of attributes i.e. GO and NOT GO gauges, and

(ii) Acceptance sampling on the basis of variables.

In acceptance sampling by attributes, no actual measurement is done and the inspection is done by way of GO & NOT GO gauges. If the product conforms to the given specifications it is accepted, otherwise rejected. The magnitude of error is not important in this case.

For example if cracks is the criteria of inspection/the products with cracks will be rejected and without cracks accepted the shape and size of the cracks shall not be measured and considered.

In acceptance sampling by variables, the actual measurements of dimensions are taken or physical and chemical testing of the characteristics of sample of materials/products is done. If the results are as per specifications the lot is accepted otherwise rejected.

Following terms are generally used in acceptance sampling:

(i) Acceptable Quality Level (AQL):

It is the desired quality level at which probability of a acceptance is high. It represents maximum proportion of defectives which the consumer finds acceptable or it is the maximum percent defectives that for the purpose of sampling inspection can be considered satisfactory.

(ii) Lot Tolerance Percent Defective (LTPD) or Reject able Quality Level (RQL):

It is the quality level at which the probability of acceptance is low and below this level the lots are rejected. This prescribes the dividing line between good and bad lots. Lots at this quality level are considered to be poor.

(iii) Average outgoing Quality (A.O.Q):

Acceptance sampling plans provides the assurance that the average quality level or percent defectives actually going to consumers will not exceed certain limit.

The AOQ curve indicates that as the actual percent defectives in a production process increases, initially the effect is for the lots to be passed for acceptance even though the number of defectives has gone up and the percent defectives going to the consumer increases.

MATERIAL REQUIREMENT PLANNING

A Material Requirements Planning (MRP) system is a planning and decision-making tool used in the production process which analyses current inventory levels vs production capacity and the need to manufacture goods, based on forecasts. MRP schedules production as per bills of materials while minimizing inventory. The technique is computerized and looks at requirements within a fixed period.

FEATURES

A master production schedule: A statement of the planning including orders, forecasts and capacity.

Bill of materials (BOM): All the materials and components required to make the final product.

Inventory status file: Stock records that allow gross requirements to be adjusted to net requirements.

MRP system work

Step 1. Exploding: achieved by using the Bill of Materials (BOM), i.e. how many components are needed to prepare one item of manufacturing?

Step 2. Netting: the net quantity of material calculated by computing the difference between the stock available in the factory from the overall, gross requirement. This figure is provided by exploding.

Step 3. Offsetting: lead time is estimated for the entire operation that helps practitioners to compute the expected time for manufacturing. It also advises when the manufacturing process should begin so that items are available on the promised date .

COST ASSOCIATED WITH INVENTORY

Inventory cost includes the costs to order and hold inventory, as well as to administer the related paperwork. This cost is examined by management as part of its evaluation of how much inventory to keep on hand.

5 Types of Inventory Costs

Ordering, holding, carrying, shortage and spoilage costs make up some of the main categories of inventory-related costs. These groupings broadly separate the many different inventory costs that exist, and below we will identify and describe some examples of the different types of cost in each category.

The other requires a certain amount of calculation to understand the impact it has on your Gross Profit. Let's look at types of costs :

1. Ordering Costs

Ordering costs include payroll taxes, benefits and the wages of the procurement department, labor costs etc. These costs are typically included in an overhead cost pool and allocated to the number of units produced in each period.

- Transportation costs
- Cost of finding suppliers and expediting orders
- Receiving costs
- Clerical costs of preparing purchase orders
- Cost of electronic data interchange

2. Inventory Holding Costs

This is simply the amount of rent a business pays for the storage area where they hold the inventory. This can be either the direct rent the company pays for all the warehouses put together or a percentage of the total rent of the office area utilized for storing inventory.

- Inventory services costs
- Inventory risk costs
- Opportunity cost - money invested in inventory
- Storage space costs
- Inventory financing costs

3. Shortage Costs

Shortage costs, also known as stock-out costs, occurs when businesses become out of stock for various reasons. Some of the reasons might be as below :

- Emergency shipments costs
- Disrupted production costs
- Customer loyalty and reputation

4. Spoilage Costs

Perishable inventory stock can rot or spoil if not sold in time, so controlling inventory to prevent spoilage is essential. Products that expire are a concern for many industries. Industries such as the food and beverage, pharmaceutical, healthcare and cosmetic industries, are affected by the expiration and use-by dates of their products.

5. Inventory Carrying Costs

This is the lesser-known aspect of inventory cost. This cost requires a certain amount of calculation to understand the extent of its impact on your P&L statement. Inventory carrying costs refers to the amount of interest a business loses out on the unsold stock value lying in the warehouses.

ECONOMIC ORDER QUANTITY (EOQ)

Definition: Economic Order Quantity, popularly known as EOQ is the standard order quantity of materials which a firm should order at a given point in time with an aim of minimizing the annual inventory costs like holding/carrying cost, and order cost.

It is a production scheduling model which was coined by Ford W. Harris in the year 1913 and has been updated with the passage of time.

Formula of EOQ

The formula used for ascertaining the economic order quantity is derived by the renowned mathematician “Wilson”. The formula is given as under:EOQ formula

EOQ=√2AO/C

Where,

A = Annual Requirement (demand) for raw material for the year

O = Cost of placing per order for purchase

C = Cost of carrying average inventory per unit, annually.

ABC Analysis

ABC Classification Definition

ABC classification (or ABC analysis) is used by inventory management teams to help identify the most important products in their portfolio and ensure they prioritize managing them above those less valuable.

ABC classification is based on the premise that not all inventory is of equal value. Instead if follows the Pareto Principle, where 20% of stock accounts for 80% of the value to the business. Using ABC classification you can therefore split inventory into three categories:

Category A: this is the smallest category and consists of the most important stock items

Category B: will generally be slightly larger in terms of volumes of SKUs and will usually be made up of products of less value

Category C: this will typically be the largest category where products will contribute the least to your business’s bottom line

Your inventory’s ‘value’ can be based on a number of criteria, such as annual sales revenue, profitability or annual consumption value.