UNIT-I

SYLLABUS

Operations Management and Operations Strategy- Nature, Importance, historical development, transformation processes, differences between services and goods. Operations Strategy, Competitive Capabilities and Core Competencies, Operations Strategy as a Competitive Weapon. Linkage Between Corporate, Business, and Operations Strategy, Developing Operations Strategy, Elements or Components of Operations Strategy. Competitive Priorities, Manufacturing Strategies, Service Strategies, Global Strategies and Role of Operations Strategy.

INTRODUCTION:

In an Organization, strategic growth and competitiveness are depending upon the effective utilization of the critical productive resources of the organization. Production/operations management is the process, which combines and transforms various resources used in the production/operations subsystem of the organization into value added product/services in a controlled manner as per the policies of the organization. Therefore, it is that part of an organization, which is concerned with the transformation of a range of inputs into the required outputs (products/services) having the requisite quality level.

CONCEPT OF PRODUCTION:

Production is defined as *"**the step-by-step conversion of one form of material into another form through chemical or mechanical process to create or enhance the utility of the product to the user.**"* Thus production is a value addition process. At each stage of processing, there will be value addition.

Edwood Buffa defines production as '*a process by which goods and services are created*'. Some examples of production are: manufacturing custom-made products like, boilers with a specific capacity, constructing flats, some structural fabrication works for selected customers, etc., and manufacturing standardized products like, car, bus, motor cycle, radio, television, etc.

CONCEPT OF OPERATIONS:

The operations function consists of all activities *directly* related to producing goods or providing services. Hence, it exists both in manufacturing and assembly operations, which are *goods-oriented*, and in areas such as health care, transportation, food handling, and retailing, which are primarily *service-oriented.* Table 1–1 provides illustrations of the diversity of operations management settings.

Type of Operations	Examples
Goods producing	Farming, mining, construction, manufacturing, power generation
Storage/Transportation	Warehousing, trucking, mail service, moving, taxis, buses, hotels, airlines
Exchange	Retailing, wholesaling, banking, renting or leasing, library loans
Entertainment	Films, radio and television, plays, concerts, recording
Communication	Newspapers, radio and TV newscasts, telephone, satellites, the Internet

Table 1-1 Examples of Types of Operations

The operations function is the core of most business organizations; it is responsible for the creation of an organizations goods or services. Inputs are used to obtain finished goods or services using one or more transformation processes (eg. Storing, transporting, cutting). To ensure that the desired outputs are obtained, measurements are taken at various points in the transformation process (feedback) and then compared with previously established standards to determine whether corrective action is needed (control).

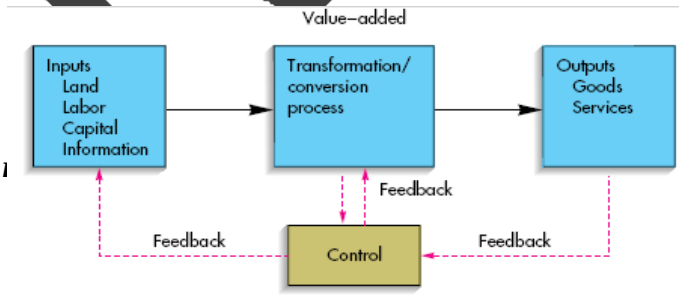


Fig. the conve

Fi g1.1: Conversion process of inputs and outputs.

The essence of operative function is to add value during the transformation process: Value added is the term used to describe the difference between the cost of inputs and value or price of outputs. In addition to value added, operations must be efficient. **Efficiency** means being able to perform activities well, and at the lowest possible cost. Table 1.2 provides examples of inputs, transformation, and outputs and Table 1–3 provides some specific illustrations of the transformation process.

Inputs	Transformation	Outputs
Land	Processes	Goods
Human	Cutting, drilling	Houses
Physical	Transporting	Automobiles
Intellectual	Teaching	Clothing
Raw materials	Farming	Computers
Energy	Mixing	Machines
Water	Packing	Televisions
Chemicals	Canning	Food products
Metals	Consulting	Textbooks
Wood	Copying, faxing	Magazines
Equipment		Shoes
Machines		CD players
Computers		Services
Trucks		Health care
Tools		Entertainment
Facilities		Car repair
Hospitals		Delivery
Factories		Gift wrapping
Offices		Legal
Retail stores		Banking
Other		Communication
Information		
Time		

Table 1.2: Examples of inputs, transformation, and outputs

Food Processor	Inputs	Processing	Output
	Raw vegetables Metal sheets Water Energy Labor Building Equipment	Cleaning Making cans Cutting Cooking Packing Labeling	Canned vegetables
Hospital	**Inputs**	**Processing**	**Output**
	Doctors, nurses Hospital Medical supplies Equipment Laboratories	Examination Surgery Monitoring Medication Therapy	Healthy patients

Table1.3 Illustrations of the transformation process

DIFFERENCE BETWEEN MANAUFACTURING AND SERVICE ORGANISATIONS:

Organizations can be divided into two broad categories: **manufacturing organizations** and **service organizations,** each posing unique challenges for the operations function. There are two primary distinctions between these categories.

First, manufacturing organizations produce physical, tangible goods that can be stored in inventory before they are needed. By contrast, service organizations produce intangible products that cannot be produced ahead of time. Second, in manufacturing organizations most customers have no direct contact with the operation. Customer contact is made through distributors and retailers. For example, a customer buying a car at a car dealership never comes into contact with the automobile factory. However, in service organizations the customers are typically present during the creation of the service. Hospitals, colleges, theaters, and barber shops are examples of service organizations in which the customer is present during the creation of the service.

The differences between manufacturing and service organizations are not as clear cut as they might appear, and there is much overlap between them. Most manufacturers provide services as part of their offering, and many service firms manufacture physical goods that they deliver to their customers or consume during service delivery. For example, a manufacturer of furniture may also provide shipment of goods and assembly of furniture. On the other hand, a barber shop may sell its own line of hair care products. The differences between manufacturing and services are shown in Figure 1-3, which focuses on the dimensions of product tangibility and the degree of customer contact.

Fig 1.3: Characteristics of Manaufacturing and Service Organisations

Difference between Goods Vs Services:

PRODUCTION SYSTEM VS SERVICE SYSTEMS (Goods Vs Services)

Focus	Production System	Service Systems
1. Product Nature	Tangible	Intangible
2. Characteristics	Physical dimensions	Service description
3. Properties	Size and Shape	Place and time
4. Production	Produced in an industrial environment	Produced in market environment
5. Process	Often standardized	Often customized
6. Function	It's a function of materials	It's a function of personnel
7. Quality	Quality inherent in product	Quality inherent in process
8. Location and Layout	Influenced largely by raw materials, labour supply and inventory considerations.	Influenced strongly by location and convenience of customers.
9. Specification	Physical dimensions	Service description
10. Performance	Reliable and efficient	Dependable and effective
11. Marketability	Design and appearance	Comfort and appeal
12. Quality control	Quality inherent in stored product.	Quality in the service and process (eg. Time, environment)

Functions of Operations Management

1. Facility Location & Layout Design: The decision of the location for the facility, manufacturing unit or service outfit, geographically. The layout design determines how the internal facilities (departments, equipments, service stations, workstations etc) will be arranged.
2. Job design and work measurement: The structuring of work tasks assigned to an employee and the study of the tasks that make up the job. The work measurement activity involves the timing of the tasks that comprise a job. The job design and work measurement activities are carried out to optimize output. Design of the production processes, type of process design, & investment and economic analysis also studied to achieve maximum productivity.
3. Demand forecasting: Organizations need to forecast the demand for their products and services so that all relevant plans can be developed for the future.
4. Planning and controlling operations: Short term, medium term & Long term
5. Materials Management-The materials management activity involves the grouping of management functions supporting materials flow.
6. Inventory control and Management: Planning & controlling of inventories (RM, WIP, FG)
7. Purchase Management: include vendor development, selection of suppliers, contract negotiation, value analysis, make or buy decisions and maintaining the high ethics .
8. Total Quality Management: Collective efforts of all managers and employees on satisfying customer expectations by continually improving operation management processes and products.
9. Supply Chain Management: It enables organizations to meet customer requirements in time with improved facility utilisation, optimimal inventory etc. Right Time available, Right qty of Product to Right customer at least cost.
10. Project Management: A thorough knowledge of project management procedures, tools and techniques is essential for the operations manager.
11. Maintenance Management: The objective of maintenance management is to ensure that the systems are working at their optimum efficiency and is essential to the organization for productivity, increase operational life of equipments and keep safe working conditions.

Need for Operations Management

- Every Organizations produces same product or services.
- All managers have to plan work, central quality & ensure productivity of their subordinate.
- Efficiently serving customers required the knowledge of OM. Servicing a customer well means in a timely fashion with exceptional quality.
- It lies at the heart of business activity they use human & material resources to create the product that either makes an organization healthy & competitive or course it to fail.
- Designing & operating processes that are quick, accurate & inexpensive to meet the customer demand which is key for building a competitive advantage.

Importance of Operations Management:

1. Understanding strategic objectives: Operations managers must clearly understand the goals of the organization and develop a clear vision of exactly how operations will help achieve them. This also involves translating these goals into implications for the operation's performance, objectives, quality, speed, dependability, flexibility and cost.

2. Developing an operations strategy: Due to the numerous decision-making involved with operations, it is critical that operations managers have a set of guidelines that are align with the organization’s long term goals.

3. Designing the operation's products, services and processes: Design involves determining the physical form, shape and composition of products, services and processes.

4. Improving the performance of operation: Operations managers are expected to continually monitor and improve the overall performance of their operation.

Also you can include

It helps in

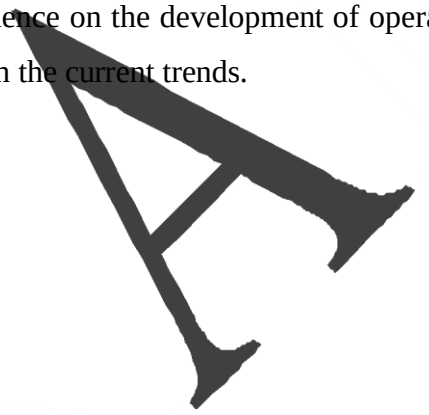
- Project Management
- Product Design
- Forecasting
- Process Analysis

- Work Measurement
- Facility Layout
- Inventory Control
- Scheduling
- Materials Management

HISTORICAL MILESTONES:

Production systems have existed since the earliest days of civilization as evidenced by the first Olympic games, building the Great Wall of China, or erecting the Egyptian pyramids, and you will see operations management at work. Operations management did not emerge as a formal field of study until the late 1950s and early 1960s, when scholars began to recognize that all production systems face a common set of problems and to stress the systems approach to viewing operations processes.

Many events helped shape operations management. Some of the most significant historical milestones and their influence on the development of operations management are summarized in the table below along with the current trends.



Concept	Time	Explanation
Industrial Revolution	Late 1700s	Brought in innovations that changed production by using machine power instead of human power.
Scientific management	Early 1900s	Brought the concepts of analysis and measurement of the technical aspects of work design, and development of moving assembly lines and mass production.
Human relations movement	1930s to 1960s	Focused on understanding human elements of job design, such as worker motivation and job satisfaction.
Management science	1940s to 1960s	Focused on the development of quantitative techniques to solve operations problems.
Computer age	1960s	Enabled processing of large amounts of data and allowed widespread use of quantitative procedures.
Just-in-time systems (JIT)	1980s	Designed to achieve high-volume production with minimal inventories.
Total quality management (TQM)	1980s	Sought to eliminate causes of production defects.
Reengineering	1980s	Required redesigning a company's processes in order to provide greater efficiency and cost reduction.
Environmental issues	1980s	Considered waste reduction, the need for recycling, and product reuse.
Flexibility	1990s	Offered customization on a mass scale.
Time-based competition	1990s	Based on time, such as speed of delivery.
Supply chain management	1990s	Focused on reducing the overall cost of the system that manages the flow of materials and information from suppliers to final customers.
Global competition	1990s	Designed operations to compete in the global market.
Electronic commerce	Late 1990s; early twenty-first century	Used the Internet for conducting business activity.

Fig. Historical Development of Operations Management

THE INDUSTRIAL REVOLUTION

The **Industrial Revolution** had a significant impact on the way goods are produced today. Prior to this movement, products were made by hand, by skilled craftspeople in their shops or homes. Each product was unique and made by an individual. The Industrial Revolution changed all that. It started in the 1770s with the development of a number of inventions that relied on machine power instead of human power. The most important of these was the steam engine, which was invented by James Watt in 1764. The steam engine provided a new source of power that was used to replace human labor in textile mills, machine-making plants, and other facilities. The concept of the factory was emerging. In addition, the steam engine led to advances in transportation, such as railroads, that allowed for a wider distribution of goods.

About the same time, the concept of *division of labor* was introduced. First described by Adam Smith in 1776 in *The Wealth of Nations*, this important concept became one of the building blocks of the assembly line. Division of labor means that the production of a good is broken down into a series of small, elemental tasks, each of which is performed by a different worker. The

repetition of the task allows the worker to become highly specialized in that task. Division of labor allowed higher volumes to be produced. This, coupled with advances in transportation, enabled distant markets to be reached by steam-powered boats and railroads.

A few years later, in 1790, Eli Whitney introduced the concept of *interchangeable parts.* Prior to that time, every part used in a production process was unique. With interchangeable parts, parts are standardized so that every item in a batch of items fits equally. This concept meant that we could move from one-at-a-time production to volume production, for example, in the manufacture of watches, clocks, and similar items.

SCIENTIFIC MANAGEMENT

Scientific management was an approach to management promoted by Frederick W. Taylor at the turn of the twentieth century. Taylor was an engineer with an eye for efficiency. Through scientific management he sought to increase worker productivity and organizational output. This concept has two key features. First, it is assumed that workers are motivated only by money and are limited only by their physical ability.

Taylor believed that worker productivity is governed by scientific laws, and that it is up to management to discover these laws through measurement, analysis, and observation. Workers are to be paid in direct proportion to how much they produce. The second feature of this approach is the separation of the planning and doing functions in a company, which means the separation of management and labor. Management is responsible for designing productive systems and determining acceptable worker output. Workers have no input into this process—they are permitted only to work.

Many people did not like the scientific management approach. This was especially true of workers, who thought that management used these methods to unfairly increase output without paying them accordingly. Still, many companies adopted the scientific management approach. Today many see scientific management as a major milestone in the field of operations management, and it has had many influences on operations management. For example, *piece rate incentives,* in which workers are paid in direct proportion to their output, came out of this movement. Also, a widely used method of work measurement, *stopwatch time studies,* was introduced by Frederick Taylor. In stopwatch time studies, observations are made and recorded of a worker performing a task over many cycles. This information is then used to set a time standard for

performing the particular task. This method is still used today to set a time standard for short, repetitive tasks.

The scientific management approach was popularized by Henry Ford, who used the techniques in his factories. Combining technology with scientific management, Ford introduced the *moving assembly line* to produce Ford cars. Ford also combined scientific management concepts with division of labor and interchangeable parts to develop the concept of *mass production.* These concepts and innovations helped him increase production and efficiency at his factories.

THE HUMAN RELATIONS MOVEMENT

The early twentieth century was dominated by the scientific management movement and its philosophy. However, this changed with the publication of the results of the **Hawthorne studies.** The Hawthorne studies were conducted at a Western Electric plant in Hawthorne, Illinois, in the 1930s. The purpose was to study the effects of environmental changes, such as changes in lighting and room temperature, on the productivity of assembly-line workers. The findings from the study were unexpected; the productivity of the workers continued to increase regardless of the environmental changes made. Elton Mayo, a sociologist from Harvard, analyzed the results and concluded that the workers were actually motivated by the attention they were given. The idea of workers responding to the attention they are given came to be known as the *Hawthorne effect.*

Many sociologists and psychologists went to Hawthorne to study these findings, which led to the **human relations movement,** an entirely new philosophy based on the recognition that factors other than money can contribute to worker productivity. The impact of these findings on the development of operations management has been tremendous. The influence of this new philosophy can be seen in the implementation of a number of concepts that motivate workers by making their jobs more interesting and meaningful. For example, the Hawthorne studies showed that scientific management had made jobs too repetitive and boring. *Job enlargement* is an approach in which workers are given a larger portion of the total task to do. Another approach used to give more meaning to jobs is *job enrichment,* in which workers are given a greater role in planning.

Recent studies have shown that environmental factors in the workplace, such as adequate lighting and ventilation, can have a major impact on productivity. However, this does not contradict the principle that attention from management is a positive factor in motivation.

MANAGEMENT SCIENCE

While one movement was focusing on the technical aspects of job design and another on the human aspects of operations management, a movement called **management science** was developing that would make its own unique contribution. Management science focused on developing quantitative techniques for solving operations problems. The first mathematical model for inventory management was developed by F.W. Harris in 1913. Shortly thereafter, procedures were developed for statistical sampling theory and quality control.

World War II created an even greater need for the ability to quantitatively solve complex problems of logistics control, weapons system design, and deployment of missiles. Consequently, management science grew during the war and continued to grow after the war was over. Many quantitative tools were developed to solve problems in forecasting, inventory control, project management, and other areas. Management science is a mathematically oriented field that provides operations management with tools that can be used to assist in decision making. A popular example of such a tool is linear programming.

THE COMPUTER AGE

The 1970s witnessed the advent of the widespread use of computers in business. With computers, many of the quantitative models developed by management science could be used on a larger scale. Data processing was made easier, with important effects in areas such as forecasting, scheduling, and inventory management. A particularly important computerized system, material requirements planning (MRP), was developed for inventory control and scheduling. Material requirements planning was able to process huge amounts of data to compute inventory requirements and develop schedules for the production of thousands of items. This type of processing was impossible before the age of computers. Today the exponential growth in computing capability continues to impact operations management.

JUST-IN-TIME

Just-in-time (JIT) is a major operations management philosophy, developed in Japan in the 1980s, that is designed to achieve high-volume production using minimal amounts of inventory. This is achieved through coordination of the flow of materials so that the right parts arrive at the right place in the right quantity; hence the term, *just-in-time*. However, JIT is much more than the coordinated movement of goods. It is an all-inclusive organizational philosophy that employs

teams of workers to achieve continuous improvement in processes and organizational efficiency by eliminating all organizational waste. Although JIT was first used in manufacturing, it has seen use in the service sector, for example, in the food service industry. JIT has had a profound impact on changing the way companies manage their operations. It is credited with helping turn many companies around and is used by companies including Honda, Toyota, and General Motors. JIT promises to continue to transform businesses in the future.

TOTAL QUALITY MANAGEMENT

Customers demand higher quality in their products and services. Companies have been forced to focus on improving quality in order to remain competitive in this situation. **Total quality management (TQM)** is a philosophy, promulgated by "quality gurus" such as W. Edwards Deming, that aggressively seeks to improve product quality by eliminating causes of product defects and making quality an all-encompassing organizational philosophy. With TQM everyone in the company is responsible for quality. TQM was practiced by some companies in the 1970s and became pervasive in the 1990s.

BUSINESS PROCESS REENGINEERING

Business process **reengineering** means redesigning a company's processes to increase efficiency, improve quality, and reduce costs. In many companies things are done in a certain ways that has been passed down over the years. Reengineering requires asking why things are done in a certain way, questioning assumptions, and then redesigning the processes. Operations management is a key player in a company's reengineering efforts.

FLEXIBILITY

Traditionally companies competed by either mass-producing a standardized product or offering customized products in small volumes. One of the current competitive challenges for companies is the need to offer a greater variety of product choices to customers of a traditionally standardized product. This is the challenge of **flexibility,** which means being able to offer a wide variety of products to customers.

One example of flexibility is **mass customization,** which is the ability of a firm to highly customize its goods and services to different customers. Mass customization requires designing flexible operations and using delayed product differentiation, also called postponement.

This means keeping the product in generic form as long as possible and postponing completions of the product until specific customer preferences are known.

TIME-BASED COMPETITION

One of the most important trends in companies today is **competition based on time.** This includes developing new products and services faster than the competition, reaching the market first, and meeting customer orders most quickly. For example, two companies may produce the same product, but if one is able to deliver it to the customer in two days whereas the other delivers it in five days, the first company will make the sale and win over the customers. Time-based competition requires specifically designing the operations function for speed.

SUPPLY CHAIN MANAGEMENT

Supply chain management (SCM) involves managing the flow of materials and information from suppliers and buyers of raw materials all the way to the final customer. The objective is to have everyone in the chain work together to reduce overall cost and improve quality and service delivery. Supply chain management requires a team approach, with functions such as marketing, purchasing, operations, and engineering all working together. This approach has been shown to result in more satisfied customers, meaning that everyone in the chain profits. SCM has become possible with the development of information technology (IT) tools that enable collaborative planning and scheduling. The technologies allow synchronized supply chain execution and design collaboration, which enables companies to respond better and faster to changing market needs.

GLOBAL MARKETPLACE

Today businesses must think in terms of a **global marketplace** in order to compete effectively. This includes the way they view their customers, competitors, and suppliers. Key issues are meeting customer needs and getting the right product to markets as diverse as the Far East, Europe, or Africa. Operations management is responsible for most of these decisions. OM decides whether to tailor products to different customer needs, where to locate facilities, how to manage suppliers, and how to meet local government standards. Also, global competition has forced companies to reach higher levels of excellence in the products and services they offer.

ENVIRONMENTAL ISSUES

There is increasing emphasis on the need to reduce waste, recycle, and reuse products and parts. Society has placed great pressure on business to focus on air and water quality, waste disposal, global warming, and other **environmental issues.** Operations management plays a key role in redesigning processes and products in order to meet and exceed environmental quality standards. The importance of this issue is demonstrated by a set of standards termed ISO 14000. Developed by the International Organization for Standardization (ISO), these standards provide guidelines and a certification program documenting a company's environmentally responsible actions.

ELECTRONIC COMMERCE

Electronic commerce (e-commerce) is the use of the Internet for conducting business activities, such as communication, business transactions, and data transfer. Since the late 1990s the Internet has become an essential business medium, enabling efficient communication between manufacturers, suppliers, distributors, and customers. It has allowed companies to reach more customers at a speed infinitely faster than ever before. It also has significantly cut costs as it provides direct links between entities. Electronic commerce can occur between businesses, known as **B2B** (**business to business**) commerce, and makes up the highest percentage of transactions. A more commonly known type of e-commerce occurs between businesses and their customers, known as **B2C** exchange, as seen with on-line retailers such as Amazon.com. E-commerce is creating **virtual marketplaces** that continue to change the way business functions.

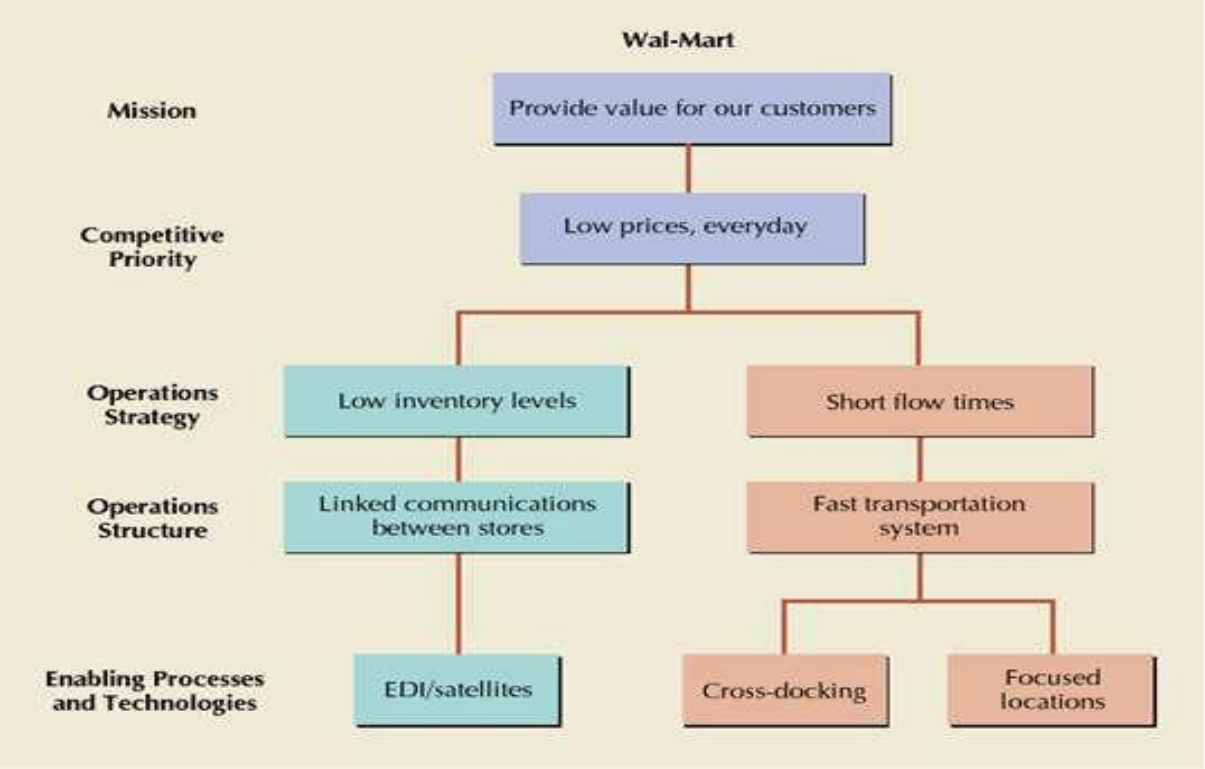
OPERATIONS STRATEGY

- It is concerned with setting broad polices & plans for using the resources of a firm to best support its competitive strategy.
- It is about beings different from your competitors.
- *Either doing different things or doing things differently.*
- It specifies how operations can achieve the organization goals, within the framework of corporate strategy

Operation Strategy at Walmart:

- Industry- Retail
- Founder Sam Walton (1962)
- No.of Location: 11,047 Units (Sep 2013)
- Employee: 2.2 million

- "*Save Money Live Better*", replacing the "*Always Low Prices, Always*"
- Capturing the Market Share with" Everyday Low Price" Strategy
- Training Employees because People are key to Wal-mart business.
- Buy at Less and Sell at less



OPERATIONS STRATEGY

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There are four levels at which strategies are formulated:

A. Corporate Level

B. Global Level

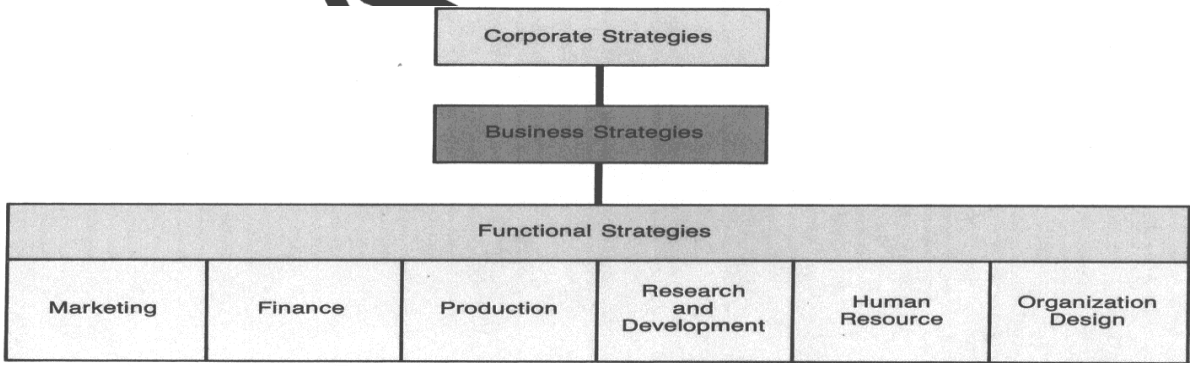
C. Business Unit Level

D. Functional Level

(A). Corporate Level Strategy

- It is formulated by top management
- The company should decide where it wants to be in 10 or 15 years,
- Market Standing, Innovation, Productivity, physical and financial resources, profitability, managerial performance and development, worker-performance and attitude, Social responsibility.

Corporate Level Strategies	
1. Growth Strategies	(a) Internal Growth (b) Horizontal Integration (c) Horizontal related diversification (d)) Conglomerate Diversification (e)) Vertical Integration of related business (f) Vertical Integration of un related business (g) Mergers and Strategic alliances
2. Stability Strategy	----
3. Retrenchment Strategies	Turnaround, Divestment, Liquidation



(B) Global Level Strategy

Increasing profit through global expansion is possible due to:

1. Location Economies:

- It is economic benefits that arising from a value creation activity in the optimal location for that activity.
- Lower cost of value media (2) It can enable company to differentiate its products from competitors.
- Ex: Philips, Nokia Manufacturing products in China because Low cost labor.

2. Experience Curve:

- It refers to the systematic decrease in production costs that have been observed to occur over the life of a product.
- It allows a company to lower its cost structure and achieve a cost advantage in relation to its competitors.

3. Transferring Distinctive competencies:

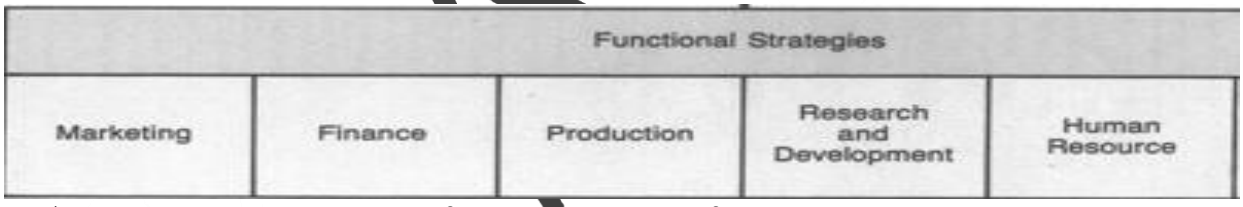
- Distinctive capabilities are the source of competitive advantage.
- Ex: Toyota's distinctive competencies allow it to produce high quality, well designed cars at a lower cost than any other company in the world.

4. **Leveraging the skills of global subsidiaries**: International Strategy, Multi domestic strategy, Global strategy, Transnational Strategy.

(D) Business Unit Level Strategy

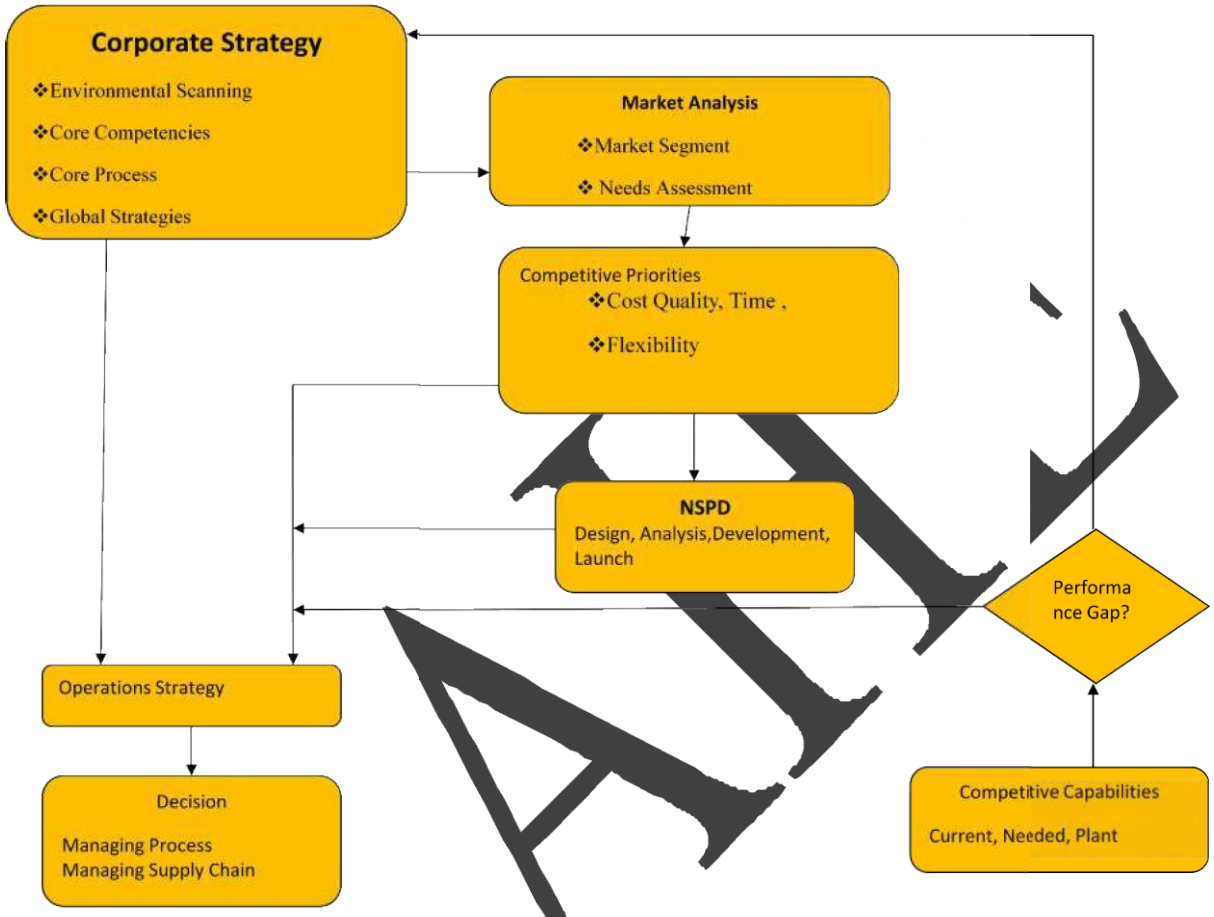
- A business unit is an organizational subsystem that has a market, a set of competitors, and a goal distinct from those of the other subsystems in the group.
- Business Level Strategy decides the base for competing with rivals.
- The concept of SBU- Strategic Business Unit was pioneered by General Electric Company.

(E) Functional Level Strategy



- Functional Strategies identify the basic course of action that each department must pursue in order to help the business unit to attain its goals.

STRATEGY FORMULATION PROCESS



Competitive Priorities:

- ❖ Cost or Price
  - ❖ Make the Product or Deliver the Service Cheap Ex:Big Bazaar
- ❖ Quality
  - ❖ Make a Great Product or Deliver a Great Service Ex: Ferrari and Mcdonald
- ❖ Delivery Speed
  - ❖ Make the Product or Deliver the Service Quickly
- ❖ Delivery Reliability Ex: FedEx (Speedy, reliable, Overnight delivery)
  - ❖ Deliver It When Promised
- ❖ Coping with Changes in Demand

- ❖ Change Its Volume
- ❖ Flexibility and New Product Introduction Speed
  - ❖ Change It

Order Winners:

Order winners are the criteria that differentiates the products and services of one firm from another .

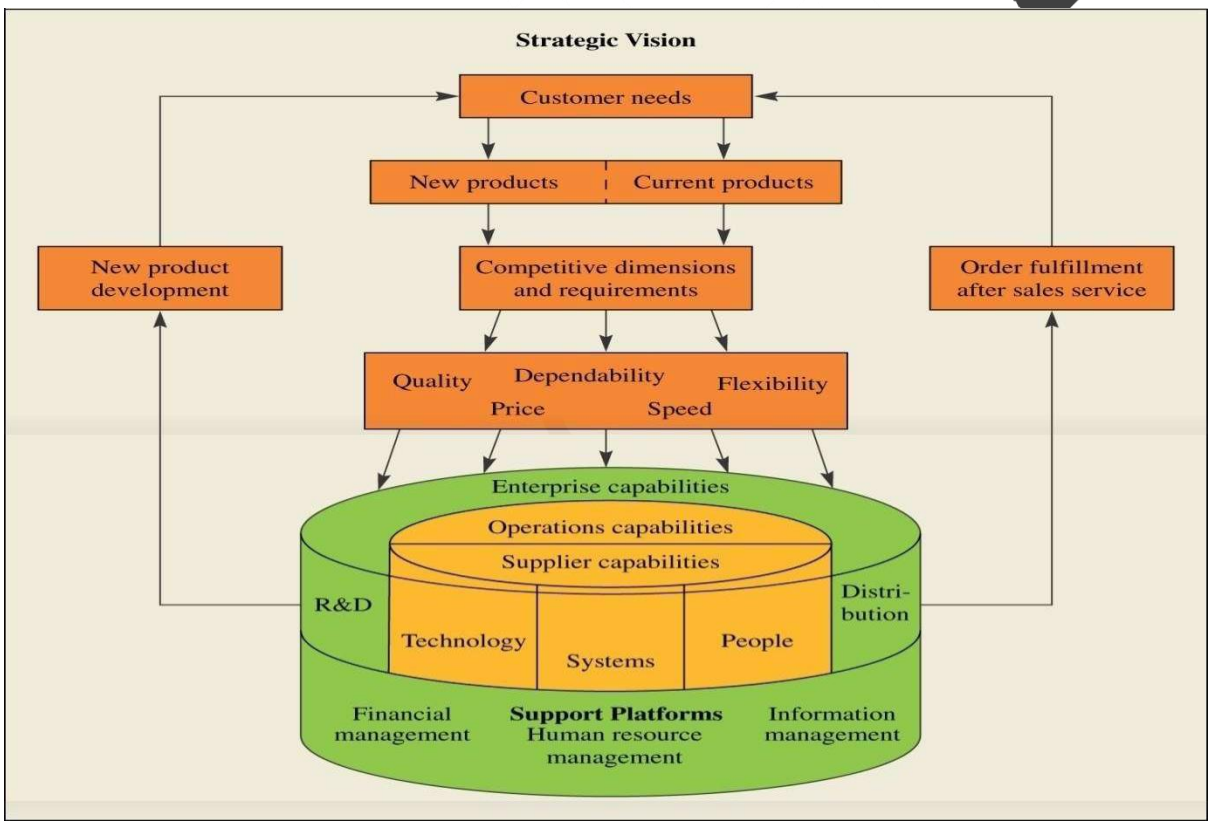
Order Qualifiers:

Order qualifiers are the screening criteria that permit the firms products to be considered as candidates for purchase by customers.

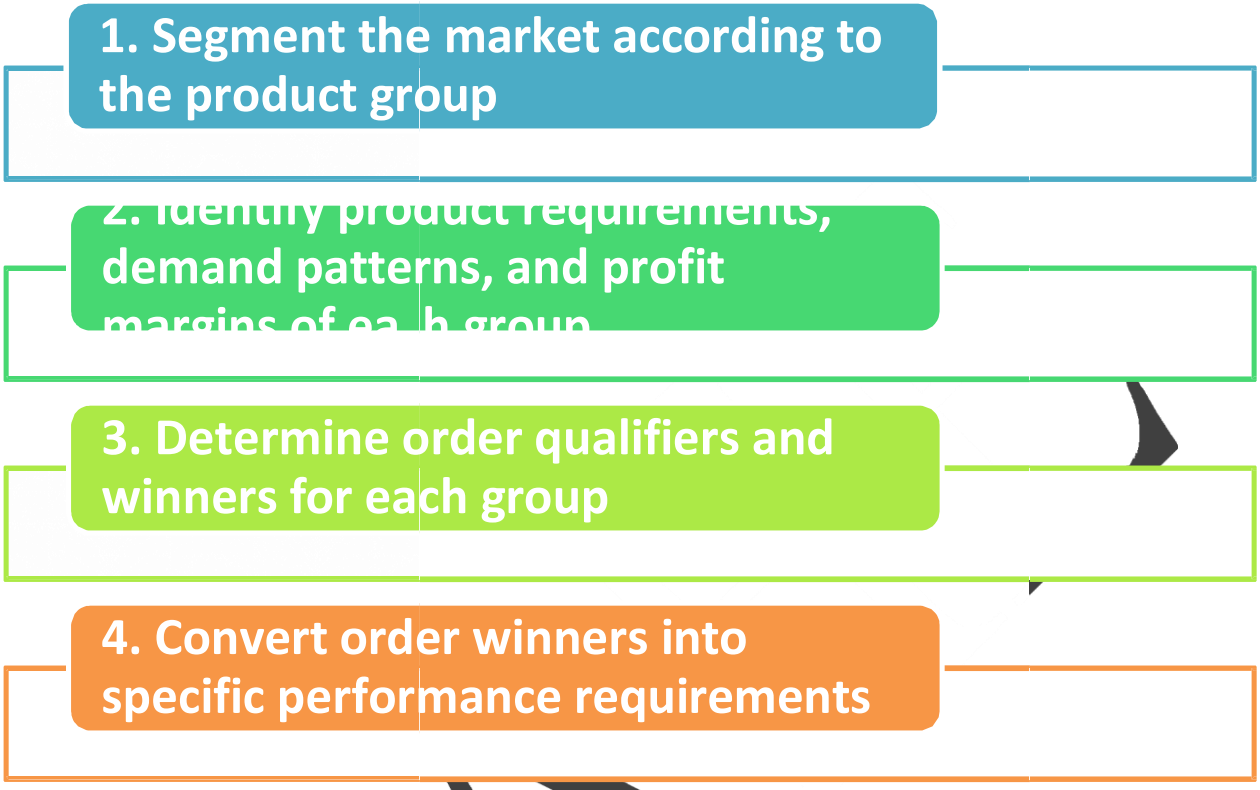
Ex: Japanese Automobile (Toyota) Order Winners (Quality, Reliability, Price)

Ford, GM, Chrysler – Order Qualifier

Customer Driven Operations Strategy



Steps in Developing a Manufacturing Strategy



Operations Strategy in Service Sectors:

- Service Firms may use the Plant with in a Plant (PWP) structure to achieve focus.
- PWP -Different Locations within the facility are allocated to different product lines, each with their own product lines.
- Ex:Hospital (Cardiac Units, Oncology Units, labor & delivery units)
- Retail Outlets (Different sections, Women's sports wear, Men clothing, Children apparel)
- Minimize the confusion associated with shifting from one type of strategy to another

Part A (ONE Mark)

Multiple Choice Questions

Part B (2 Marks)

1. Define Productions and Operations management.
2. What does the term Operations strategy?
3. What is meant by 'competitive strategy'?
4. List four performance characteristics that a company can choose to emphasize to have competitive advantage:
5. What are order winning and order qualifying attributes? Give three examples of each in the service and manufacturing industries.
6. List out the competitive priorities of operations.

Part C (6 Marks)

1. "Paying attention to the smallest details of production can be strategic importance"- Elucidate the statement.
2. Explain the system concept of Production system.
3. Define the production system Explain how the concept of productions system helps in understanding of Production and operations management.
4. Explain in details the various elements of operations strategy.
5. Explain the recent trends in production and operations management
6. Explain the various elements of adopting operations strategy in manufacturing firms.
7. Elucidate the various objectives of Operations Management
8. Describe the need for production and operations Management.
9. What are the steps involved in strategic formulation process? How does manufacturing technology provide unique advantages to organization in providing products and services to customers?
10. Briefly describe the strategy formulation process.

Part D (Case Study- 11 Marks)

Busy Monday morning, Rahul bhai was getting ready to go to Office in Kochi. Thirty years, old Rahul Bhai purchased a Honda City car from ABC dealer in Trivandrum on 2008. He could not start his car due to overnight rain. After some moments, he started his car. He was rushing up to go to office. On the middle of the road, the car got jump started. He was annoyed with his car's performance.

The Manufacturers and dealers offer variety of services for their products like arranging car loan, five years warranty period, assisting Insurance and Roadside Assistance Programme etc. They are charging a considerable amount of money for their services. Particularly, Roadside Assistance Programme which means whenever car breaks down, the battery failure, more smoke comes from silencer or carelessly locked door. In such an emergency case, the customer can make a call the toll free number provided and help will arrive at your location. If car cannot be fixed immediately, some programmes offer to tow it to the nearest service station and find accommodation or a replacement car for customer in the mean time. If car is new, the manufacturer or dealer has given you the option of registering for a Roadside Assistance Programme at the time of purchase.

Companies like Volkswagen offers Roadside Assistance Programme free of cost during the two year warranty period. Honda offers five year warranty period. They charge for Roadside Assistance Programme, 1750/-INR for the first year of service, 2900/- INR in th second, 3700/-INR in the third, 4600/-INR in the fourth and 6000/-INR in the fifth year. Compare to Chevrolet too has a subscription fee 1000/- INR during the first year or 2700/-INR for a three year programme. After warranty period, they charge a flat 1350/-INR per year.

If customers purchase second hand vehicle, the manufacturer or dealer unlikely to give you the benefit of Roadside Assistance Programme. In addition, Manufacturer would not be willing to extend such services after the warranty period. Further, the signing up of the Roadside Assistance programme is quite complicated with most manufacturers including details of dealership customer purchased the vehicle from and vehicle identification number that establishes that the automobiles qualifies for the programme.

However, third party enter into the Roadside Assistance Programme, companies like Crossroads India Assistance (CRIA), Carzcare and MyTVS. They provide similar services offered by manufacturers or dealers. In addition, they can also save you money on services such as towing your

vehicle in case of a breakdown that cannot be rectified on spot. Most service providers offering concessional rates on this facility. The major drawbacks of some of third parties restrict their services to certain territories. For example, CRIA provides RoadSide Assistance programme only in 23 cities in Country. MyTVS assures customers of assistance anywhere in India, barring J&K and the North East.

Also, Roadside Assistance Programme cap the number of free services customer can entitles to in a year. If car breaks down frequently, it's probably best to junk it! Third parties' service cost is less than obtaining similar kit from manufacturer or dealer after vehicle has crossed a certain age. For example CRIA start at 799/- plan in New Delhi/NCR, MyTVS' Basic gold membership plan 1250/- per year.

Q1: As an Operation Manager of a Third Party Company, What operations Strategy should focus for increasing customer satisfaction?

Q2: Recommend What Competitive Priorities, Manufacturers and dealers should highlights in their operations.

KARPAGAM ACADEMY OF HIGHER EDUCATION, COIMBATORE

DEPARTMENT OF MANAGMENET

Unit 1- Introduction to Operations Management and Operations Strategy- Multiple Choice Questions- Each Question carries ONE Mark

SI.NO	Question	Option 1	Option 2	Option 3	Option 4	Answer
1	A strategy which aims to produce a perfect product which will suit everybody is called	Product orientation	Marketing orientation.	Production orientation.	Perfect orientation	Product orientation.
2	A strategy which aims to produce the maximum amount of goods at the lowest possible price is called	Production orientation.	Selling orientation.	Societal marketing.	Cost orientation.	Production orientation.
3	Someone who has responsibility for marketing decisions concerning a group of products is	A product manager.	A brand manager.	A sales manager.	A marketing manager.	A product manager.
4	Which of the following is true?	value is always lower than price.	value is what consumers are prepared to pay.	cost is always lower than price.	price is always lower than value.	value is what consumers are prepared to pay.
5	Demand is created when	A need is identified	A significant group of people want to buy something	People who can afford something want to buy it	Marketers persuade people to want something	People who can afford something want to buy it
6	The paradigm that leads to more complex products at ever-increasing prices is _____.	Product orientation	Production orientation	Marketing orientation	Sales orientation	Product orientation
7	Someone who is responsible for finding out what individual customers need, and explaining how the firm's products meet those needs, is a	brand manager	salesperson	sales manager	market research manager	salesperson
8	Someone who controls media purchases and deals with advertising agencies is an	Sales manager	Brand manager	Advertising manager	Market research manager	Advertising manager

9	A specific satisfier for a need is called as	Product	Demand	Want	Market	Want
10	Long-term capacity planning deals with which of the following factors	overtime budgets	investment in new facilities	inventories	workforce sizes	investment in new facilities
11	Input measures of capacity are preferred when there are	Flexible flow processes	High-volume processes	Service processes	Low customizations	Flexible flow processes
12	A measure of the reserve capacity a process has to handle in unexpected increases in demand is the _____.	capacity utilization rate	capacity cushion	capacity bottleneck	capacity constraint limit	capacity cushion
13	In general, a less capital-intensive industry such as a hotel chain would do well with a utilization rate of	18%	30-40%	60-70%	100%	60-70%
14	An expansionist capacity strategy is NOT indicated when	a pre-emptive marketing strategy is used	capacity expansion is consistently ahead of demand	expansion is made in large increment	expansion will lead to economies of scale	expansion will lead to economies of scale
15	Chang and Chang observe that the competition is increasing the size of its warehouses. They have decided to do the same. They are following a strategy	Theory of constraints	Expansionist	Follow the leader	Wait-and-see	Follow the leader
16	When evaluating alternative capacity decisions, qualitative concerns exclude?	Cash flows	Uncertanities about demands	Competative reactions	Technology changes	Cash flows
17	Efficiency is given by	Actual output divided by design capacity	Capacity divided by utilization	Actual output divided by effective capacity	Effective capacity divided by actual output	Actual output divided by effective capacity

18	The maximum output of a system in a given period is called the	Efficiency	Effective capacity	Design capacity	Break-even point	Design capacity
19	Costs that continue even if no units are produced are called	Fixed costs	Mixed costs	Marginal costs	Variable costs	Fixed costs
20	A facility with a design capacity of 1,000 units, an actual average of 800 units, and effective capacity of 850 units has an efficiency of…….	80%	50%	85%	94%	94%
21	A facility with a design capacity of 1,000 units, an actual average of 800 units, and effective capacity of 850 units has a utilization of …….	85%	80%	125%	94%	80%
22	Which of the following actions would be best if a firm faced highly seasonal demand for a perishable product	hire and fire employees as demand fluctuate	build up inventory when demand is low	add warehouse and production building space to accommodate the highest period of demand	offer a product with a complementary demand pattern	offer a product with a complementary demand pattern
23	The first steps of capacity planning and control do not include	Identifying the alternative capacity plan	Measuring aggregate demand and capacity	Studying the effect of queuing theory	Choosing the most appropriate capacity plan	Studying the effect of queuing theory
24	Yield management is not especially useful where	The service cannot be sold in advance	Capacity is relatively fixed	The service/product can be stored	The market can be fairly clearly segmented	The service/product can be stored
25	Which of the following is not a measure of utilisation?	uptime in a factory.	number of hours available for production.	room occupancy level in hotel.	load factor for aircraft.	number of hours available for production.

26	Identify the best definition of planning	core activity of planners and planning departments	setting an organisation's objectives and the means of reaching them	devising ways of achieving the objectives of an organisation	an integrated process in which plans are formulated, carried out and controlled	setting an organisation's objectives and the means of reaching them
27	What are the three levels of planning	Top, middle and bottom	Headquarters, divisional and local	Operational, intermediate and strategic	short term	Operational, intermediate and strategic
28	What is the planning horizon	time ahead for which there is no information	time period within which uncertainty is very low	maximum time for which managers can make plans	time between making a plan and putting it into effect	time between making a plan and putting it into effect
29	We identified several internal benefits of objectives, goals and a sense of mission Which is not included _____	Basis to resolve disputes	Unity of directions	Basis of plans and decisions	None of the above	Basis to resolve disputes
30	What is measurement ship	collecting too much performance data	discussing "the numbers" at every opportunity	surveying by naval architects	trying to agree low objectives so as to look good later	trying to agree low objectives so as to look good later
31	What is the more formal term for what is known as 'Plan B'?	A contingency plans	A circumstantial plans	Conductive plans	concentration plans	A contingency plans
32	Demand for a given item is said to be dependent if	the item has several children	there is a deep bill of materials	the finished products are mostly services (rather than goods)	there is a clearly identifiable parent	there is a clearly identifiable parent
33	Dependent demand and independent demand items differ in that	for any product, all components are dependent-demand items	the need for independent-demand items is forecasted	the need for dependent-demand items is calculated	a,b & c are true	a,b & c are true

34	A master production schedule specifies	The financial resources required for production	What component is to be made, and when	What product is to be made, and when	The labour hours required for production	What product is to be made, and when
35	A master production schedule contains information about	quantities and required delivery dates of all sub-assemblies	quantities and required delivery dates of final products	inventory on hand for each sub-assemblies	inventory on hand for each final products	quantities and required delivery dates of final products
36	Business cycle, price trends, National Economy are	Macro Factors	Micro Factors	Controllable Factors	factoring	Macro Factors
37	_____ also called part lists or building lists is the document generated at the design stage	MRP (Material Requirement Planning)	MPS (Master Production Schedule)	BOM (Bill of Materials)	bill of exchange	BOM (Bill of Materials)
38	_____ is the time that elapses between issuing replenishment order and receiving the material in stores.	replenishment time	lead time	idle time	safety stock	lead time
39	____ is the task of buying goods of right quality, in the right quantities, at the right time and at the right price.	Purchasing	Supplying	Scrutinizing	demand	Purchasing
40	Which is not a part of 5R's of buying	right quality	right quantity	right source	right person	right person
41	Purchasing responsibilities can be divided into Buying, Clerical and division	packing	traffic	record	follow up	traffic
42	Buying according to the requirements is called	Hand to mouth buying	Seasonal Buying	Scheduled Buying	Tender Buying	Hand to mouth buying

43	Procuring an item in staggering deliveries according to the delivery schedule finished to the supplier by the buyer	seasonal buying	scheduled buying	hand to mouth buying	tender buying	scheduled buying
44	Buying of the annual requirements of an item during its season	Seasonal Buying	Hand to mouth buying	Scheduled Buying	Tender Buying	Seasonal Buying
45	Raw Materials and WIP can be classified under-	indirect materials	direct materials	finished materials	standard parts	direct materials
46	____ are the basic materials which have not undergone any conversion since their receipt from suppliers	WIP	Work Made Part	Raw Material	Finished Part	Raw Material
47	Decisions which are primarily focused on design activities are called……..	Structural decisions	Design decisions	Infrastructural decisions	Strategic decisions	Structural decisions
48	A possible move to commodity standardisation will occur at which stage of the product–service life cycle?	Maturity	Decline	Introduction	Growth	Decline
49	During the decline stage of the product–service life cycle, the number of competitors will…….	Be stable	Increase	Be few	Decline	Decline
50	Market needs are largely met by which stage of the product–service life cycle?	Introduction	Decline	Maturity	Growth	Decline
51	For corporate banking, which of the following are likely to be key internal performance objectives?	Flexibility, cost, speed	Flexibility, quality, dependability	Dependability, speed, cost	Speed, cost, quality	Flexibility, quality, dependability
52	Things which directly and significantly contribute to gaining business are termed:	Critical factors	Competitive factors	Order winning factors	Qualifying factors	Order winning factors
53	Another term for the bottom up perspective is the concept of:	Emergent strategies	Hierarchical strategies	Experiential strategies	Group strategies	Emergent strategies

54	The operations, marketing, product–service development departments will all need to consider how best they should organise themselves. This is called:	Business strategy	Functional strategy	Operations strategy	Corporate strategy	Functional strategy
55	Decisions about what types of business the group wants to be in, what parts of the world it wants to operate in, and how to allocate its cash between its various businesses, all relate to:	Business strategy	Functional strategy	Operations strategy	Corporate strategy	Corporate strategy
56	Which of the following is true of the relationship between the content and the process of strategy?	They influence each other	Content influences process	They are independent of one another	Process influences content	They influence each other
57	The set of specific decisions and actions which shape the strategy are known as:	The content of strategy	The operationalisation of strategy	The tangibles of strategy	The process of strategy	The content of strategy
58	Which of the following decisions is NOT usually related to strategy?	Decisions that define the position of an organisation relative to its environment	Decisions involving the translation of market requirements into operations processes	Decisions which have a widespread effect on the organisation	Decisions which move an organisation closer to its short-term goals	Decisions which move an organisation closer to its short-term goals
59	Which of the following performance objectives are key to Ryanair's strategy?	Speed and dependability	Flexibility and cost	Cost and dependability	Quality and speed	Cost and dependability
60	A model for comparing the gap between market requirements and achieved performance is:	The Hill methodology	The operations strategy matrix	The Platts-Gregory procedure	The operations resources perspective	The Platts-Gregory procedure

UNIT-II

SYLLABUS

Location, Layout, Material Handling and Maintenance- Location Strategies: Introduction, Location Planning Process Facility or Layout Planning and Analysis: Introduction, Objectives of Layout, Classification of Facilities, Basis for Types of Layouts, Why Layout decisions are important, Nature of layout problems, Redesigning of a layout, Manufacturing facility layouts, Types of Layouts, Layout Planning, Evaluating Plant Layouts, Assembly Line Balancing, Material handling - Material Requirements Planning (MRP) - Manufacturing Resources Planning (MRP II) - Enterprise Resource Planning (ERP) Maintenance Management- Reliability and Maintenance - Replacement Techniques

FACILITY LOCATION

INTORDUCTION

The location planning is one of the major decisions of the organization. It is a strategic decision by nature. The general objective of facility location is to optimize the establishment cost and logistics cost of the product. For manufacturing units, the location is broadly categorized into factory location and warehouse location. If it is an existing organization, the relative location gets importance. The establishment of facility location includes the costs associated with land, construction, manpower, and state and local expenses and regulations. Logistics costs, are those directly related to the shipping of supplies and products to customers and other branches of the distribution network.

In services organizations, due to the nature of the industry location decision is very important and has to be nearer to the customer base. The service which is provided is intangible, and hence the storage is restricted to the input area. The customer participation in the service process is more, and hence the location of facility is necessarily customer centric.

LOCATIONS OF FACILITIES

In every organization location of facility is an integral part of business planning process. Though it is considered that location decision is a one time process, often the mangers encounter situations that calls for expansion or balancing the existing facilities.

Firms such as banks, fast food restaurant, super markets and retail stores view locations as a marketing strategy and they look for locations that will help them to expand their markets. A similar situation occurs when an organization experiences a growth in demand for its products or services that cannot be satisfied by expansion at an existing location. The addition of a new location to complement an existing system is often a realistic alternative. Location decisions for many types of businesses are made rather infrequently, but they tend to have a significant impact on the organization. There are two primary reasons that make location decisions a highly important part of production systems design. One is that they entail long-term commitment, which makes mistakes difficult to overcome. The other is that location decisions often have an impact on operating costs (both fixed and variable) and revenues as well as on operations. Profit oriented organizations base their decisions on profit potential, while non profit organizations strive to achieve a balance between cost and the level of customer service they provide. The organizations will try to identify the best location available.

The location options for any organization are as follows:

1. Expanding the existing facility.
2. Add new locations while retaining existing ones, as is done in many retail stores.
3. Shut down one location and move to another.

FACTORS OF PLANT LOCATION:

a) Availability of Raw Material: Nearness to the place of the raw material will give advantage on the transportation cost, so that the profitability can be improved. When the raw material is heavy or is consumed in bulk. Then plant location has to be nearer to the raw material site.

b) Nearness to Market it reduces the cost of transportation as well as the chances of the finished products getting damaged and spoiled on the way, especially the perishable products. Moreover, a plant being nearer to the market can capture a big market share and can render quick service to the customers.

c) Transport Facilities: A lot of money is spent both in transporting the raw materials and the finished goods, depending upon the size of raw material and finished goods, a suitable method of transportation like road, rail, water or air is selected and accordingly the plant location is decided. One point which must be kept in mind is that the cost of transportation should remain fairly small in proportion to the total cost.

d) Availability of Labour : Stable labour force right kind, of adequate size and at reasonable rates with its proper attitude towards work are a few factors which govern plant location to a major extent.

e) Availability of Fuel and Power: The main sources of energy are electrical power, coal, oil, etc. in the case of power intensive industries like steel manufacturing units or continuous process industries like petrochemical and cement, the availability of fuel and power will be one of the major deciding factors in plant location.

f) Climate: Depending on the type of industry and the products that are being manufactured, this is a different factor. For instance, in the case of textile mills climatic conditions with adequate humidity is a basic essential criterion. That is the reason many textile mills have been put up in Bombay, Coimbatore region.

g) Water Availability: In industries like textile dying, paper or chemicals. The requirement of good quality water is one of the basic requirement for plant location. The water is required for processing or for effluent ejection into the rivers or specifically for waste disposal.

h) Government Policies: The central and state government may declare many taluks as backward and give numerous concessions like tax holiday, uninterrupted power supply,

capital subsidy, easy availability of loans, etc., for balanced development of regions in the country.

i) Land: Topography, area, the shape of the site, cost, drainage and other facilities, the probability of floods and earthquakes will influence the selection of the location,

j) Community Attitude: Industries like matches, crackers, hosiery and leather have flourished because of the positive attitude of the community towards these industries.

k) The presence of related industries will give many advantages like availability of skilled labourers, standard components.

l) Housing facilities.

m) Security.

n) Local by-laws, taxes, building restrictions

o) Existence of other service facilities like hospital marketing centres, schools, banks, post offices, clubs.

These factors, depending on the product to be manufactured or the industry may separately or collectively have to be given the required weightage. In the process, many alternatives may emerge. The management decision will be taken after weighing all the alternatives and selecting the best among them.

STEPS INVOLVED IN LOCATION DECISION:

- Identification of the location objectives through Vision and Mission statements of the organization.
- Enumeration of associated constraints
- Identify the relevant qualitative and quantitative decision criteria.
- Identify the relevant models from Break even analysis, Linear programming, Simulation, Economic cost analysis and Qualitative factor analysis.
- Design data capture method and capture data.
- Apply the selected model to evaluate the alternative.
- Select the location that satisfaction the criteria
- Locate the facility.

TECHNIQUES USED FOR FACILITY LOCATION

a. Industry Precedence –

- Basic Assumption : if the location is best for many companies in the same industry, then it holds good for a new company too.
- No need for conducting detailed location study.
- Location choice is subject to the "Principle of Precedence".

b. Preferential Factor

- Decision is dictated by Personal factor.
- Individual preference
- Not a professional approach; but widely used.

c. Dominant Factor

- Availability of raw material may be a dominant factor in case of Cement. Oil exploration, Mining industries.
- Contrast to preferential factor.
- Existence of good infrastructure and skilled personnel is a dominant factor for establishing IT companies.

For evaluating quantitative factors, the techniques used are:

- Total cost method
- Locational Break even analysis

For evaluating qualitative factors, the techniques used are:

- Factor Ranking
- Factor Weight Rating

LOCATIONAL BREAK EVEN ANALYSIS:

Locational break even analysis is a quantitative analysis. In this, the economic analysis of various location options are analyzed. This is similar to the Cost – Volume – Profit analysis carried out in the earlier chapter.

The locational break even analysis can be carried out using the following steps.

- Identify the number of locational alternatives available for establishing the facility.
- Determine the costs – Fixed and Variable – associated with each alternative.
- Calculate the total cost (TC) for each locational alternative.
- Consider Annual Production Volume on the x-axis and Annual Total cost on the Y-axis.
- Draw the total cost line for all the alternatives in the graph.
- Analyse and arrive at the quantity range suitable for each location.
- Decide on the location which meets the organizational requirements.

Factor Rating Method:

Location Factor Rating

The decision where to locate is based on many different types of information and inputs. There is no single model or technique that will select the "best" site from a group. However, techniques are available that help to organize site information and that can be used as a starting point for comparing different locations.

In the **location factor rating** system, factors that are important in the location decision are identified. Each factor is weighted from 0 to 1.00 to prioritize the factor and reflect its importance. A subjective score is assigned (usually between 0 and 100) to each factor based on its attractiveness compared with other locations, and the weighted scores are summed. Decisions typically will not be made based solely on these ratings, but they provide a good way to organize and rank factors.

EXAMPLE — Location Factor Rating

The Dynaco Manufacturing Company is going to build a new plant to manufacture ring bearings (used in automobiles and trucks). The site selection team is evaluating three sites, and they have scored the important factors for each as follows. They want to use these ratings to compare the locations.

		Scores (0 to 100)		
Location Factor	*Weight*	*Site 1*	*Site 2*	*Site 3*
Labor pool and climate	0.30	80	65	90
Proximity to suppliers	0.20	100	91	75
Wage rates	0.15	60	95	72
Community environment	0.15	75	80	80
Proximity to customers	0.10	65	90	95
Shipping modes	0.05	85	92	65
Air service	0.05	50	65	90

SOLUTION:

The weighted scores for each site are computed by multiplying the factor weights by the score for that factor. For example, the weighted score for "labor pool and climate" for site 1 is

$$(0.30)(80) = 24 \text{ points}$$

The weighted scores for each factor for each site and the total scores are summarized as follows:

	Weighted Scores		
Location Factor	*Site 1*	*Site 2*	*Site 3*
Labor pool and climate	24.00	19.50	27.00
Proximity to suppliers	20.00	18.20	15.00
Wage rates	9.00	14.25	10.80
Community environment	11.25	12.00	12.00
Proximity to customers	6.50	9.00	9.50
Shipping modes	4.25	4.60	3.25
Air service	2.50	3.25	4.50
Total score	77.50	80.80	82.05

Site 3 has the highest factor rating compared with the other locations; however, this evaluation would have to be used with other information, particularly a cost analysis, before making a decision.

COST FACTOR

In plant location, apart from the availability of technology, etc., the major deciding factor will be the cost of the final product. The ideal plant location is the one which result in lowest cost of production and distribution of the items in the market. For some production facilities, the basic necessity itself may be that it has to be located nearer to the market, that is, the facility has to be created in the urban area. For some others it can be located at remote rural areas. Cost is associated with each decision. Other than this, there are other advantages as well as disadvantages.

PROBLEM NO.1

The operations manager has obtained the following details from various sources. His job is to identify the optimal location for establishing the production facility.

S.No	Item	Site A	Site B	Site C
	A.Fixed Costs	Rs.	Rs.	Rs.
1.	Land	3,00,000	6,00,000	4,50,000
2.	Building	4,50,000	5,50,000	4,00,000
3.	Other Fixed costs	50,000	50,000	50,000
	B.Operating Cost/Year			
4.	Labour	6,00,000	5,00,000	5,20,000
5.	Transportation	2,20,000	1,80,000	2,00,000
6.	Power	60,000	75,000	50,000
7.	Fuel	20,000	25,000	18,000
8.	Water	3,000	8,000	5,0000
9.	Miscellaneous	50,000	75,000	60,000

The details on Insurance and taxes are :

Local tax on the fixed cost is 10%, 12% and 8% for Site – A,B and C respectively.

The insurance covers the fixed cost component and it is flat 15% for all the locations.

Solution: Total Fixed cost = (1+2+3) + Local tax + Insurance cost

Total Operating cost/year = (4+5+6+7+8+9)

Item	Site –A	Site – B	Site - C
Total Fixed Cost :			
(1+2+3)	8,00,000	12,00,000	9,00,000
Local Tax	80,000	1,44,000	72,000
Insurance	1,20,000	1,80,000	1,35,000
Total F.C	10,00,000	15,24,000	11,07,000
Total Operating Cost/Year	9,53,000	8,63,000	8,53,000
Grand total	19,53,000	23,87,000	19,60,000

Site A and C are competing with each other on the grand total cost.

Going by the calculations, Site – A is selected as the location with minimum cost.

A close look at the total fixed cost and total annual operating cost will give us more insight.

The fixed cost (one time expense) of Site – C is higher by 11.07%, whereas the annual operating cost is lower by 1 – [(8,53,000/9,53,000)]=10.5 percent.

This is a recurring reduction in the annual production cost of the organization. Hence, optimal location is Site – C.

PROBLEM NO – 2

An economic survey is conducted by a manager to identify a suitable location for his organization. Use the following cost data and decide on the location for establishing the facility.

QUANTITATIVE FACTORS COST OF	Location Cost (Rs.)		
	Urban	Semi Urban	Rural
Land	12,00,000	17,00,000	11,00,000
Building	1,00,00,000	1,12,00,000	1,00,00,000
Power	1,00,000	80,000	60,000
Water	50,000	70,000	60,000
Labour	25,00,000	20,00,000	15,00,000
Fuel	4,00,000	3,00,000	5,00,000
Raw Materials	14,00,000	15,00,000	17,00,000
Incoming Freight	6,00,000	5,00,000	8,00,000
Outgoing Freight	10,00,000	8,00,000	9,00,000
Cost	1,72,50,000	1,81,50,000	1,66,20,000
Taxes (% of cost)	10%	8%	5%
Total Project cost	1,89,75,000	1,96,02,000	1,74,51,000
Qualitative Factor			
Work Culture	Unionized	Party organized	Non organised
Established Infrastructure	Very good	Good	Average
Standard of living	Costly	Average	Moderate
Community attitude	Good	Average	Hostile

ANALYSIS:

The positive factors for the Rural location is the cost, which is the minimum at Rs. 1,74,51,000. Other positive factors are : Unorganised unions, moderate standard of living.

The negative factors are : hostile community attitude and average available infrastructure.

If the management has the capability to win over the community, Rural location is the host.

RATE OF RETURN METHOD (RoR)

The rate of return is the expected rate of return on the investment made on a specific location. It is computed as:

$$Rate of\ Return = \frac{Total\ Revenue - Total Expenses}{Gross Investment}$$

PROBLEM NO. 3

A company manufacturing chemical want to expand their capacity by establishing the production facility at a new location. Two locations and their details are presented below. Using these, identify the best location using the Rate of Return method.

S. No.	Item	Location – I	Location – II
1.	Capital investment	10,00,000	12,00,000
2.	Total Revenue/Year	13,00,000	17,00,000
3.	Raw material cost /year	3,00,000	3,75,000
4.	Labour Cost / year	4,00,000	4,25,000
5.	Sales and Distribution cost / year	70,000	1,15,000
6.	Annual Electricity cost	1,30,000	1,00,000
7.	Annual water supply cost	50,000	1,00,000
8.	Effluent treatment facility	Individual facilities	Common facilities

9.	Concentration of similar units	High	Very high

SOLUTION :

The total expense is calculated by adding the items C to G.

Total Expense of Location – 1 = Rs. 9,50,000

Total Expense of Location – 2 = Rs.11,50,000

$$Rate of\ Return(Location-1) = \frac{Rs.13,00,000 - Rs.9,50,000}{Rs.10,00,000}$$

$$Rate of\ Return(Location-2) = \frac{Rs.17,00,000 - Rs.11,50,000}{Rs.12,00,000}$$

$$= 45.8\%$$

It is advisable to locate the chemical unit in Location – 2 as it has:

1. High Rate of Return (45.8%)
2. Common effluent treatment facility, which is an important requirement for waste disposal and
3. Very high concentration of similar units will help to effectively handle pollution and community related issues.

PLANT LAYOUT

LAYOUT

- *Layout*: the configuration of departments, work centers, and equipment, with particular emphasis on movement of work (customers or materials) through the system
- Allocation of Space and the arrangement of machines and equipments in such a manner that overall operating costs are minimized.

Arrangement of various work centers, departments, equipments and support services too is the focus of layout. Specific emphasis on the flow of materials and movement of men in the organization is given while designing the layout. The flow patterns of the work activities affect the:

- Utilization of facilities
- Efficiency of materials handling
- Inventory at all stages viz., raw material, work-in progress and finished goods.
- Labour productivity
- The number of accidents in the factory
- Quality of the product and
- Quantum of production.

Decision on product design, facility location and capacity planning will affect the layout and vice – versa. Efforts to increase the capacity may involve modification in layout and changes in location. Any time, a new location is established or products or services are introduced or changed, layout is affected.

IMPORTANCE OF LAYOUT

Layout decisions are important on the following counts:

- Requires substantial investments of money and effort
- Involves long-term commitments
- Has significant impact on cost and efficiency of short-term operations
- It is a strategic decision
- Affects the cost structure of the product.

NEED FOR LAYOUT PLANNING

The need arises on two occasions – one while creating a new layout; and another while modifying the existing layout. There are valid reasons for redesigning the existing layout and they are:

- Frequent changes in scheduling
- Inefficient operations
- Pilling up of work-in-progress at each work centre.
- Numerous bottlenecks
- Idle time of equipments, machineries and material handling equipments.
- Labour productivity is low
- Low employee morale
- Changes in product or service design
- Introduction of new products or services
- Outdated technology
- Over-stretched equipment
- Increase in rework
- Scrap increase
- Changes in the environment or legal aspects.

OBJECTIVES OF GOOD PLANT LAYOUT

a. Economies of materials - Overall simplification of production process in terms of

- Equipment utlisation
- Minimization of delays
- Reducing manufacturing time
- Better provision for maintenance.

b. Overall integration of men, materials, machinery, supporting activities and any other consideration which may give a better compromise.

c. Provision for MH equipments and other basic amenities to minimize material handling cost.

d. Floor space saving

- Effective space utilization

- Less congestion and confusion

e. Continuous Production for Increased output and reduced work-in-progress.

f. Provision for better supervision and control

g.Better working environment - To provide safety

h. Workers convenience

- Worker / Job satisfaction
- Improved morale.

i. Waste minimization and higher usage

j. avoid unnecessary capital investment

k. Higher flexibility and adaptability to changing conditions

l. To improve production process to and reduced production cycle time and get better product quality

m. Proper utilization of cubic space.

PRINCIPLES OF LAYOUT

The basic principles or plant layout is as follows:

- Continuous Flow
- Avoid Back tracking
- Cubic Space utilization
- Flexibility
- Minimise Material Handling
- Use of Gravity to minimise MH costs

The total movement of material should be minimum. For this, one has to consider the movement distances between different work areas as well as the number of times such movements occur per unit period of time.

The arrangement of the work area should have as much congruence as possible with the flow of materials within the plant (from the stage of raw materials to the stage of finished goods). By 'flow' it was not meant a particular straight line direction, but the different stages through which the material passes before it becomes a finished product. The stages at which value is added to the product and the sequence of the work areas should correspond with each other, as much as possible.

In effect, there should be no back-tracking and very little interruption in the flow of the product from the raw materials stage to the finished product.

A good layout should take into consideration all the three dimensions of space available. In addition to the floor space, the vertical space available should also be taken into account while designing the work areas.

The layout should be adaptable or flexible enough to allow for probable changes in the future as all systems should anticipate changes in the future.

The layout should ensure adequate safety and satisfactory working conditions for the employees.

A good layout has to satisfy, therefore, the availability of space, the size and work area requirements of machinery and other utilities, the flow direction, type and number of movements of the material, the men working in the plant, and also the future anticipated changes. The principle is one of integrating all these aspects.

TYPES OF LAYOUT

The layout design can be carried out on the basis of:

- Work flow.
- The function of the production system.

CLASSIFICATION BY WORK FLOW:

There are four basic types of layout based on the work flow format and they are :

- Product layout
- Process layout
- Combination layout
- Fixed position layout
- Cellular layout

PRODUCT LAYOUT

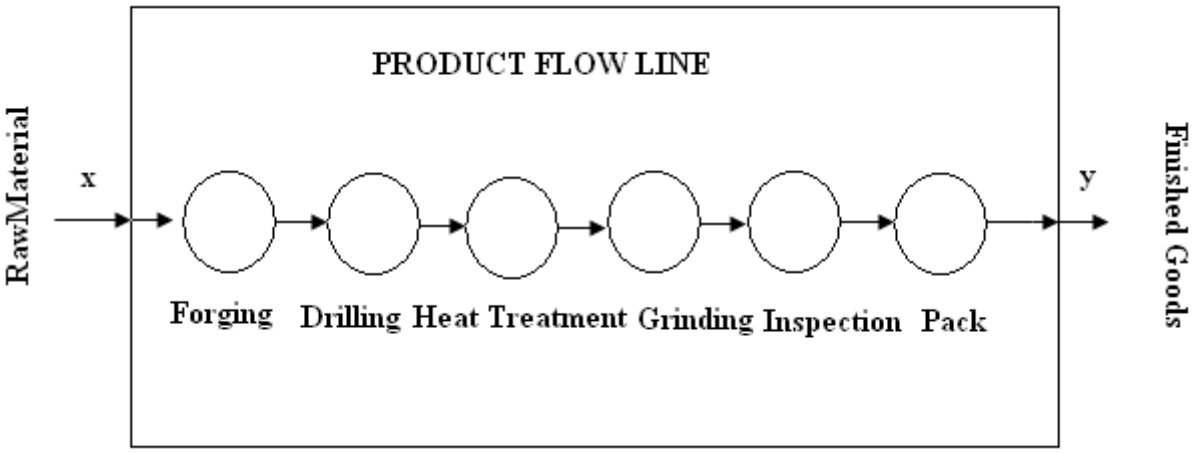
Arrangement of machines according to the sequence involved in manufacturing a product from the Input stage to the Output stage is called a Product layout or Line layout. The flow is an unbroken line from raw material to the finished goods. It is a Layout that uses standardized processing operations to achieve smooth, rapid, high-volume flow.

Example : Automobile Manufacturing, Food Processing.

The product layout is preferred under situations where it is required to achieve a smooth and rapid flow of large of volume of products (in the case of goods production) and customer (in case of services) through a system. This layout is ideal for product focused systems.

The highly standardized product or service which requires highly standardized, respective processing operations uses this type of layout. In the product layout, only one product or one type of product is produced in the specified place or shop floor.

If a product is assembled in the product layout, it is called as an Assembly line.



Product Layout

The raw materials enter from one end (x) and value addition takes place at each and every stage of the operations. Finally it comes out of the shop floor(y) as finished goods. Then it is moved over to the market directly or to the storage yard.

Product layouts are suitable for manufacturing products having the following characteristics:

- High volume of production
- Quick cycle time of manufacturing

- Standardisation of product
- Reasonably stable product demand
- Less variety

Advantages of Product Layout

- High rate of output
- Low unit cost
- Labor specialization
- Low material handling cost
- High utilization of labor and equipment
- Established routing and scheduling
- Routine accounting and purchasing

Disadvantages of Product Layout

- Creates dull, repetitive jobs
- Poorly skilled workers may not maintain equipment or quality of output
- Fairly inflexible to changes in volume
- Highly susceptible to shutdowns
- Needs preventive maintenance
- Individual incentive plans are impractical

PROCESS LAYOUT

Arranging machines performing similar functions or process together in particular place to enhance variety of operation is called Process Layout or Functional Layout. The layout can handle varied processing requirements.

Example : Job shops, Hospitals, Departmental Stores.

The process layout is developed for process focused systems. These layouts are designed to accommodate various products or services that uses all or few of the processes available in the shop floor. The processing units are organized by functions into each department on the assumptions that

certain skills and facilities are available in each department. Similar equipments and operations are grouped together. For example, turning, milling, foundry and heat treatment.

Product or services which requires all or few of these operations are converted into batches and moved in. The sequences of operations are not a straight line as in product layout; but zig zag. This is dictated by technical considerations. Different products may call for different processing requirements and their equipments. The use of general purpose machines provide flexibility necessary to handle a wide range of processing requirements. Workers who operate the equipments are usually skilled or semi-skilled.

Advantages of Process Layouts

- Can handle a variety of processing requirements
- Not particularly vulnerable to equipment failures
- Equipment used is less costly
- Possible to use individual incentive plans

Disadvantages of Process Layouts

- In-process inventory costs can be high
- Challenging routing and scheduling
- Equipment utilization rates are low
- Material handling slow and inefficient
- Complexities often reduce span of supervision
- Special attention for each product or customer
- Accounting and purchasing are more involved

FIXED POSITION LAYOUT

This is a type of layout in which the product, by virtue of its bulk or weight, remains at one location. The required equipments and machineries are moved to the work spot and the conversion process is carried out. This layout is characterized by a fixed facility that is designed to turn out more than one of a given product.

Examples: Ship building, Aircraft Assembly.

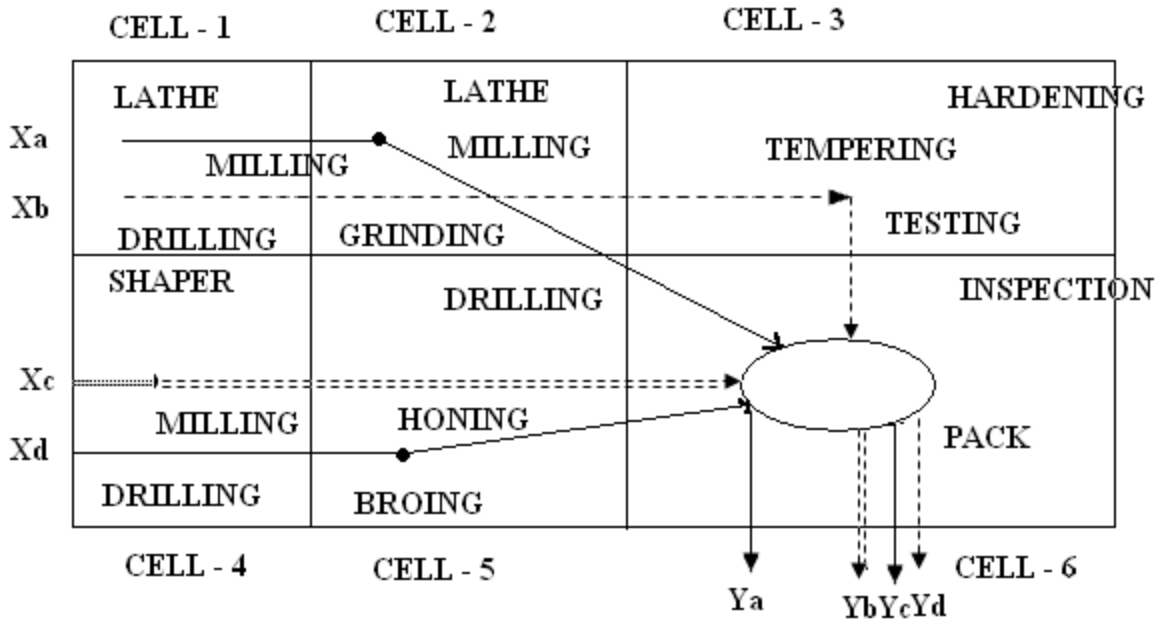
CELLULAR LAYOUT

This is a layout that derives the advantages of both product and process layouts. Interlinked processing facilities required for certain group of products are coupled together and brought under a 'cell'. There will be many cells in this layout.

Example : Custom built job shops, Specialty hospitals, Beauty Parlours.

Consider the layout in the figure below. It consists of six cells, Each cell is clubbed with the frequency used adjacent facilities. Cell- 1 consists of turning, mining and drilling facilities; Cell -2 has turning grinding and milling facilities and so on. Cell -6 is a common inspection and packing facilities.

The cellular layout is a layout that tries to derive the advantage of both product and process layout.



Cellular Layout

CELLULAR LAYOUT: ADVANTAGES

- Suitable for mass production also.
- Higher degree of flexibility than product layout in handling variety of products.
- Employs high degree of automation, but still posses flexibility.
- Can serve a fluctuating market demand.
- Better supervision and control.

- Skill requirement is skewed towards specialization.
- Capacity utilization is between product and process layouts.

GROUP TECHNOLOGY

The grouping into part families of items with similar design or manufacturing characteristics.

COMPARISION OF LAYOUTS

S.No	Item	Product Layout	Process Layout	Cellular Layout
1	Orientation	Product	Process	Process in cells
2	Product	Standardized Large volume Fixed rate of production	Diversified products Facility sharing Output varies with product Rate of output varies Flexible	Limited standardization Diverse product
3	Mfg. flexibility	Inflexible	Flexible	Highly flexible
4	Capital required	Large	Moderate	In between process and product layout
5	Type of equipments	Special purpose machines Sophisticated process Dedicated	General purpose machines Shared facilities	Combination of special and general purpose machines Sharing of facilities is of higher order.
6	Workflow	Straight line flow Repeated operation One or few setups	Zig-zag work flow Varied sequence of operations Very frequent set-ups	Zig –zag, but to a limited extent Limited sequence of operations Moderate number of set ups
7	Operation cycle time	Least	High	Moderate
8	Inventory	Very low	High	Moderate
9	Product cost	Low	High	Moderate
10	Human Skill	Specialized	Generalized	Mostly generalized, little amount of specialization is needed
11	Capacity	Very high	Moderate	Low
12	Material Handling	Automated Predictable	Less automation Unpredictable	Moderate level of automation within the

		In lots of large volume	One or few	cells Few
13	Maintenanc e	Preventive	Breakdown	Planned
14	Support staff	Large in number Highly specialized skills	Few in number General skills	Moderate in number Slightly specialised skills

LAYOUT DESIGN PROCEDURE

The layout design is based on the factors discussed above. Once we have those information we use different tools and techniques for layout.

Tools and Techniques of layout

- Process Charts – OPC & FPC
- Process flow diagram
- Machine datacard
- Visualisation of layout

– Two dimensional plan

-Three dimensional plan

- Computer softwares like CORELAP, CAN-Q.

LAYOUT DESIGN PROCEDURE

1. Statement of specific objectives, scope and factors to be considered.
2. Collection of basic data on sales forecast and production volumes, production schedules, part lists, operations to be performed and their sequences, work measurement, existing layouts, building drawings.
3. Preparation of various kinds of charts such as flow process charts, flow diagram, string diagram, templates etc.
4. Designing the production process.
5. Planning the material flow pattern and developing the overall material handling plan.
6. Calculation of requirement of work centers and equipments.

7. Planning individual work centers.
8. Selection of material handling cost.
9. Determine the storage requirements.
10. Planning the auxiliary and service facilities.
11. Determination of routing, space requirements for each work station and service department, employee facilities etc.,
12. Draw building specification to fit requirements of the layout.
13. Preparation of floor plan
14. Preparation of tentative or draft layout plans.
15. Preparation of work schedule for installation of layouts.
16. Preparation detail layout drawing and get approval of the top management.

CELLULAR MANUFACTURING

Cellular Manufacturing (CM) refers to a manufacturing system wherein the equipment and workstations are arranged in an efficient sequence that allows a continuous and smooth movement of inventories and materials to produce products from start to finish in a single process flow, while incurring minimal transport or waiting time, or any delay for that matter. CM is an important ingredient of lean manufacturing.

Work Cell: The single process flow set-up described is a 'work cell'. A work cell is defined as a collection of equipment and workstations arranged in a single area that allows a product or group of similar products to be processed completely from start to finish. It is, in essence, a self-contained mini-production line that caters to a group of products that undergo the same production process.

Benefits of Cellular Manufacturing

- higher production efficiency
- elimination of waste
- reduced inventory levels
- optimized use of floor space
- shorter production cycle times
- higher effective manufacturing capacity &

- improved customer response time.

LINE BALANCING

The process of assigning tasks to work stations in such a way that the workstations have approximately equal time requirements is referred to as line balancing. An assembly line should be balanced. Each work station in the assembly line should have the same operating time and the various operations should be sequenced properly. There should be perfect balance between the output rates of the parts and the subassemblies. However, it is not always possible that the parts reach in a steady stream immediately before subassembly. This may be because of the limitations as regards materials, me and equipments or it may be economical to manufacture and supply parts in batches. The flow control section has to cope with such situations and thus carry big inventories and arrange facilities for storage.

Line balancing minimizes the idle time along the line and results in high utilization of labour and equipment. Lines that are perfectly balanced will have a smooth flow of work as activities along the line are synchronized to achieve higher efficiency.

Steps involved in assembly line balancing:

1. **Draw the precedence diagram**:- It is a precedence diagram which virtually portrays the tasks that are to be performed along with the sequential requirements, that is, the order in which each task must be performed. The diagram is read from left to right, so that the initial tasks are on the left and the final tasks are on the right.
2. **Determine the Cycle Time**:- The cycle time is the maximum time allowed at each work station to perform the assigned tasks before the work moves on. The cycle time also establishes the output rate of the line.

   $$\text{Cycle time} = \frac{\text{Operating time avialabe per day}}{\text{Desired output rate}} = \frac{OT}{D}$$

3. **Determine the theoretical number of workstations**:- The number of workstations needed is a function of the desired output rate and our ability to combine all elemental tasks into the workstations. We ca determine the same as follows:

Theoretical minimum no. of Workstations

= Sum of task Times = ∑t / CT

Cycle time

4. **Perform the balancing**:

   a. Make assignments to workstations in order, beginning with station 1. Task are assigned to workstations moving from left to right through the precedence diagram.

   b. Before each assignment, use the following criteria to determine which tasks are eligible to be assigned to a workstation.

      (i) All preceding tasks in the sequence have been assigned.

      (ii) The task time does not exceed the time remaining at the workstation.

      (iii) If no task are eligible move on to the next workstation.

   c. After each assignment, determine the time remaining at the current workstation by subtracting the sum of times for tasks already assigned to it from the cycle time.

   d. Break ties that occur using one of these rules:

      (i) Assign task with the longest task time first.
      (ii) Assign the task with the greatest number of followers.
      (iii) If there is still tie, choose one task arbitrarily.

   e. Continue until all tasks have been assigned to workstations.

5. **Calculate the Efficiency of the line and the percentage of idle time or balance delay**.

   Percentage of idle time

   = Total idle time of all workstations x 100

   Actual no. of Workstation x Cycle time

   Efficiency = 100 – percentage of idle time.

MATERIAL REQUIREMENT PLANNING:=

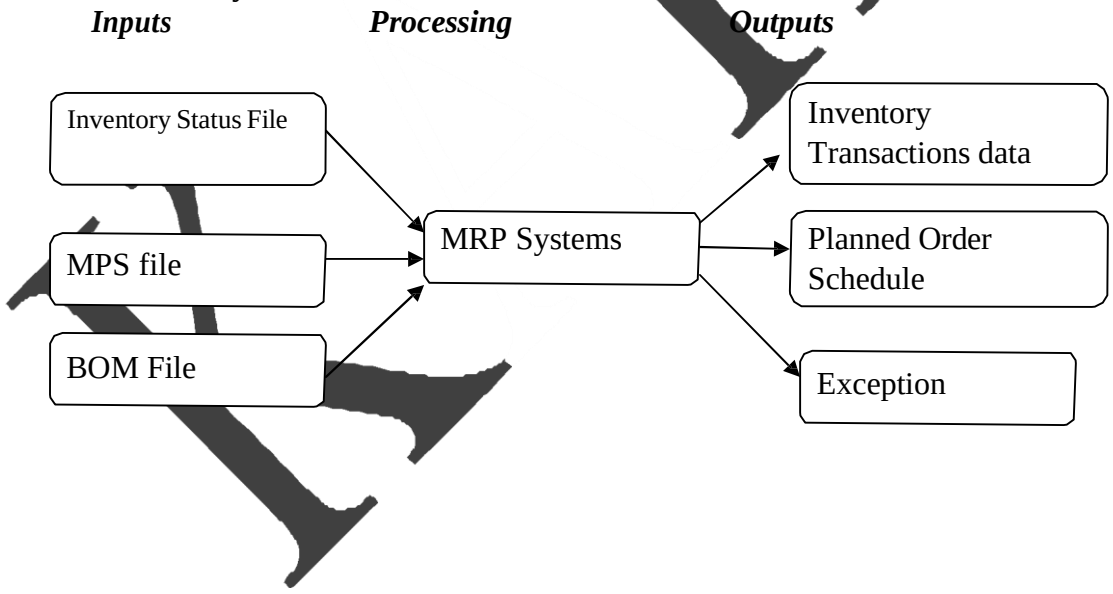
The basic inputs for MRP

1. Product structure or Bill of Materials (BOM)
2. MPS for the final assembly
3. Economic order quantity
4. Beginning inventory

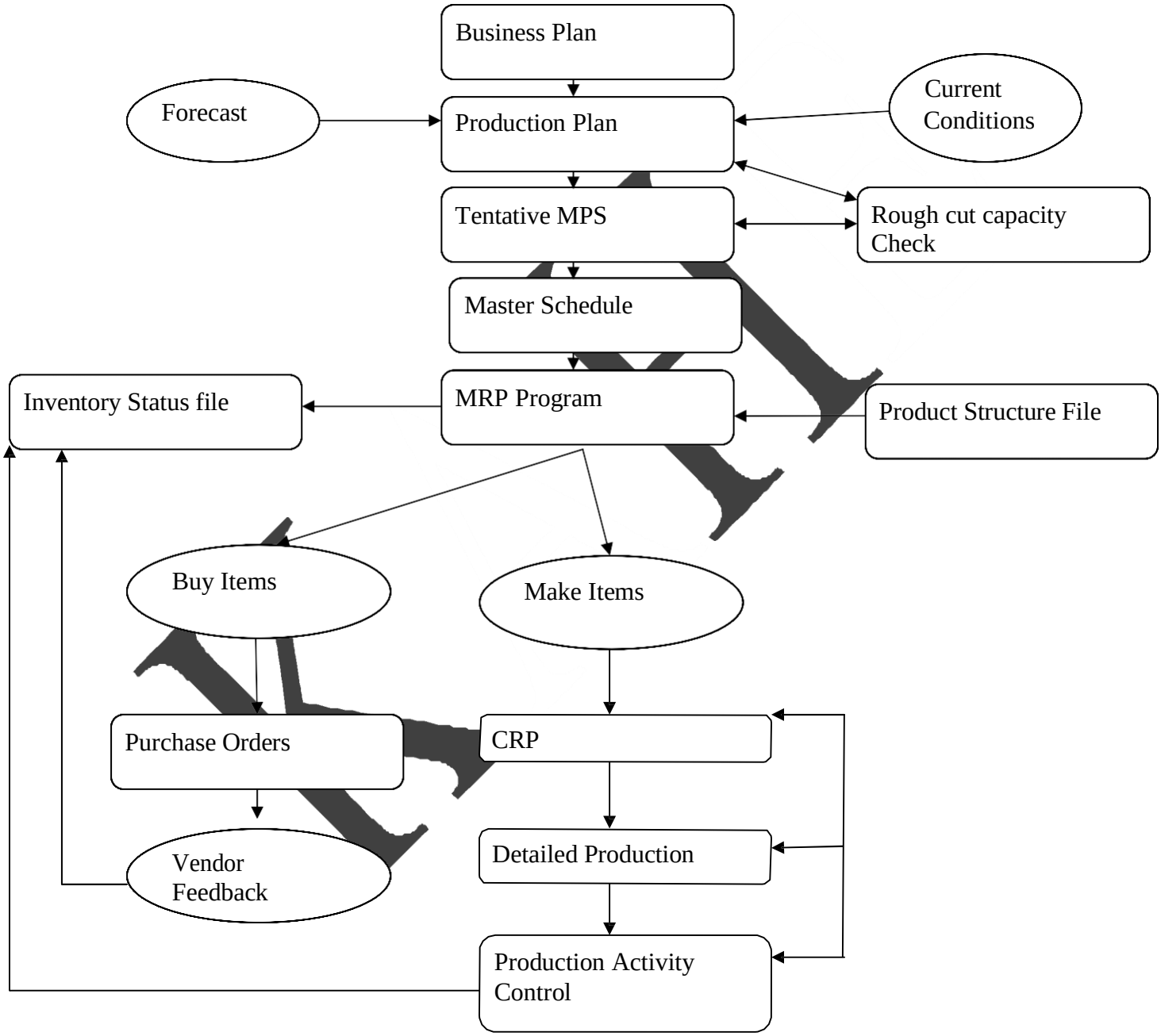
BILL OF MATERIALS:

- List of components, ingredients, and materials needed to make product
- Provides product structure
- Items above given level are called parents
- Items below given level are called children

Operations of MRP System



Information flow for Planning and controlling with MRP



Manufacturing Resource Planning (MRP-II)

- Successor to the material requirements planning (MRP), it integrates planning of all aspects (not just production) of a manufacturing firm.
- MRP-II includes functions such as business planning, production planning and scheduling, capacity requirement planning, job costing, financial management and forecasting, order processing, shop floor control, time and attendance, performance measurement, and sales and operations planning.
- Goal: Plan and monitor all resources of a manufacturing firm (closed loop):
- Manufacturing
- Marketing
- Finance
- Engineering
- Simulate the manufacturing system

Enterprise Resource Planning:

- Enterprise Resource Planning Systems is a computer system that integrates application programs in accounting, sales, manufacturing, and other functions in the firm
- This integration is accomplished through a database shared by all the application programs
- An extension of the MRP system to tie in customers and suppliers
  - Allows automation and integration of many business processes
  - Shares common data bases and business practices
  - Produces information in real time
- Coordinates business from supplier evaluation to customer invoicing
- ERP modules include
  - Basic MRP
  - Finance
  - Human resources

- Supply chain management (SCM)
- Customer relationship management (CRM)

- ERP can be highly customized to meet specific business requirements
- Enterprise application integration software (EAI) allows ERP systems to be integrated with
  - Warehouse management
  - Logistics
  - Electronic catalogs
  - Quality management
- ERP systems have the potential to
  - Reduce transaction costs
  - Increase the speed and accuracy of information
- Facilitates a strategic emphasis on JIT systems and integration

Advantages of ERP Systems:

1. Provides integration of the supply chain, production, and administration
2. Creates commonality of databases
3. Can incorporate improved best processes
4. Increases communication and collaboration between business units and sites
5. Has an off-the-shelf software database
6. May provide a strategic advantage

Disadvantages of ERP Systems

1. Is very expensive to purchase and even more so to customize
2. Implementation may require major changes in the company and its processes

3. Is so complex that many companies cannot adjust to it
4. Involves an ongoing, possibly never completed, process for implementation
5. Expertise is limited with ongoing staffing problem.

MAINTENANCE MANAGEMENT

- ✓ It is necessary to keep materials, tools and equipment in good condition in order to achieve desired result.
- ✓ If the working equipments are in good running condition, the products obtained will be of required quality and the process will be reliable. Therefore it is necessary to maintain the plant.
- ✓ **Set of organized activities that are carried out in order to keep the item in its best operational condition with minimum cost required**

Objectives of Maintenance Management:

1. To increase functional reliability of production facilities.
2. To enable desired quality through correctly adjusted, serviced and operated equipments
3. To maximize the useful life of equipments.
4. To minimize cost of production.
5. To minimize frequency of interruptions.
6. To enhance the safety of manpower.

Need for Maintenance Management:

1. Dependability of service
2. Assured quality
3. Prevent equipment failure Cost control
4. Huge investment in equipment

Functions of Maintenance Management:

1. Inspection.
2. Repair.
3. Overhaul.
4. Lubrication.

5. Salvage.

Equipment Life Cycle or Bath Tub Curve:

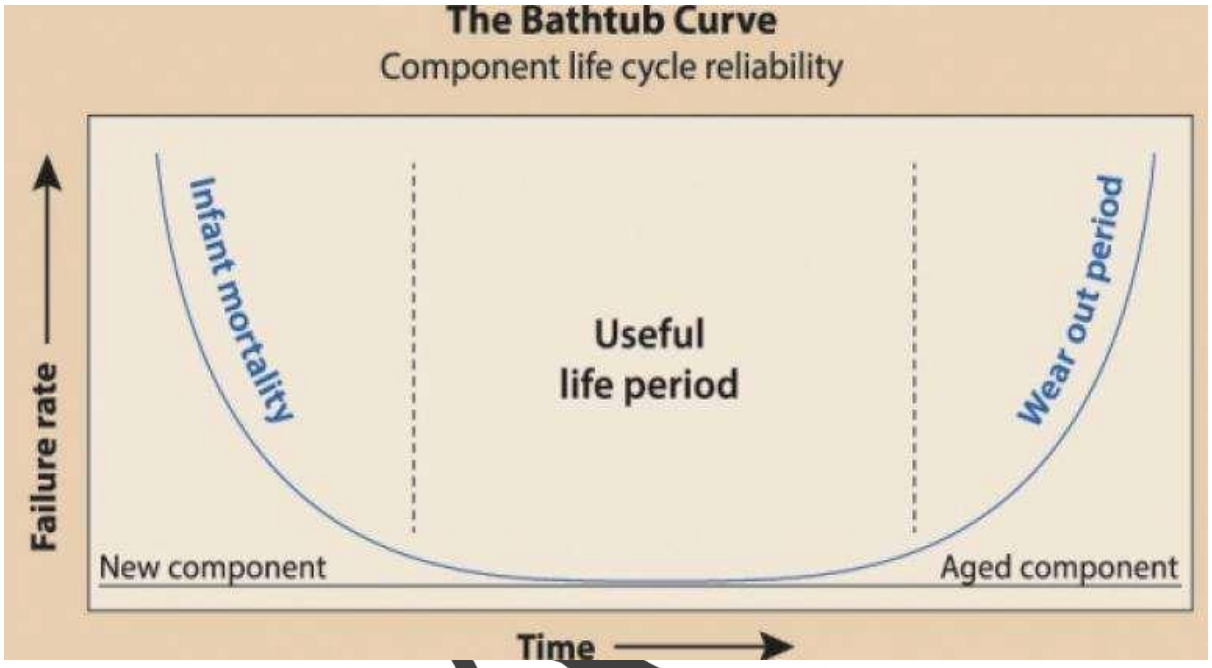


Figure: Equipment Life cycle- Maintenance Management

The **bathtub curve** is widely used in reliability engineering. It describes a particular form of the hazard function which comprises three parts:

- The first part is a decreasing failure rate, known as early failures.
- The second part is a constant failure rate, known as random failures.
- The third part is an increasing failure rate, known as wear-out failures.

The name is derived from the cross-sectional shape of a bathtub: steep sides and a flat bottom.

The bathtub curve is generated by mapping the rate of early **"infant mortality"** failures when first introduced, the rate of random failures with constant failure rate during its **"useful life"**, and finally the rate of **"wear out"** failures as the product exceeds its design lifetime.

In less technical terms, in the early life of a product adhering to the bathtub curve, the failure rate is high but rapidly decreasing as defective products are identified and discarded, and early sources of potential failure such as handling and installation error are surmounted. In the mid-life of a product—generally speaking for consumer products—the failure rate is low and constant. In the late life of the product, the failure rate increases, as age and wear take their toll on the product. Many consumer product life cycles strongly exhibit the bathtub curve.

While the bathtub curve is useful, not every product or system follows a bathtub curve hazard function, for example if units are retired or have decreased use during or before the onset of the wear-out period, they will show fewer failures per unit calendar time (not per unit use time) than the bathtub curve.

Measures of Maintenance Performance:

MTBF and MTTR:

- MTBF, or Mean Time between Failures, is a metric that concerns the average time elapseed between a failure and the next time it occurs. These lapses of time can be calculated by using a formula.
- Whereas the MTTR, or Mean Time To Repair, is the time it takes to run a repair after the occurrence of the failure. That is, it is the time spent during the intervention in a given process.

Overall Equipment Efficiency (O.E.E)

O.E.E. = Up time % X Speed % X Quality %

Up time = (MTBF-MTTR) X 100

MTBF- Mean Time between Failures

MTBF = Total Running Time/No.of. Failures

$$\text{Speed \% efficiency} = \frac{\text{Actual cycle time X 100}}{\text{Design Cycle time}}$$

$$\text{Quality \% Efficiency} = \frac{\text{Good Parts Produced X 100}}{\text{Total Parts Produced}}$$

- Mean Time between Failures and Mean Time To Repair are two important KPI's in plant maintenance management and lean manufacturing.

- Mean Time between Failures = (Total up time) / (number of breakdowns)
- Mean Time To Repair = (Total down time) / (number of breakdowns)
- "Mean Time" means, statistically, the average time.
- "Mean Time between Failures" is literally the average time elapsed from one failure to the next. Usually people think of it as the average time that something works until it fails and needs to be repaired (again). As reliable production processes are crucial in a Lean Manufacturing environment, MTBF is vital for all lean initiatives
- "Mean Time To Repair" is the average time that it takes to repair something after a failure.
- For something that cannot be repaired, the correct term is "Mean Time To Failure" (MTTF). Some would define MTBF – for repair-able devices – as the sum of MTTF plus MTTR. .In other words, the mean time between failures is the time from one failure to another. This distinction is important if the repair time is a significant fraction of MTTF.
- Here is an example. A light bulb in a chandelier is not repairable, so MTTF is most appropriate. (The light bulb will be replaced). The MTTF might be 10,000 hours.
- On the other hand, without oil changes, an automobile's engine may fail after 150 hours of highway driving – that is the MTTF. Assuming 6 hours to remove and replace the engine (MTTR), Mean Time between Failures is 150 hours.
- Like automobiles, most manufacturing equipment will be repaired, rather than replaced after a failure, so Mean Time between Failures is the more appropriate measurement.

What is Availability?

- The "availability" of a device is, mathematically, MTBF / (MTBF + MTTR) for scheduled working time.
- The automobile in the earlier example is available for 150/156 = 96.2% of the time. The repair is unscheduled down time.
- With an unscheduled half-hour oil change every 50 hours – when a dashboard indicator alerts the driver – availability would increase to 50/50.5 = 99%.
- If oil changes were properly scheduled as a maintenance activity, then availability would be 100%.

Part A- (ONE Mark)
Multiple Choice Questions

Part B- (TWO Marks)

1. What is the importance of Plant Location decision?
2. Define Plant layout.
3. What are the different types of layout?
4. Define Cellular manufacturing System.
5. Define Cycle time.
6. What do you mean by heuristic rule?
7. What is meant by Assembly Line Balancing?
8. List out the objectives of facility location.
9. List out the benefits of good layout.
10. What is cellular layout?
11. What is Material Requirement Planning?
12. What are the inputs and outputs required by MRP processing logic?
13. What is BOM?
14. Define MTBF?
15. What is MTTR?
16. What is Availability?
17. What is Maintenance Management?
18. List out the need of maintenance Management.
19. Draw the Bath tub curve of Maintenance Management.
20. List out the advantages of ERP.
21. Define ERP?
22. What do you understand by Master Production Schedule?

23. What is the importance of ERP in today's organisation?
24. What are the inputs to MRP?
25. Define MRP?
26. What is meant by Bill of Materials? Give example.

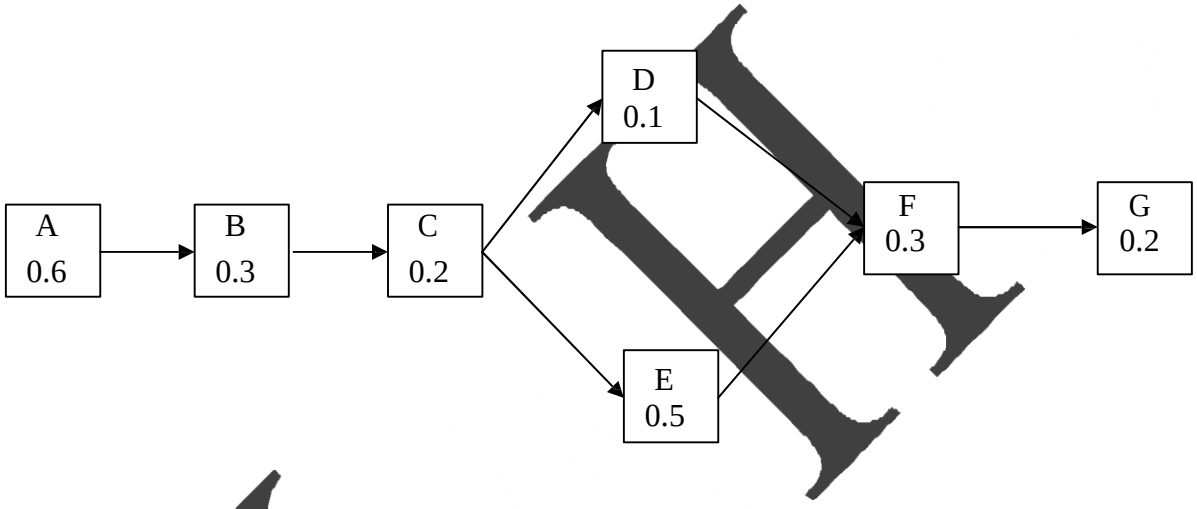
Part C- 5 Marks

1. Explain the factors affecting the plant location decision in detail.
2. 120 Pizzas are to be produced per night. Tasty Restaurant works from 16.00 hrs to 01.00 hrs. Given the following set of tasks and their relationship may a balanced the assembly line. Calculate the Cycle time, idle time, number of work station and balanced efficiency.

Task	A	B	C	D	E	F
Immediate Predecessors Task	-	A	A	B,C	D	E
Duration (hrs)	2	1	2	3	3	3

3. Explain the different types of layout with suitable examples. Also discuss their advantages and disadvantages. (Draw neat diagrams wherever required)
4. What is meant by Assembly Line balancing? Define cycle time and explain its various implications.
5. Discuss the merits and demerits of Process layout and Product Layout.
6. Ram Lal Ltd is considering the two location options for locating new cloths manufacturing Chennai and Bangalore. The company has existing facility Hyderabad which gauges at the market of Southern part of country. The new plant will cater to other parts of country. The company estimates the fixed cost and variable cost Chennai for facilitate Rs. 2 million and Rs. 30 /Cloths respectively. On the other hand Bangalore the fixed cost and variable cost are estimated at Rs. 1.8 million and Rs. 40 /cloth respectively. A cloth manufacturer in Chennai can be sold at Rs. 100/- and same cloth manufacturer in Bangalore can be sold Rs. 120/- The management of company choose that location option for few facilitates at which breakeven lower. Which option company chooses according to criteria.
7. Give the general format of an MRP report using a hypothetical example.
8. Explain the various methods of determining the order size in MRP?

9. Elucidate the business application of ERP.
10. What is MRP? What are the inputs and outputs required by the MRP processing logic?
11. What is ERP? Elucidate the steps in ERP implementation?
12. Explain the equipment life cycle of Maintenance Management.
13. The precedence diagram for assembly activities from "A" to "G" is shown with element time requirement shown in minutes. The line operates 7 hrs/day. An output of 600 units/day is decided. Compute: (a) Cycle time (b) Theoretical minimum number of workers (c) Balance efficiency



Part D Case Study : **11 Marks**

The 'dream car' project of Ratan Tata, the Chairman of one of India's largest and most respected business conglomerates is located in West Bengal. In 2005-06 the group had revenues of US$21.9 billion—the equivalent of about 2.8 per cent of the country's GDP—and a market capitalization of US$46.9 billion. Tata dreams to create a car to be sold in the Indian markets with a price tag of Rs 100,000. The car will have a Euro IV compliant 700 cc petrol engine, a suspension, and a steering system designed for its size. Targeting the burgeoning middle-class, Tata Motors plans to roll out its car in the next three years by using a low-cost assembly operation. The car will be smaller compared to most existing cars on the road and will be produced in larger volumes, with all the high-volume parts manufactured in one plant. The other cost-cutting measures relate to intensive use of plastics on the body of the car and eliminating dealer margin. The group is looking at a very low-cost assembly operation and the use of modern-day adhesives instead of welding. There are some issues concerning

safety, mainly because of the car's modest size, but Tatas are determined to resolve them before the car reaches the market. In view of the socio-economic dimension in manufacturing the car, the company is looking at small satellite units, with very low break- even points, where the cars would be assembled, sold, and serviced. Tatas are planning to encourage local entrepreneurs to invest in these units, and to train these entrepreneurs to assemble the fully knocked-down or semi-knocked-down components that Tatas would send. These entrepreneurs would also sell and service the assembled vehicles. This approach would replace the dealer, and, therefore, the dealer's margin. It will lead to an assembly-cum-retail operation that would be combined with very low-cost service facilities.

During early 2006, Tatas started scouting for a good location for their dream car plant. The three states initially looking lucrative for the location were—Karnataka, West Bengal, and Uttaranchal. Dharwad in Karnataka had the advantage of geographic location, being located between Bangalore and Pune (where Tatas have major facilities). The Karnataka government also offered water and power tariff sops and agreed to Tata's proposed move to build a township near the scheduled facility. The West Bengal government, which is currently in an industrialization drive in the state, enticed the Tatas with various subsidies and sops. It tried to convince Tatas to set up the factory in the backward district of West Midnapore near Kharagpur. In today's competitive environment, the car Tatas would be manufacturing would be the cheapest car available in the country, and the task they have undertaken is very challenging. Hence, they have taken into consideration all aspects, including logistics. Since the price factor is so important in this project, the choice of location is very critical. Apart from the availability of proper infrastructure and skilled labour, the company has to take into consideration social infrastructure such as proximity of educational institutions for the children of its employees. Out of the six different places offered by the West Bengal government, the company found Singur, about 50 kilometres north-west of Kolkata to be the most suitable.

If a particular company wants a big chunk of land for setting up a large plant, it is not possible for it to purchase land from each and every farmer. This is particularly true in West Bengal where fragmentation of land is very high. The state government came forward to acquire the land for the project. When the opposition raised issues against it, the government gave the justification that it is for a public purpose. According to the government, industrialization means employment generation

and development of society. The entire people of the state will be benefited from the new project. Therefore, the land acquisition was in public interest.

Setting a healthy precedent, the West Bengal government agreed to pay compensation to farmers for acquiring their land at a generous rate—almost 150 per cent more than the prevailing market price. This was much more than what most other state governments had ordained as the price to be paid for acquiring land from farmers for setting up industries or special economic zones. For instance, owners of single-crop land in Singur got Rs 840,000 per acre and Rs 1 .2 million an acre if the land was used for double-cropping, while in Maharashtra, farmers got only Rs 24,000 an acre. However, this comparison may not be appropriate.

The land in Singur has a greater market value as it is close to the National Highway No. 2, connecting Kolkata with Delhi, and the land in question in Maharashtra may not enjoy a similar advantage. Yet, it has to be conceded that the compensation package decided by the West Bengal government is generous and an important factor in convincing over 9,000 land-owners at Singur (over 94 per cent of the total land to be acquired). These farmers have agreed to the deal and have already received their compensation money from the state government. Land acquisition in Singur has been completed and the land has been handed over to the West Bengal Industrial Development Corporation (WBI DC). Now WBIDC is the owner of the land. Till 2 December 2006, Rs 766.4 million has been disbursed as compensation to the farmers who have lost their land. Around 9,020 farmers have received compensation for 635 acres of land. Eighty-eight recorded bargadars (sharecroppers) have already received a payment of Rs 1 .7 million and the number of persons yet to receive payment, till 2 December 2006, was around 3,000.

Another allegation by the opposition against the State government is that land acquired for a private enterprise cannot be considered a public purpose. It is further alleged that the acquisition of land has not followed the established procedure of the company making advance payment.

Thirdly, there is a perception that the Tata small car project has acquired land far in excess of what it actually requires to set up a factory of that capacity. Maruti Udyog is situated in a total land area of 300 acres and has an installed capacity of 3,50,000 cars a year. The Singur land being handed over to the Tatas is three times more than what Maruti Udyog has and that too for producing only 1,00,000 cars. The question in everyone's mind is why the Tatas need 997 acres of land and whether there are

other facilities that are being planned in that same area. Due to such issues, questions on the justification of allocating the Singur land to the Tatas will continue to be raised.

Agitations against the project started immediately after the fencing of the land was done. Singur's uneasy peace was shattered during early February 2007 as pro-farmland forces clashed with the police in phases throughout the day. It was a grim reminder of the fact that the Tatas' problems there are still far from over. The state government received an unequivocal support by Ratan Tata, who has said his group will not move out of West Bengal. Tata Motors has also proposed a weekly forum meeting where farmers meet company executives and clear doubts.

Some of the opposition parties are still not satisfied and are not restricting their agitation only to Singur.

Questions:

Q1. Why did Tatas prefer to locate their 'dream car' plant at Singur, West Bengal despite other equally good options such as Dharwad and Uttaranchal?

Q2. How do you think the problems at Singur can be amicably resolved by Tatas for earliest construction of their plant?

KARPAGAM ACADEMY OF HIGHER EDUCATION, COIMBATORE						
DEPARTMENT OF MANAGMENET						
Unit 2- Facility Location, Layout, Material Handling and Maintenance Management- Multiple Choice Questions- Each Question carries ONE Mark						
SI.NO	**Question**	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Answer**
1	Product layout is preferably used for _____ .	Repetitive processing	Intermittent processing	Quantitative processing	Qualitative Processing	Repetitive processing
2	The most significant advantage of U-shaped layout is	Cost minimization	Easy handling of process	Increased flexibility in work	Profit maximization	Increased flexibility in work
3	Location decisions are viewed primarily as part of	marketing strategy	growth factors	financial aspect	both (a) and (b)	both (a) and (b)
4	Which of these layouts is most suitable for processing sugar from sugar beets or sugar cane?	Process-oriented layout	Fixed-position layout	Focused factory	Product-oriented layout	Process-oriented layout
5	Process layout is used for _____ .	Repetitive processing	Intermittent processing	Quantitative processing	Qualitative Processing	Repetitive processing

6	When the flow of materials is variable	line balancing is most suitable	layout by product is most suitable	layout by fixed position is most suitable	layout by process is most suitable	layout by process is most suitable
7	Mass customization uses which of these techniques to deliver its order winners?	kanban	modularity	just in time	efficient consumer response	modularity
8	Which of the following is not a characteristic of a well-designed process	Each element is consistent with the purpose of the operating system	The process is user-friendly	Consistency is not easy to maintain at every stage	The whole process is cost-effective	Consistency is not easy to maintain at every stage
9	Which of the following is a characteristic of a well-designed process?	whole process is not easy to understand	whole process is robust	whole process has ineffective links	whole process is not cost effective	whole process is robust
10	What is a robust process?	One that can take small variations	One that is very strong in parts	One that is very consistent	One that is easily understood	One that can take small variations
11	According to Value Creation Partners which of the following does not indicate that a process is not working	some operations take too long	there are too many process reviews and changes	inventory sits idle	complexity and exceptions are unlikely to occur	complexity and exceptions are unlikely to occur

12	The three types of process map are a relationship map, a cross-functional map and a	Process Blueprint map	Process Distribution map	Process Flowchart map	Process Delivery map	Process Flowchart map
13	In a process flow chart transportation is depicted by an	circle	triangle	square	arrow	arrow
14	In a process flow chart storage is depicted by a _____ .	circle	triangle	square	arrow	triangle
15	A useful process improvement tool is Pareto Analysis. This is also known as the	60/40 rule	70/30 rule	80/20 rule	90/10 rule	90/10 rule
16	A useful process improvement tool to search for the root cause of a problem is the _____ process?	3 What	4 Who	5 Why	6 Where	5 Why
17	Technology is widely used in operations. What type of technology interaction is a typical hotel check in	passive self-service	customer and employee interaction	hidden technology interaction	no customer interaction with the technology	no customer interaction with the technology

18	Which of the following is not a physical factor that can influence the choice of location for an operation?	Access to customers	Nature of the communication links	Access to raw materials	Access to raw materials	Access to customers
19	Which of the following is not a socio-economic factor that can influence the choice of location for an operation	local labour markets	transportation networks	business climates	proximity to competitors	transportation networks
20	Locating several mobile phone shops in the same part of a town is an example of _____	Competitive clustering	Saturation clustering	Saturation marketing	Competitive clustering	Competitive clustering
21	The initial decision whether a manufacturer fabricates in-house or uses an outside supplier is known as _____	An Offshoring decision	An Outsourcing decision	A Make-or-Buy decision	A Purchasing decision	A Make-or-Buy decision
22	Which of these layout types is most associated with a mass process	Fixed position layout	Process layout	Product layout	Cell layout	Product layout
23	Which of these layout types is most associated with a project process?	Fixed position layout	Process layout	Product layout	Cell layout	Fixed position layout

24	Which of these layout types is most associated with a batch processing operation	fixed position layout	process layout	product layout	cell layout	cell layout
25	The physical environment of a service operation is often referred to as the _____	Manu scape	Land scape	Service scape	Physical scape	Service scape
26	Which one does not use operations management?	a bank	an hospital	a supermarket	they all use it	an hospital
27	Which came last in the development of manufacturing techniques?	Lean production	Division of labor	Mass production	Craft production	Lean production
28	The type of processing structure that is used for producing discrete products at higher volume is	Work center	Batch	Assembly Line	Project Layout	Assembly Line
29	A system designed for competing effectively in a specific marketplace is called a _____	strategic models	business models	business plans	strategic plans	business models

30	Which of the following types of manufacturing layout is considered a hybrid	process layout	product layout	fixed-position layout	cellular layout	cellular layout
31	Which of the following is NOT a mark of a good layout in manufacturing	Straight line flow patter	Predictable production line	Bottleneck operation	Open plant floor	Bottleneck operation
32	Assembly lines relate most closely to a	functional layouts	product layouts	process layouts	departmental layouts	product layouts
33	Compute the required cycle time for a process that operates 8 hours daily with a required output of 300 units per day.	.625 minutes	1.6 minutes	37.5 minutes	.027 minutes	1.6 minutes
34	According to the authors, when balancing an assembly line, it is best to start by:	Establishing rules by which tasks are to be assigned to work stations	Computing the minimum number of work stations	Determining the required cycle times	Assigning tasks to individual work stations	Establishing rules by which tasks are to be assigned to work stations
35	Which of the following is NOT an element of a service scape	lighting	symbols	spatial layout	prices	prices

36	Which of the following is NOT a method which is used in location analysis?	linear programming-transportation model	best location method	cost analysis	center of gravity method	best location method
37	Which of the following is NOT a qualitative factor in location decisions?	Exchange rates	Worker education and skills	Product content requirements	Local infrastructures	Exchange rates
38	The concept of Agile organization refers to	flexibility	quality	profitability	quick response	quick response
39	_____ ensures that manufacturing concerns are systematically incorporated into the design process.	Design for manufacture	Modular design	Design for robustness	Quality function deployment	Design for manufacture
40	One solution to the problem of how you can gain the cost benefits of standardization without losing the market advantages of product	Design for robustness	Quality function deployment	Modular design	Process planning	Modular design
41	Which one of the following is the overall objective of product and service design	customer satisfaction and variety	reliability and variety	quality and reliability	customer satisfaction and profitability	customer satisfaction and profitability

42	In which of the following layouts, work stations are arranged according to the general function they perform without regard to	product	process	fixed-position	storage	process
43	Which one of the following is the correct order of layout types from low volume/high variety to high volume/low variety?	Fixed position, process, cell, product	Fixed position, cell, process, product	Fixed position, process, product, cell	Process, fixed position, cell, product	Fixed position, process, cell, product
44	What would be the output capacity if an assembly line operates for 7 hours per day with a cycle time of 2.0 minutes?	210 units per day	3.5 units per day	0.004 units per day	14 units per day	210 units per day
45	A design that focuses on reducing the number of parts in a product and on assembly methods and sequence is known as	Design for manufacturing	Design for recycling	Design for assembly	Design for disassembly	Design for assembly
46	Advantages of Process Layout Include _____ .	Equipment used is less costly	Low unit cost	Labor specialization	Low material handling cost	Equipment used is less costly
47	MRP stands for	Materials Requirements Planning	Management Reaction Planning	Master Resources Planning	Manufacturing Resource Planning	Materials Requirements Planning

48	MPS stands for	Master Planning System	Material Production Schedule	Master Production Schedule	Material Planning System	Master Production Schedule
49	Closed Loop MRP means	actual inventory is counted regularly and adjustment made to the inventory record	capacity and resource planning is included in the MRP logic	unused materials are returned to stores and recorded back into the system	actual sales are netted off the forecasts in the MPS	capacity and resource planning is included in the MRP logic
50	Enterprise Resource Planning (ERP) has been criticised on a number of grounds Which of the following is not a common	it can have a disruptive effect on the organisation's operation	implementation is expensive	the effect it has on businesses is disappointing	it doesn't allow decisions and databases from all parts of the organisation to be integrated	it doesn't allow decisions and databases from all parts of the organisation to be integrated
51	In MRP (Materials Requirements Planning) the Bill of Materials is	The required output from a process over time	A list of required safety stock item	The product structure showing where common parts are used	The sum of stock-on-hand and work-in-progress	The product structure showing where common parts are used
52	The outputs of a MRP II system are	Material Requirement Plans / scheduled purchase orders / capacity	Sales order priorities / Bills of Materials / Material Requirement Plans	Stock quantities / Bills of Materials / Master Production Schedules	Capacity requirement plans / stock quantities / stock locations	Material Requirement Plans / scheduled purchase orders / capacity requirement plans
53	Three inputs for every MRP system are	Sales forecast, delivery costs, capacity plan	Average replenishment time, re-order point, economic order quantity	Stock on hand, Master Production Schedule, Bill of Materials	Bill of Materials, sales forecast, sales history	Stock on hand, Master Production Schedule, Bill of Materials

54	Belt of an electric motor is broken, it needs	Corrective maintenance	Scheduled maintenance	Preventive maintenance	Timely maintenance	Corrective maintenance
55	(Number of breakdowns / Available machine hours) =	Maintenance effectiveness	Frequency of breakdown	Effectiveness of maintenance planning	Machine failure hours	Frequency of breakdown
56	(Down time in hours / Availal	Maintenance effectiveness	Frequency of breakdown	Effectiveness of maintenance planning	Machine failure hours	Maintenance effectiveness
57	A systematic approach for maintenance is	Problem – Cause – Diagnosis – Rectification	Problem– Diagnosis – Cause – Rectification	Problem – Measure – Diagnosis – Rectification	Problem– Diagnosis – Measure – Rectification	Problem – Cause – Diagnosis – Rectification
58	With the increase in preventive maintenance cost, breakdown maintenance cost	Increases	Decreases	Remain same	Any of the above	Decreases
59	The ____ goes on increasing with the increase in degree of maintenance efforts.	Cost of down time	Cost of spares and maintenance	Labour and Overhead Cost	Operation Cost	Labour and Overhead Cost

60	Scheduled maintenance is _____ between breakdown maintenance and the preventive maintenance.	Joint	Compromise	bridge	in	Compromise