

# 4. OPERATIONS AND PROJECT MANAGEMENT (AS LEVEL)

## 4.1 THE NATURE OF OPERATIONS

-It is also referred to as production management. Production is the transformation of inputs into outputs. Thus production takes place when a business takes inputs, carries out a production process and produces output. In other words, it is the conversion of resources such as raw materials or components into goods or services. Operations management decisions involve making effective use of resources (inputs), land, labour and capital to provide outputs in the form of goods and services.

-Production can be done at primary, secondary or tertiary levels. The inputs of production differ from one organisation to another. The outputs of one organisation can be the inputs of another firm.

-operations management seeks to ensure that goods/ services are made with the required quantity, required standard and at the right time and in the most efficient manner. Thus it is concerned with acquiring the necessary inputs, allocating and utilising them in such a way as to maximise output

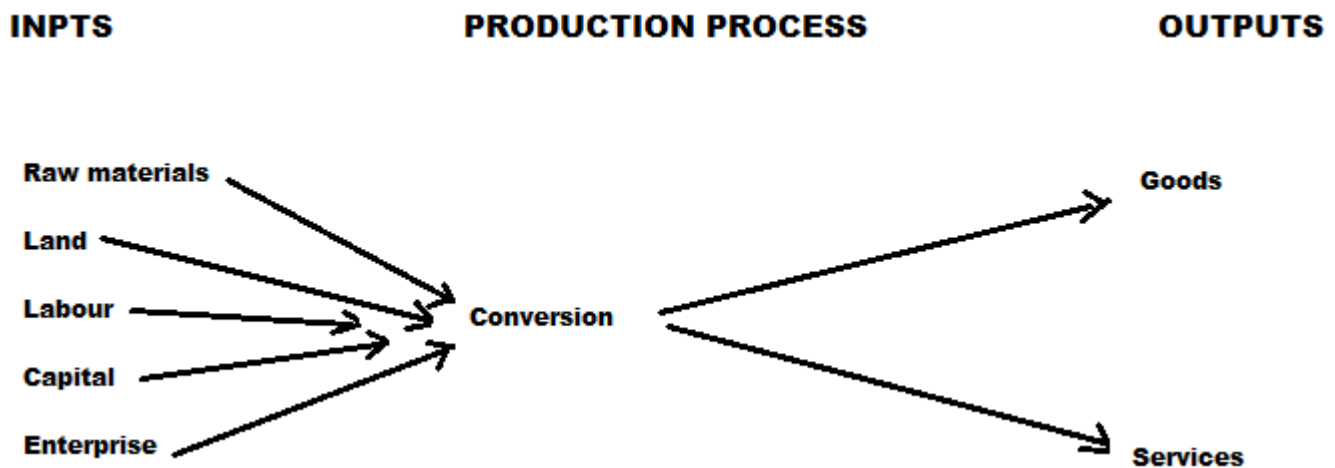
- **Operations management and planning is concerned with:**

- which resources are needed to complete the production/service process.
- how the work/process will be organised and scheduled.
- who will perform the work.

### Objectives of an operations management department

- To design, create, produce goods and services for an organisation and its customers effectively.
- To direct and control the transformation process so that it is efficient and effective and adds value.
- To procure appropriate inputs in a cost effective way.
- To effectively manage an appropriate inventory level.
- To focus on quality, speed of response, flexibility, type cost of the production process.
- Achieve an effective labour/capital production mix.
- To incorporate latest technological approaches into the production process.

THE DIAGRAM BELOW SUMMARISES PRODUCTION



## Transformation process

An activity (process) or group of activities that takes inputs and converts them into outputs.

### INPUTS

- i. **Raw materials**- the basic materials that can be used to make or create something e.g wheat is a raw material in bread production
- ii. **Land**- refers to the site on which production takes. It also refers to all the free gifts of nature e.g minerals, climate
- iii. **Labour**- refers to the physical and mental effort put into the production process. Production process is said to be labour intensive if labour cost constitutes a larger fraction of a firm's total costs. There are three types of labour:- unskilled labour, semi-skilled labour and skilled labour
- iv. **Capital**:- refers to the tools, machinery, computers and other equipment that businesses uses to produce goods and services. All man-made items used in the production of other goods i.e machines, buildings, computers, vehicles, roads e.tc Production process is said to be capital intensive if the cost on capital constitute a larger proportion of the firm's total cost

**NB- Intellectual Capital** - is defined as the amount by which the market value of a company exceeds its tangible assets (physical and financial) – the collective knowledge and skills of a company. Intellectual capital is the intangible bank of expertise, skills and competencies within a business that can give the production process a distinctive competitive edge.

INTELLECTUAL CAPITAL- total market value of business asset- total net book value of assets

### VALUE-ADDITION and OPERATIONS DECISIONS

Refers to the differences between the cost of purchasing raw materials and the price at which finished goods are sold. In other words it is an increase in value a business adds from one stage of production to another. When inputs are transformed into outputs, they will end up with a higher value than their starting point. As each stage of production process takes place, value is added to the starting inputs because these have to be transformed, adding value. The role of operations decisions is to achieve a desired value added, in terms of productive efficiency in reducing unit costs (minimising inputs in relation to outputs) and in terms of financial value (sales revenue and profit). The operations decisions should lead to efficiency and effectiveness so that customers' needs are met by the value added through the productive process

### Value added and Marketing

Value addition can be looked at from the point of view of customers. Marketing is the process of meeting customers' needs, and the process of adding value is making sure that that production process is effective in doing this. Adding value in marketing is giving something to customer that is of high value to them but is low cost to producer. Added value marketing gives customers what they really want by making the product have improved performance or better looks, giving advice on using it, making it more easily available to the customer, providing discounts as well as quality assurance.

### PRODUCTIVITY

-It is a measure of efficiency of production. It shows the relationship between output of a system and factor inputs. It is also defined as the ratio of outputs to inputs during production. There are two types of productivity:-

- i. **Labour Productivity**- refers to the number of units produced per worker

Labour Productivity= total units produced/ total workers involved



## Differences between Labour intensive and Capital intensive method of production

Labour intensive	Capital intensive
<ul style="list-style-type: none"> <li>• Costs of labour are a higher proportion of total costs than costs of capital</li> <li>• E.g hand worked farm</li> </ul>	<ul style="list-style-type: none"> <li>• Costs of capital are a higher proportion of total costs than costs of labour</li> <li>• E.g an oil refinery</li> </ul>
Benefits	Benefits
<ul style="list-style-type: none"> <li>• Can produce one-off unique products</li> <li>• Well suited to deliver personal services</li> <li>• Lower productions costs especially when labour is cheaper in that area</li> <li>• Low start-up costs</li> <li>• Relatively easy to vary labour force (recruit/retrench)</li> </ul>	<ul style="list-style-type: none"> <li>• Mass production requires large scale output using repeated task. Machine can deliver this much more quickly than labour</li> <li>• Enables the business to enjoy economies of scale</li> <li>• Increased labour productivity</li> <li>• Skills level may be lower so costs are less and it is easier to recruit employees.</li> </ul>
Limitations	Limitations
<ul style="list-style-type: none"> <li>• Cannot produce large-scale output quickly</li> <li>• Limited economies of scale</li> <li>• Employees can disrupt production easily due to industrial action or absence</li> <li>• Legal constrains may make it difficult to vary labour force</li> <li>• Training costs may be very high</li> </ul>	<ul style="list-style-type: none"> <li>• Difficult to produce a range of varied one-off products</li> <li>• Difficult to deliver personal services</li> <li>• High start-up costs. Cost of capital may be too high for a business to buy machinery</li> <li>• Machine break down can be a big challenge to the business</li> <li>• Employees using machines can be bored</li> </ul>

## Factors that could influence a decision to change to more capital intensive production methods.

- Relative prices of the two inputs may change – labour costs significantly increase.
- Cost of capital machinery may reduce.
- Technological development may allow production process (or parts of it) to be mechanised.
- Competitors may force a business into capital intensive approach.
- Business may become large enough/profitable enough to purchase capital machinery.

## **BENEFITS OF OPERATIONS MANAGEMENT**

Operations management is concerned with orchestrating all resources to produce a final product or service and as such it is constantly seeking to make the transformation process of inputs into outputs more efficient.

- reducing costs.
- reducing wastage.
- increasing productivity.
- taking out activities that do not add value.
- improving design.
- improving quality.
- designing more efficient work methods.
- better product development.
- more efficient inventory management.

## **4.2 OPERATIONS PLANNING**

## OPERATIONS DECISIONS

-decisions taken by operations manager can have a significant impact on the success of business. These decisions are often influenced by marketing factors, availability of resources and technology.

- a) **Marketing Factors-** there is a link between operations department and marketing department. Operations manager requires information pertaining to estimated market demand when planning future production levels. Thus the operations manager will try to match supply to potential demand (operations planning)  
**NB-**operations planning involves preparing input resources to supply products to meet expected demand

### Important elements of operations planning

- reducing wastages
  - producing the range of product that are forecast to be demanded
  - employ and keep an appropriate number of staff
  - keep sufficient inventory
- b) **The availability of Resources-** the production department use resources to produce goods and services. These resources include land, labour, capital equipment and raw materials. Thus the availability of raw materials or lack of them can influence a number of important operations decisions. The business must decide on the best location, nature of the production method ( robot-controlled equipment)
- c) **Technology-** the provision of services and also the manufacturing of goods has changed. Firms now use digital technology and there two main forms i.e **CAD** and **CAM**

### COMPUTER-AIDED DESIGN (CAD)

-involves the use of computer programs to create 2 or 3 dimensional graphical representations of physical objects. It is most used in architectural designs and on computer animations. It can provide special effects on movies and advertising.  
-**CAD** is also used in furniture manufacturing and the software is used to calculate the optimal size or shape of the product. Engineering department also uses **CAD** to analyse the components of various structures.

### BENEFITS OF CAD

- Lower product development costs
- Increased productivity
- Improved product quality
- Good visualisation of the final product and its constituent parts
- Errors are minimised i.e it is more accurate

### LIMITATIONS OF CAD

- Complexity of programs
- Need for extensive employee training
- It is more expensive i.e computer software used are very expensive
- Computer programs can be affected by virus

### COMPUTER-AIDED MANUFACTURING (CAM)

-involves the use of computer software to control machine tools and related machinery in the manufacturing of components or complete products. Processes in a **CAM** process are controlled by

computers. Thus a high degree of precision and consistency can be achieved than a machine controlled by men.

### **BENEFITS OF CAM**

- ✓ Quality products are produced
- ✓ Faster production and increased labour productivity
- ✓ **CAM** can be combined with **CAD** to produce a wide range of products
- ✓ More flexible production allowing quick changeover from one product to another

### **LIMITATIONS OF CAM**

- ✓ High costs of hardware, programs and employee training
- ✓ Hardware failure can be time-consuming to solve
- ✓ Computer system can be easily affected by virus
- ✓ Small firms cannot afford it

### **FLEXIBILITY AND INNOVATION IN PRODUCTION**

- a) **Operational Flexibility-** refers to the ability of a business to vary both the level of production and the range of products following changes in customer demand. The level of demand is not constant, it may increase or decrease. Thus the business must be able to respond quickly to changes in demand.

#### **Way to achieve operational flexibility**

- Buy more equipment
- Construct or buy new buildings
- Maintain the efficient stock levels
- Employ part-time or temporary labour force

- b) **Process Innovation-:** refers to the use of a new or much improved production method or service delivery method

#### **Elements of process innovation**

- Use of robots in manufacturing
- Faster machines to manufacture microchips for computers
- Use of bar codes and scanner for tracking inventory
- Use of internet to track the exact location of parcels being delivered worldwide and improve the speed of delivery.

#### **Benefits of process innovation**

- Being able to get more accurate and reliable information on the performance of various departments
- Being able to save time i.e less paper work is involved
- Increased professionalism and image to suppliers and customers
- Increased productivity
- Reduction of costs in the long run i.e in the short-run the costs of acquisition are high
- Cheaper production methods makes the business more competitive

**NB:** Process innovation involves the use of automation/ robotics. **Automation-** refers to the use of electronics and machinery to control a production system. **Robotics** refers to the use of robots/ machinery that resembles a human being in the operations it can perform in a production system.

## **PRODUCTION METHODS (OPERATION METHODS)**

Each firm must carry out production designing. Production design refers to the scheduling of production which involves organising the activities in a manufacturing plant or service industry to ensure that the product or service is completed at the expected time. There are four basic ways of production design namely job, batch, flow production and mass customisation.

**The method chosen will depend on the following factors:-**

- a) Nature of product- unique products require jobbing, group of identical products require batch and identical products requires flow production
- b) Size of business- small businesses use jobbing and batch while large firms use flow. This is because flow production is expensive to set up.
- c) Size and location of the market- the firm must take into cognizance the volume of output required. If the demand is high but not in large quantities, batch is used. Mass marketing requires flow production.
- d) Demand of the product- less frequent demand requires jobbing while larger and fairly steady demand requires flow production.

### **JOB PRODUCTION**

Used when a single product or small orders are completed by one/ a group of people from start to finish to meet the customer's individual requirements. Thus the products are customised (produced according to the customer's specifications)

Each order is different and it may not be repeated at all. It is usually used by small and new firms to make products like wedding cakes, wedding gowns, building plan etc

It is the most expensive form of production, very labour intensive (requires few machines) and requires highly multi-skilled labour.

### **ADVANTAGES**

- Product can be tailored to meet customer needs
- It is suitable for personal services e.g hair cuts
- The workforce has greater involvement with the product. This increase job satisfaction.
- The product meets the exact requirements of the customer. This result in guaranteed customer satisfaction.
- Use of skilled staff results in the production of quality products
- High employee motivation. This is because there is no monotony since each task is different from others

### **DISADVANTAGES**

- Need a highly skilled workforce, competent supervisors and management. Specialists are costly to attract and to keep at a business
- Production takes long. This is because there is no automation or use of complex machines. It is usually done manually.
- Special materials are required leading to high cost of production. Only quality material is required.
- Products are specially made to order and any error is very expensive.

### **BATCH PRODUCTION**

-a method of production where items are made in groups with similar characteristics. Each item in a group of products passes through a stage of production at the same time.

- it is the production of a limited number of identical products to meet customer order or specifications and each order is called a batch.

-It falls between job and flow production. It is commonly used by bakeries, furniture manufacturers etc

### **ADVANTAGES**

- It gives variety to workers' jobs. This is because workers work on different batches that may require different skills. This removes boredom from work
- It allows more variety to be produced. This will increase consumer choice
- Materials can be bought in bulk. This will give bulk discounts to the business
- Unit cost is lower than Jobbing. Producing more goods reduces average cost of production
- Production can be easily changed from one product to another

### **DISADVANTAGES**

- No product will be completed before another, lead time
- Increase in costs since there is need for a very efficient control system in planning production
- Warehouse space will be needed for stock of raw materials and components.
- Machines have to be reset between production batches. This will result in delayed production and output is lost

### **FLOW PRODUCTION**

-It is also known as mass/ continuous/ serial or repetitive production.

-It is the production of large quantities of a product in a continuous process. The products produced are identical or standardised

-It uses a series of repetitive processes so that each item moves on to the next stage as soon as a process is completed. Products pass along a conveyor belt or assembly line. It requires a high degree of standardisation and specialisation

-It is more capital intensive- it requires more machines, robots and automation than people. It is also very expensive to start because of the need to buy expensive machines and automation.

-The following products are produced using flow or mass production: chemicals, fuels, packaged food products, cars, televisions etc

### **ADVANTAGES**

- Automation allows goods to be produced quickly
- Mass production enables the business to enjoy the economies of scale which leads to lower prices
- Automated production lines can operate 24 hours a day and 7 days a week



- Time is saved since goods move on conveyor belts
- Promotes specialisation. Repetition of the same task makes the employee more skilled
- Materials can be bought in bulk. This will give bulk discounts to the business

#### **DISADVANTAGES**

- If one machine breaks down, the whole production line will have to be halted
- It is very costly. This is because machines and automation are very expensive to buy
- Repetition of the same task can be boring to the worker
- It is not flexible. Once production lines are set it is difficult to switch to other methods
- High warehousing costs since the mass produced goods must be stored before delivery to consumers
- Use of machines puts people out of their jobs
- Only suitable for products with a large market and high demand

#### **MASS CUSTOMISATION**

-It's a flexible mass production system enabling customers to specify what features of a product/ service they want. This process combines the latest technology with multi-skilled labour force to use production lines to make a range of varied products. This allows the business to move away from the mass- marketing approach with high output of identical products. The businesses will now use focused or differentiated marketing which allows for higher added value. Few changes to the products are made using flexible computer aided production systems to produce items to meet individual customers' requirements at mass production cost levels

#### **ADVANTAGES**

- Accurate records are kept. This is because of the use of computers to keep records
- Greater job satisfaction as boring and routine tasks are now being done by computers
- New products are produced as new methods of production are introduced
- Better quality products are produced due to better production methods

#### **DISADVANTAGES**

- It is very expensive to set up. Computers, robots and machine are very expensive
- Technology will become out-dated. Technology keeps on changing
- Employees may need to be retrained to use the new technology. This adds to business costs
- Increased unemployment as workers will be replaced with machines

## **Problems of changing operations methods**

Setting up an operation method takes time, planning and capital. To change from one method to another would mean taking apart the machinery and equipment and redesigning the whole production system. It would also mean that it might be necessary to redesign the product. It would be extremely difficult and very expensive to produce some batch produced products by flow production

## **BUSINESS LOCATION**

Business have to make the important decision of the best place to locate in order to operate well. The location of the business can affect its costs, its demand, its image and its ability to attract employees to work for it. Thus

location choices should not be taken lightly and will involve decisions at the most senior level. Influence on the final location depends on the type of business, size, demands of the production process and the market.

### **FACTORS AFFECTING CHOICE OF LOCATION**

- a) Market :-** a factory must be closer to its customers to reduce transport costs. Perishable goods must reach the market as fast as possible. Heavy products must also be manufactured near customers
- b) Raw materials and Components :-** if the raw materials are heavier to transport than the final product, the firm must locate near raw material source to reduce transport cost. E.g sugar cane is heavier than the manufactured sugar. Where mineral is processed from ore, the ore is much heavier than the final product.
- c) Availability of Labour :-** Workers operate machine and do all of the management and manual work. If a process requires skilled labour, it is best to locate near people with the required skills. If the manufacturing requires more unskilled labour, it is best to locate where there is high unemployment
- d) Infrastructure and communication :-** business need to be located near to transport system such as roads, rail, inland water ways, sea-ports and air-ports. Good transport system enables the business to be easily accessible by suppliers and customers
- e) Power and Water supply :-** uninterrupted supplies of water and electricity can be a competitive advantage to some industries where power and water are critical inputs e.g steel manufacturing
- f) Government Influence :-** Land is allocated to businesses by the government. It may also offer grants to businesses to encourage them to locate in certain areas. On the other hand, the government can also refuse businesses to locate in a certain area or may put restriction in certain areas. Governments have planning regulations which determine where to build and what to build.
- g) The costs of a particular location relative to other options :-** the cost of land, for example, will vary from area to area. The cost of land in major towns is very high than in small towns. Thus locating in small towns can be a better option for small firms.

### **BENEFITS OF THE BEST (OPTIMAL) LOCATION**

- Lower costs- decrease in transport costs leads to higher profits
- Improves the firm's competitiveness- being closer to customers may boost sales and profits since the firm is able to sale at lower prices
- Overcoming trade barriers- to overcome trade restriction a firm may locate itself in a particular country rather than exporting goods to that country.
- Attracting suitable job candidates- the firm will have access to the right job candidates at the right time.
- Lower taxes- by locating itself in the designated areas, the firm may be exempted from paying taxes or pay taxes at concessionary rates

### **BUSINESS RELOCATION**

Relocation can be defined as a change in the physical location of a business OR the movement of a business from one area/region to another. Relocation can occur within or between countries

#### **Reasons why a business may want to change its location**

- Infrastructural development in other locations

- Cheaper labour costs in other locations
- Changing objectives and strategies of the business
- Changing of location of suppliers or customers
- Change in government policies

## **Relocation costs**

### **Changing location may involve costs such as:**

- Finding and training new employees
- Finding new customers and suppliers
- Administrative costs of the change
- Redundancy payments
- Adjusting to the new set-up

**Industrial Inertia:** occurs when a business stays in its current location even though the factors that led to its original location no longer apply. The costs of moving will be exceeding the costs of staying. Large-scale industries like iron and steel production often display industrial inertia.

## **THE OPPORTUNITIES AND PROBLEMS OF ENTERING NEW MARKETS ABROAD**

### **Opportunities of entering new markets abroad**

- Sales growth-** new markets increases a firm's sales. This may boost company sales revenue as new customers are buying the product
- Increased profits-** The new markets abroad may result in more profits to the business. Increased sales volumes mean more profits to the business
- Improved business image-** a good image locally and internationally may result because the business is selling in foreign and competitive markets, the business products will be seen as of high quality
- Earn foreign currency-** foreign currency obtained can be used to acquire new machinery in foreign countries

### **Problems of entering foreign markets**

- Cultural differences-** different countries have different cultures. The firm needs to understand the culture of the country they intent to enter for them to be successful.
- Lack of knowledge-** the business may lack marketing knowledge of the new country or market e.g consumer preferences, goods offered by competitors, advertising methods and distribution methods
- Lack of foreign currency-** the business may not have sufficient foreign currency to pay for workers, taxes, rentals and advertising

### **How to overcome such challenges**

- Form joint ventures-** the business can join with an existing local business. The business will have knowledge from the local business who understands the local market.
- Use local agents and local dealers-** the business can engage local dealers to distribute and market the goods for business. The local agents have local marketing information and they know the best methods to distribute the goods

- c) **Primary and Secondary research**- essential information about the products, customers, markets is obtained through conducting market research.

## **ECONOMIES AND DISECONOMIES OF SCALE**

- businesses can expand by employing more of a few or all of the factors of production.
- scale of production is changed when all the factors of production are changed.
- Large scale operation leads to a fall in the average total cost (cost per unit). On the other hand, when the organisation continues to grow beyond a certain optimal level, unit cost may begin to increase
- Thus large scale operations may result in a decrease (economies of scale) or increase (diseconomies of scale) in the unit cost

### **ECONOMIES OF SCALE**

-refers to the cost saving advantages that a business can exploit by expanding their scale of production. Thus making things cheaper because they are bigger. The effect is to reduce the long run average cost of production over a range of output.

-economies are divided into internal and external economies of scale

### **INTERNAL ECONOMIES OF SCALE**

-internal economies of scale arises from the growth of the firm itself. Thus the average cost will decrease as the firm employs more capital and labour

### **SOURCES OF INTERNAL ECONOMIES OF SCALE**

#### **a)Purchasing Economies of Scale**

Large firms receive discounts when they buy raw materials in bulk. Thus the cost of acquiring raw materials will decrease leading to a fall in the unit cost/ average cost. A 5% trade discount will lead to a 5% decrease in the cost of production and the cost per unit

#### **b)Marketing Economies of Scale**

A large firm can spread its advertising and marketing budget over a large output. Advertising is charged per total time on airplay (TV/ Radio) or space (Newspaper) not on the size of the business. As the firm grows in size, the average marketing cost will decrease

#### **c)Financial Economies of Scale**

Large businesses may be able to access finance at lower interest rates because of the growth of the business. Large businesses are usually rated by the financial markets to be more 'credit worth' and have access to credit facilities with favourable rates of borrowing

#### **d)Managerial Economies of Scale**

Large scale manufacturers can afford to employ skilled workers to supervise and to carry out production. Effective leadership can also lead to an improvement in worker motivation. Skilled workers will also help reduce wastages. Employees also become experts due to the length of experience in a market and the cost per unit will decrease

#### **e) Technical Economies of Scale**

Large scale businesses can afford to invest in very expensive and specialist capital machinery. For example, a National Chain Supermarket can invest in technology that improves stock control and helps to control costs. It would not be viable or cost efficient for a small corner shop to buy this technology.

The LAW of increased dimensions –this is linked to the cubic law where doubling the height and width of a tanker or building leads to a more than proportionate increase in the cubic capacity. It is an important aspect in the distribution and transport industries

#### **f) Risk Bearing Economies of Scale**

A large firm is able to provide a wide range of products in different markets. This lowers the risk of putting all eggs in one basket. McDonalds hamburgers and French fries share the use of food storage and preparation facilities.

### **EXTERNAL ECONOMIES OF SCALE**

External economies of scale exist when the long term expansion of an industry leads to the development of ancillary (something additional) services which benefit all or some of the businesses in the industry. External economies partly explain the tendency for firms to cluster geographically.

#### **SOURCES OF EXTERNAL ECONOMIES OF SCALE**

**a) Supply of raw materials**- as the industry grows, suppliers of raw materials will be willing to locate themselves close to the manufacturers. This will reduce transport costs to the manufacturers in a given industry.

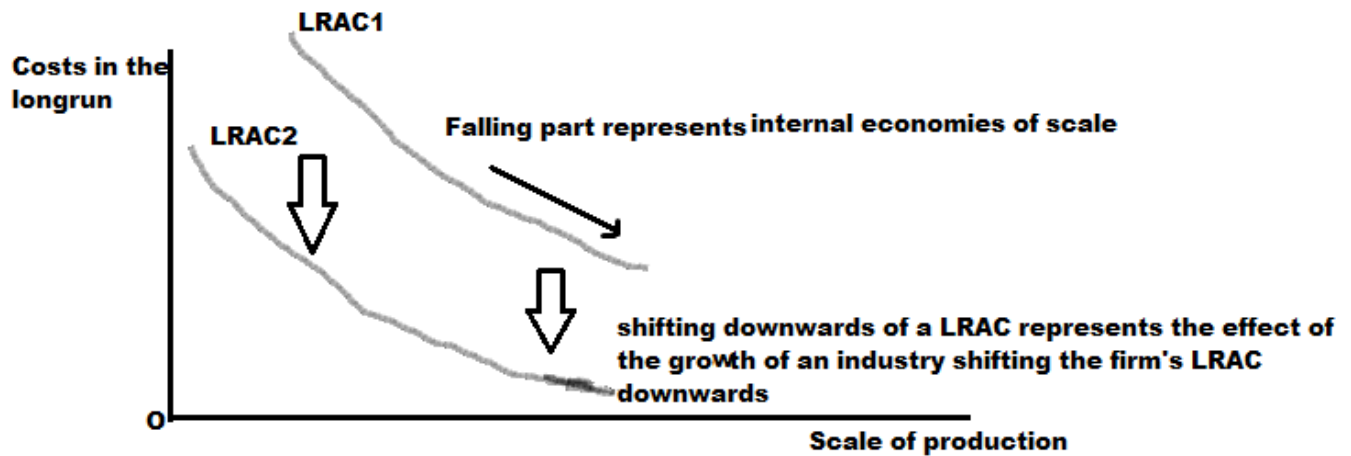
**b) Better transport network**- as the industry grows, there will be massive infrastructural development in the area. The development of transport networks cut costs and also saves time.

**c) Research and Development Facilities**- businesses can benefit from researches done by local universities

**d) Economies of information**- business in the same industry may share vital information about the market or about the economy in general. This reduces the cost of acquiring information to a single business.

**e) Trade Magazines**- enables all firms in an industry to advertise and disseminate information cheaply.

### **Diagram : Internal and External Economies of scale**



## DISECONOMIES OF SCALE

Diseconomies of scale leads to a rise in the long run average cost. Average cost rises due to firms expanding beyond their optimum scale (Optimum-right size)

## SOURCES OF INTERNAL DISECONOMIES OF SCALE

**a) Managerial Diseconomies of Scale-** monitoring the productivity and quality of output from thousands of employees in big corporations is imperfect and costly.

**b) Administrative Diseconomies of Scale-** these are associated with the bureaucratic structures of large firms where long channels of communication and complex administrative procedures delay effective action. Instructions from the top management may be partly or completely distorted if they are to follow a long channel of communication down the organogram.

**c) Over-specialisation-** workers in large firms may feel a sense of alienation and subsequent loss of morale. If they do not consider themselves to be an integral part of the business, their productivity may fall leading to wastage of factor inputs and higher costs.

## EXTERNAL DISECONOMIES OF SCALE

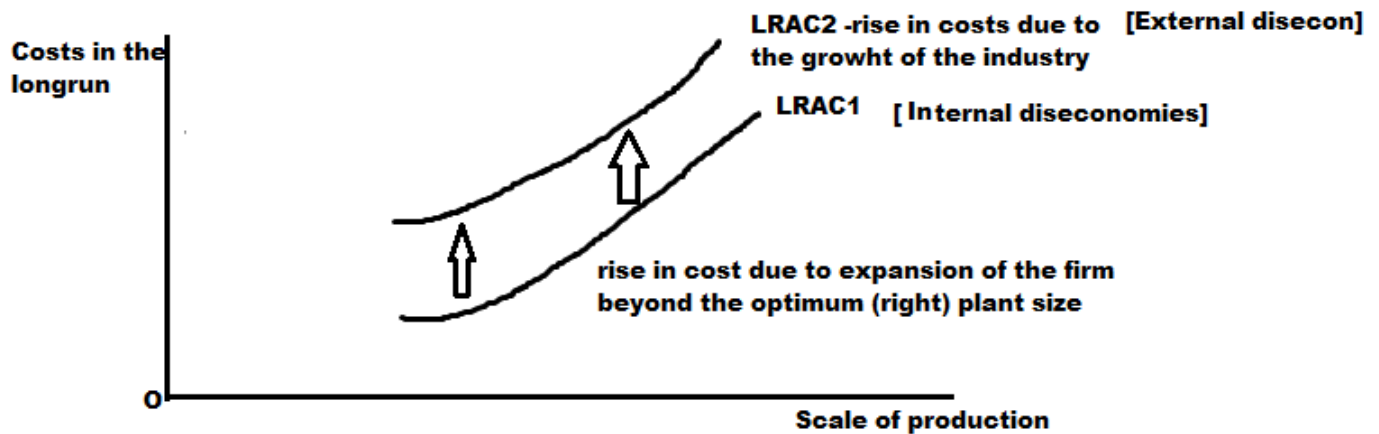
-refers to a rise in the average costs which is independent of the firm's output. They arise due to the growth of the whole industry. These occur when too many firms have located in one area.

## SOURCES OF EXTERNAL DISECONOMIES OF SCALE

- Shortage of Labour-** as the industry grows, shortage of labour may crop up. Firms have to bid wages higher to attract and retain new workers. As the wage rises due to labour shortages, the cost of production to all firms in an industry will increase.
- Formation of Trade Unions-** growth of an industry may lead to the formation of industrial unions. Such Trade unions may ask for higher wages for their members which then increases the production costs.
- Pressure on Raw materials-** increased demand on raw materials and other components may lead to a rise in the unit cost. Geographical concentration of firms in an area may lead to a rise in the rentals, interest rates.

- d) **Disposal of Waste material becomes costly**- when the industry grows, dumping sites will be shifted to the peripheries of a town or business centre. Firms can also be forced to acquire more advanced equipment to reduce and dispose waste. The government can also increase pollution taxes as the industry grows

Diagram: Internal and External Diseconomies of Scale



## 4.3 INVENTORY MANAGEMENT

### STOCK MANAGEMENT

-it also known as stock control. Stock management occurs when the purchasing department aims to minimise cost of stock by maintaining adequate levels of stock. Thus the purchasing department must obtain the right quality at the right time in the right quantity, from the right source at the right price.

### Reasons for holding stock ( or purpose of stock control)

- Stock of raw materials is kept in order to meet production requirement
- Stock of work-in-progress is maintained in order to continue the production process and allowing greater flexibility and better utilisation of time and machinery.
- Stocks of finished goods are maintained in order to meet customers' demand on time
- Stocks of equipment and spares are kept in order to support sales and production
- To control cash tied up in stocks
- To control wastage and pilferage (stealing of small items/amounts at a time)

### TYPES OF INVENTORY

- 1) **Raw materials**-: the basic materials from which a product is made and they are usually bought from outside.
- 2) **Work-in-progress**-: unfinished project that is still being added to or developed or partially completed goods
- 3) **Finished products**-: goods that have completed the manufacturing process

### COSTS OF HOLDING HIGH LEVEL STOCK

- Opportunity cost as capital is tied up in stored stocks
- Storage costs will increase
- Increase in spoilage
- Rise in administrative and finance costs e.g insurance
- Wastage of resources in a period of lower demand in the market
- Risk of theft

### COSTS OF HOLDING INADQUATE / LOW LEVEL OF STOCK

- Lost sales which are known as out-of-sale costs
- Idle production resources i.e the machines will be operating below capacity
- Ordering costs will increase since the firm places more number of orders in a given period
- The advantage of bulk buying cannot be achieved

### **BENEFITS OF HOLDING HIGH LEVEL STOCK**

- The firm can enjoy the benefit of bulk buying
- There is production flexibility since the business will be having enough stock at any given time
- Machine and factory plant will be operating at full capacity at all times
- Enough stock will be available to support production and sales

### **BENEFITS OF HOLDING LOW LEVEL STOCK**

- Storage costs are reduced
- Insurance costs are minimised
- Capital is not unnecessarily held or kept in stocks
- Minimum wastages in a period of reduced demand
- Risk of theft and spoilage is reduced

### **MANAGING INVENTORY**

-involves the stock control techniques

#### **a)BUFFER STOCK**

-refers to the reserves of stock kept to cater for eventual stock out or uncertainties. To avoid the risk of running out of stock, the business must have reserved stock

-this technique is used to avoid stock out costs which are:-

- ✓ Lost production
- ✓ Lost contribution from lost sales
- ✓ Loss of customer good will
- ✓ High unit costs associated with urgent purchases
- ✓ Loss of bulk buying discounts

#### **b)RE-ORDER LEVEL**

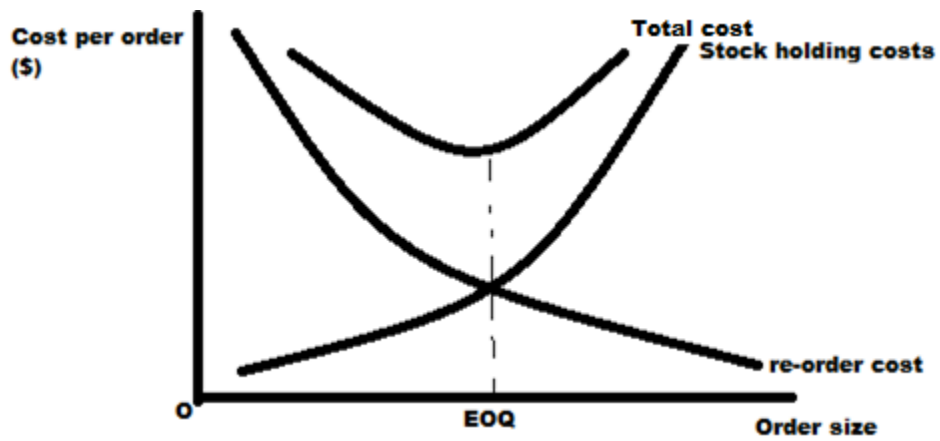
-refers to the level of stock at which a new order is placed with the supplier. The quantity of this order or the re-order quantity will be influenced by the economic order quantity (EOQ)

-EOQ refers to the quantity of materials ordered at cash point to minimise the total annual stocking costs or the least cost quantity of stock to re-order taking into account delivery costs and stock holding costs.

-EOQ depends on -:

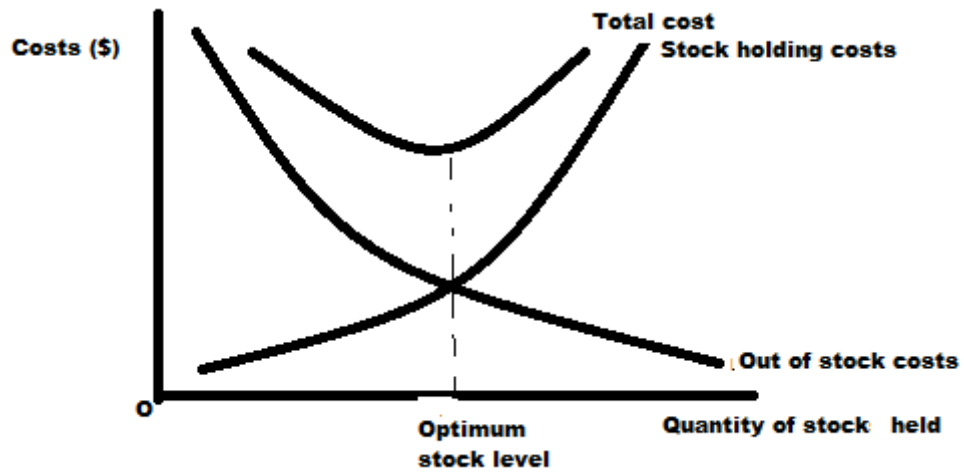
- interest on capital
- storage costs
- wastage costs
- insurance costs





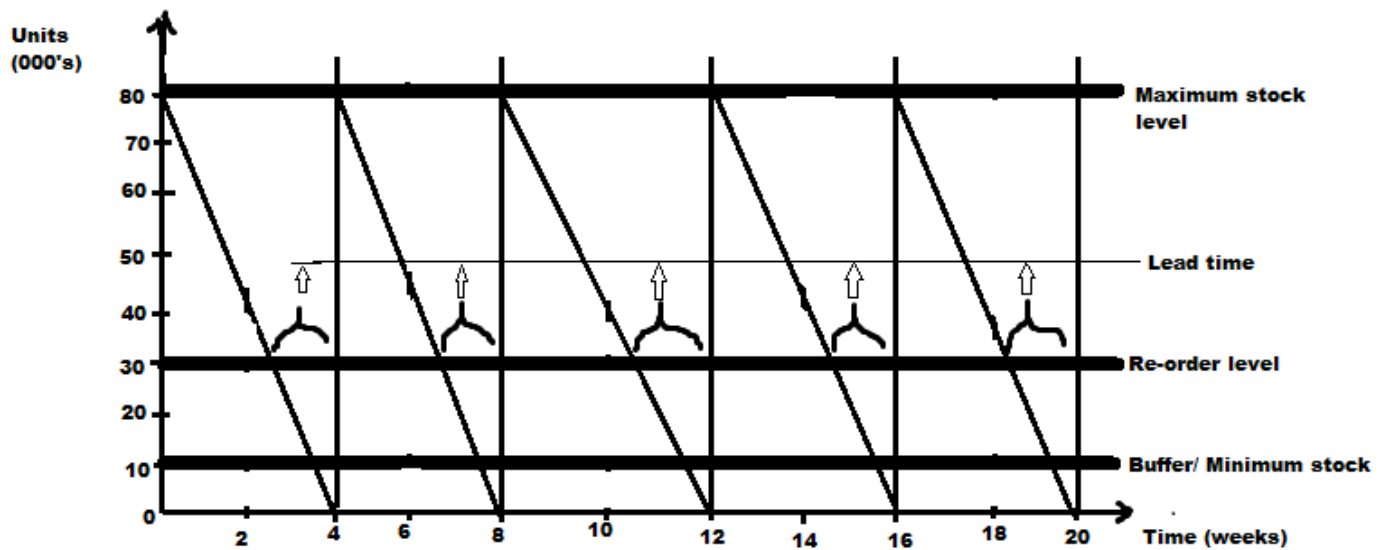
**c)OPTIMUM STOCK LEVEL TO BE HELD**

-refers to the right quality and quantity of stocks to be kept at the business to promote the smooth running of production.



❖  $TOTAL\ STOCK\ COSTS = stock\ holding\ costs + out\ of\ stock\ costs$

d).**INVENTORY CHATRS-** is a tool used to control stock



**MAXIMUM STOCK-** refers to the highest amount of stock kept and it is limited by space and the financial costs of holding higher levels

❖ Maximum stock = EOQ + Buffer Stock

**MINIMUM STOCK-** is also known as buffer stock. This is the minimum number of stock that should be held to ensure that production still continue in case of delay in the delivery of raw materials

**RE-ORDER LEVEL-** this is the level of stock at which a new order is placed with the supplier. The quantity of the new order will be influenced by the EOQ

**LEAD TIME-** it is the amount of time it takes for a stock purchased to be received, inspected and made ready for use. If more time is required between ordering new stocks and their delivery then a higher minimum stock is needed

**f).JUST-IN-TIME**

-it is a stock control system in which material is scheduled to arrive exactly when it is needed for production and in the exact quantity. Raw materials are reduced to zero and finished goods inventories are minimised by matching production to demand. Thus JIT does not require any Buffer Stocks to be held. The components arrive just at the time that they are needed and the finished goods are delivered to customers as soon as they are completed

**NB-** JIT is basically a Japanese approach towards production

**Requirements for JIT Production**

**i).Employee Flexibility-** employees of the firm should be multi-skilled and should be able to switch jobs quickly so that excess stocks of raw materials won't build up.

**ii)Flexibility of Machinery-** modern, computerised machinery is required for JIT production as it can produce a wide range of products just by changing a single software

**iii)Excellent relationships with suppliers-** it should be possible for suppliers to be able to supply raw materials at short notice.

**iv)Accurate demand forecast-** this will enable the business to produce a reliable production schedule which would help in the calculation of precise number of goods to be produced over a certain time

**v)Extensive use of IT-** computerised records of sales and stock levels would allow minimum stocks to be held. Electronic communication with suppliers would enable accurate delivery of supplies

**vi)Strict quality control/ zero defect-** since there are no spare stocks, therefore goods have to be produced correctly the first time otherwise customer orders will not be completed on time.

### **BENEFITS OF JIT**

- ✓ The right quantities are produced or purchased at the right time
- ✓ Improvements on product quality
- ✓ Improved customer service
- ✓ Reduction in storage costs
- ✓ Less chance of stock being out-dated or obsolescent
- ✓ Less stock reduce the risk of damage and wastage
- ✓ Higher profits due to overall decrease in costs

### **DISADVANTAGES OF JIT**

- ✓ It is associated with high start-up cost
- ✓ Advantages of bulk buying are lost
- ✓ Delivery costs rises as frequent small orders are delivered
- ✓ Administration costs rises as so many small orders need to be processed
- ✓ Doesn't work when demand is unpredictable

## **Examination Questions**

### **November 2013**

**4 (a)** Distinguish between capital intensive production and labour intensive production.

[2]

**(b)** Briefly explain **two** factors that could influence a decision to change to more capital intensive production methods.

[3]

**4 (a)** Define the term 'intellectual capital'.

[2]

**(b)** Briefly explain how intellectual capital could increase the value of a business.

[3]

**6** Discuss the important factors that will need to be considered by a business in deciding where to locate a new adventure and amusement park.

[20]

### **June 2014**

**4 (a)** Define the term 'operations management'.

[2]

**(b)** Briefly explain how changes in technology could affect the operations management of a business.

[3]

**7 (a)** Explain the differences between batch production and flow production methods.

[8]

**(b)** Discuss the implications for a manufacturing business of changing from batch production to flow production.

[12]

**4 (a)** Define the term 'value added'.

[2]

**(b)** Briefly explain **two** ways operations management could contribute to the success of a business.

[3]

**3** Explain factors that could affect the level of inventory held by a business.

[5]

### **June 2015**

**2 (a)** Define the term 'business relocation'.

[2]

- (b) Briefly explain **two** factors that could cause a business to relocate. [3]
- 4 (a) Define the term 'diseconomies of scale'. [2]
- (b) Briefly explain **two** causes of managerial diseconomies of scale. [3]
- 2 (a) Define the term 'process innovation'. [2]
- (b) Briefly explain **two** ways a manufacturing business could use process innovation to improve efficiency and effectiveness. [3]

**November 2015**

- 2 (a) Define the term 'buffer inventory'. [2]
- (b) Briefly explain **two** reasons why inventories of finished goods need to be carefully managed. [3]
- 4 (a) Define the term 'intellectual capital'. [2]
- (b) Briefly explain how the input of capital (including intellectual capital) can contribute to the effectiveness of business operations. [3]
- 2 (a) Define the term 'process innovation'. [2]
- (b) Briefly explain **two** ways in which process innovation could improve the operational efficiency of a business. [3]

**Specimen paper 2016**

- 3 Explain the difference between efficiency and effectiveness in business operations. [5]
- 5 (a) Analyse the importance of inventory management to a retail business. [8]
- (b) Discuss the factors which could influence the successful operation of Just-in-Time (JIT) inventory management. [12]

**March 2016**

- 2 (a) Define 'productivity'. [2]
- (b) Briefly explain **two** ways of improving manufacturing productivity in a business. [3]

**June 2016**

- 4 (a) Define 'inventory management'. [2]
- (b) Briefly explain **two** reasons why a business might decide to hold a high level of inventory. [3]
- 3 Explain the costs and benefits to a business of a decision to hold low levels of inventory. [5]
- 3 Explain why efficiency is important to a manufacturing business. [5]

**November 2016**

- 5 (a) Analyse the benefits and limitations of a labour intensive production process for a business. [8]
- (b) Discuss the importance of 'intellectual capital' for a university. [12]
- 6 Discuss ways in which the operations management department of a car manufacturing company could help the business survive during an economic recession. [20]
- 4 (a) Define 'transformation process'. [2]
- (b) Briefly explain two objectives of an operations management department [3]

**March 2017**

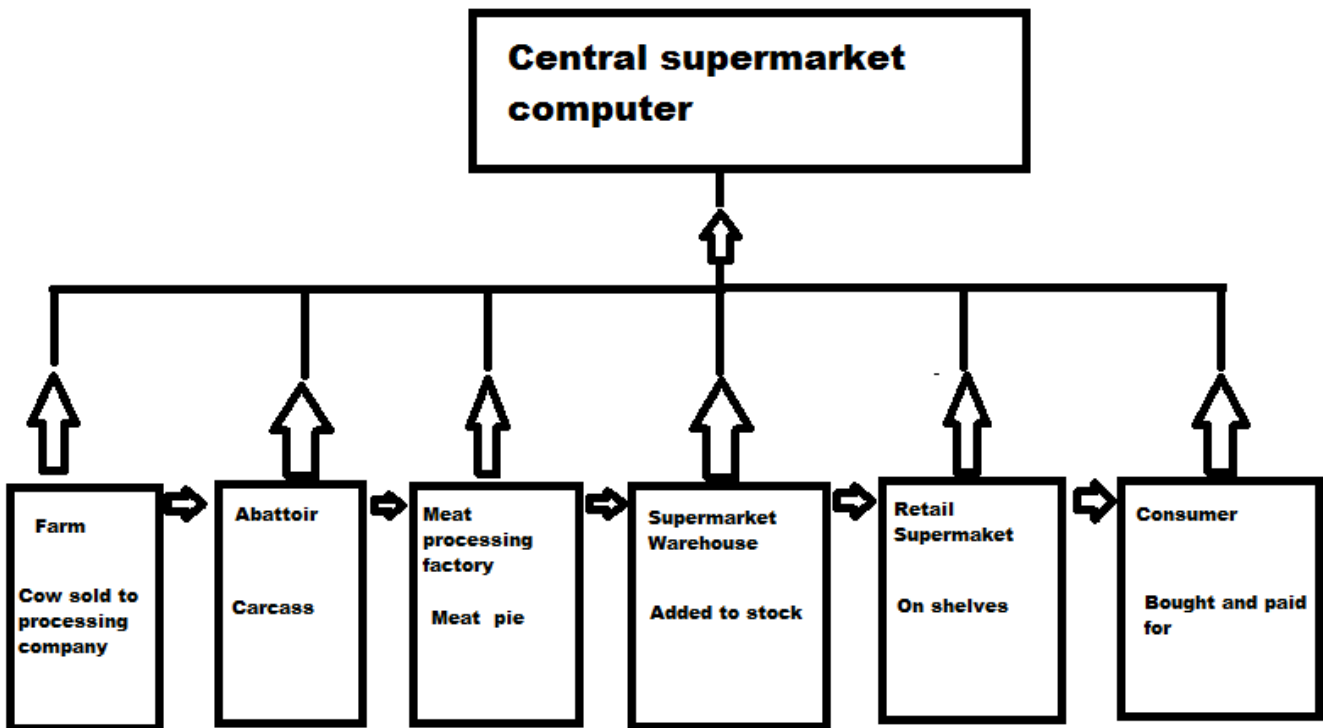
- 4 (a) Define the term 'economies of scale'. [2]
- (b) Briefly explain **two** causes of **diseconomies** of scale. [3]

# OPERATIONS AND PROJECT MANAGEMENT (AL)

## 4.2.1 Enterprise resource planning (ERP)

Refers to a software based system that integrates management information from all functions in a business into a single computer system that serves all those functional needs. Thus it is a method of integrating production systems so that product planning, manufacturing, marketing, inventory and delivery are all linked together in an automated integrated way. ERP involves the use of carefully designed computer software and other techniques to improve the efficiency of an organisation. It integrates management information from all functions in a business into a single system that serves all the functional needs. This enables a business to use one set of information (e.g sales requirement) and the ERP software then orders materials, arranges employees, set up machines, and notifies customers of delivery details. ERP tries to make information flow freely within the organisation and between it and outside stakeholders like customers, suppliers and government. Typically, ERP systems are supplied in modules which match functions like finance and marketing. These modules will replace standalone computer packages in these areas and all of them will access a central database so information can be shared. The modules allow different functions to maintain their own systems but now they will all be linked, so communications will be easier. Putting in more modules will increase the integration but will increase the costs, the amount of change and the risk of losing data in the transition

ERP in getting a meat pie to a customer



## Benefits of ERP

- all employees will be able to find out at any time the progress of an order
- employees are able to know where the products are and what flows of money are involved (production management)
- all the departments have the same information
- helps to reduce organisational conflicts
- the business will know the details of the customers who buy their products (customer relations management)
- enables the business to easily obtain raw materials (supply chain management)

## Limitations of ERP

- ERP systems are very expensive. The average cost of ERP system is \$15 million.
- ERP cannot be used by small firms
- The method can be affected by computer system failure

## How ERP can improve Efficiency

- ❖ **Inventory management:** inventory refers to the stocks a business holds. It can be raw materials, work in progress or finished goods. ERP enables all departments to know exactly what inventory is held, how much raw material is needed, how much unsold stock exist. This can be used to reduce stock holding costs so that efficiency is increased
- ❖ **Costing and pricing:** ERP enables the precise cost of each order to be calculated, so it is much easier to set a price that will yield a profit. Costs of employees, materials, production and fixed costs are built into an integrated system. ERP reduces the administrative cost of setting a price to the customer and therefore increases efficiency.
- ❖ **Capacity Utilisation:** refers to the proportion of full capacity being produced by the business.

$$\text{Capacity Utilisation} = \frac{\text{Current output}}{\text{Maximum output}} \times 100\%$$

**Illustration:** A school with 500 places for learners with only 400 learners at the school. Capacity utilisation is 80%

In manufacturing businesses, it enables the business to know exactly what orders there are, what orders might be coming in, when the orders must be fulfilled and what materials are needed for them. Because all departments have this information, production can be planned to ensure that the equipment is being used as near to full capacity as possible as often as possible, with all the materials ordered and stocked to make this possible. All of this reduces the cost of production, so efficiency is increased.

- ❖ **Response to change:** ERP enables all departments (functional areas) to know what is happening in each of the areas. It will indicate changes in orders, employees profiles, prices of materials, hold-ups in production and financial shortfalls or surpluses. This means that the business is able to respond to changes quickly and with the best possible overall approach. Quick responses reduces the cost of identifying and reacting to change, so efficiency is increased.
- ❖ **Management Information:** ERP covers all the functional areas in a business so management will know at the time what is happening. This means that decisions can take account of all the functional areas and be

based on accurate up-to-date information. This ready availability of information reduces the cost of obtaining it so increasing efficiency

#### **Examples of how ERP can improve efficiency**

- Accurate sales and order information allows optimum amount of inventory
- Orders can be tracked by process and finance arrangements can be matched to supplies needed
- Everyone has the same financial information, not slightly different biased versions
- Real-time information is available to all so decisions-making is improved
- Security is improved as there is only one system that deals with all aspects of production.

### **What reasons are there for ensuring capacity utilisation does not go too high**

- Machines break down and people make mistakes when they work as hard as they can and for long hours
- There will be no possibility of increasing output to meet any special orders
- Scheduling and planning may be difficult
- Employees, including managers, may feel under pressured and become demotivated

### **Problems of too much capacity?**

- Increasing costs
- Increased wastages
- Leads to losses

### **Strategies taken by a firm when there is too much capacity**

a) **Rationalisation**: organising resources and working methods in a better way so that the result is greater efficiency. This often involves reducing capacity by cutting overheads, for example by closing a factory or a production line. This will reduce costs and increase capacity utilisation but the business will have to make employees redundant.

b) **Make major changes to the production capacity to produce new products**. This could be very expensive and may take a long time.

c) **Explore new markets overseas**. It is sometimes the case that out-dated products in some countries may be acceptable in others.

### **Ways of improving capacity utilisation**

- a) **Rationalisation**
- b) **Acquire more resources to expand capacity**. Make the production facility bigger. Invest in more plant, machinery and equipment

#### **Advantages**

- An opportunity to update equipment and procedures
- The firm may end up enjoying economies of scale
- Long term benefits

## Disadvantages

- Can be expensive with large capital investment
  - There will be too much capacity if demand subsequently fell
  - May take time, and be disruptive. Customers may not want to wait.
- c) **Subcontracting:** involves paying another business to undertake part of the functions required to produce a product or service. Thus production is transferred to other business that may have far more efficient production capacity, and so may be able to produce cheaper than in-house. An example is that a builder will pay an electrical business to install all the electrical cables and fittings in house.

### Advantages of subcontracting

- No major capital investments
- Offers great flexibility in relation to future changes in demand
- Quicker solution than capital investments

## Disadvantages of subcontracting

- Potential loss of control over quality and output
- Unit costs may increase as the subcontractor will want to make a profit
- Contact between the business and subcontracted firm can be terminated any time.

- d) **Outsourcing:** using another business (third party) to undertake a part of the production process rather than doing it within the business using the firm's own employees. Outsourcing is a special type of subcontracting. Subcontracting involves the transfer of a task to another business while outsourcing involves the transfer of functions to another business.

### Advantages of outsourcing

- It enables the business to focus on its core activities
- Offer more flexibility than expansion of facilities
- Greater scope for growth without high capital investments
- Possibility of reduced operating costs
- Third party may do the job better

### Disadvantages of outsourcing

- Third parties may have access to sensitive information which may put the business at risk
- Quality may be more difficult to control
- May be uncertainty over delivery times and reliability of delivery
- Could be difficult and expensive to reverse the process if circumstances change
- Loss of jobs within the business

**NB: Offshoring:** occurs when the business relocates some of its functions overseas, usually to businesses in a country with cheaper labour.

## Questions

1. Explain what enterprise resource planning(ERP) is ? [4]
2. Describe the advantages of ERP [6]



3. Describe the main advantages of ERP [6]
4. What type of business would ERP be most appropriate for [6]
5. Discuss the factors a medium-sized electrical goods manufacturer might take into account when deciding whether to introduce enterprise resource planning (ERP) [12]
6. Give three advantages of outsourcing the accounting functions of a small manufacturing business. [6]

**LEAN PRODUCTION:** is the use of resources as efficiently as possible to minimise waste and improve quality. It involves the introduction of new processes and technology to reduce waste and inefficiency in production. Lean production tries to reduce the time taken to develop a product and to make it available to consumers. Lean production also removes any activity which does not add value to the product or service. A business achieves this by examining all of its activities and processes and finding ways in which to improve on the methods employed.

#### **Lean production focuses on the following processes**

- **Inventory control:** if there is too much stock more space will be used up hindering efficient production of other goods
- **Employee roles:** if they can be developed and improved the whole process can be more efficient
- **Defects:** any fault requires the goods to be fixed and time will be wasted inspecting the goods
- **Utilisation of resources:** resources should not be wasted
- **Time factor:** machines and workers must not be unnecessarily moved. Movement is a waste of time.
- **Capacity management:** capacity must not be underutilised or over utilised.

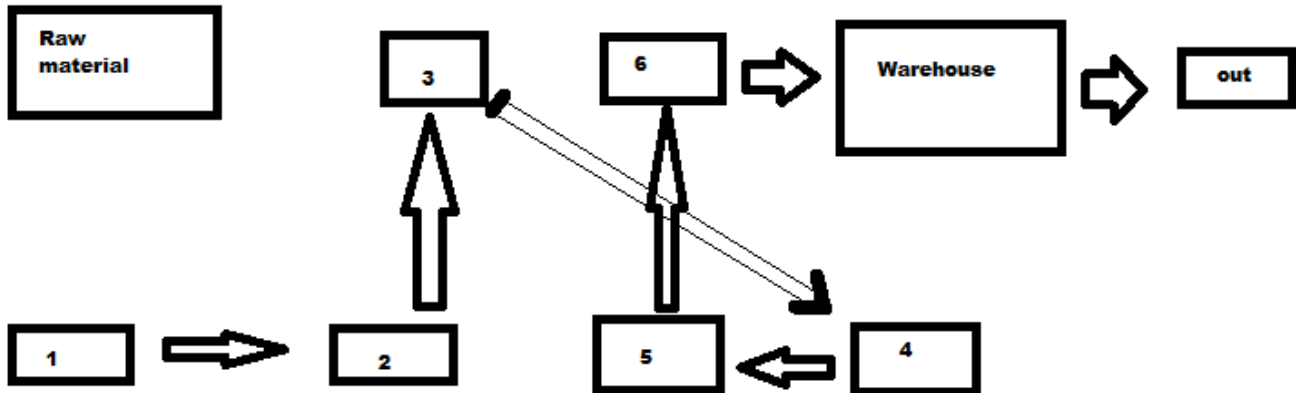
#### **Advantages of Lean production**

- Less storage costs of raw material, components and finished goods. The firm will only keep the required stock
- No defects or need for replacement. All goods produced will be defect free. This will increase customer satisfaction
- Less money is tied in inventory. Only few stocks will be held, hence only less money is kept in stock
- Time is saved. This is because unnecessary processes have been removed. All processes that do not add value are removed.
- Few accidents at work place. This results in improved worker health and safety. This is because of less movement in machinery and workers in the factory

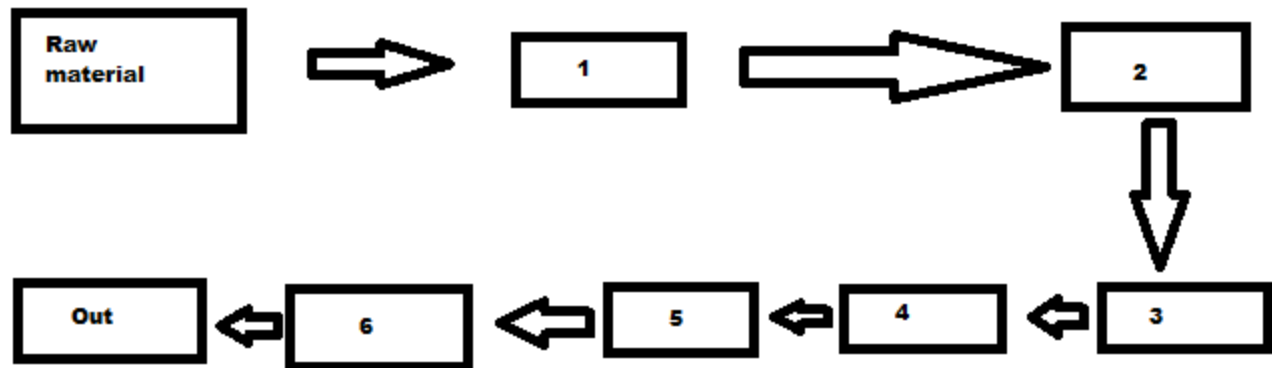
#### **Lean Production Methods**

**Kaizen Effect:** a Japanese word that means that a business should seek continuous improvements. The basic idea is that the employees of an organisation are the best people to know how a task should be undertaken. The Kaizen idea is that employees should be given the responsibility of working out how their jobs can be changed so that efficiency and quality can be improved. It is achieved through new processing ideas from workers. Small groups of workers meet regularly to discuss processing problems and possible solutions to the problems. Kaizen eliminates waste by removing unnecessary movement at the work place and by improving factory layout. This increases factory space and frees employees from unnecessary jobs.

### Before Kaizen



### After Kaizen



### Conditions for Kaizen to work at a business

- Employees must be empowered to make the necessary improvements
- Team working should be part of the organisation's culture
- Management or leadership style must promote democratic style
- All staff should be involved, no matter how seemingly insignificant their contribution.

### Limitations of lean production

- Employees may require training which can be costly to the business
- The business may not be able to increase the supply of goods when demand increases in the near future
- Lean production can lead to job losses which can make the business unpopular
- Sometimes employees may be unwilling to take on responsibility. Employees may be resistant to change.

### Summary: Lean production aims for:-

- ✓ Zero delays
- ✓ Zero inventories
- ✓ Zero mistakes
- ✓ Zero waiting

- ✓ **Zero accidents**

### **Just-in-Time (JIT) in the context of lean production**

It is believed that stock control on its own can be inadequate and there can be waste, particularly money which could better employed elsewhere. JIT production involves managing the flow of raw materials, work-in-progress, finished products and production systems so that these items are available exactly when they are needed and not before. An effective lean production will minimise inventories and flows throughout the process by ensuring purchases, production and deliveries to customers have as much co-ordination of flows as possible.

### **Benefits of JIT production**

- The business can save rent and insurance costs
- As inventory is only obtained when it is needed, less working capital is tied up in stock
- There is less likelihood of products becoming obsolete or out of date
- Avoids the build-up of unsold finished products that can occur with sudden changes in demand

### **Problems of JIT production**

- There is little room for mistakes as minimal inventory is kept for reworking faulty product
- Production is very reliant on suppliers, and if deliveries are not on time the whole schedule can be delayed.
- There is no spare finished product available to meet unexpected orders because all products are made to meet actual orders.
- The firm is vulnerable to action taken by employees

### **Quality control and assurance**

#### **What is quality?**

- Refers to fitness of a product or service for its purpose
- The ability of a product or service to meet customer expectations
- Quality does not mean producing a high quality product. Quality is meeting customer's expectations. Quality is determined by consumer expectation. Thus it is in the interests of all businesses to know the quality levels that customers expect and to have systems in place to minimise the risk of customers being dissatisfied with the quality that they receive. To achieve quality, managers must therefore set targets based on customer needs and then make sure that the targets are being achieved.

### **KEY CONCEPT 3: CUSTOMER FOCUS**

Quality is about making products and services which are 'fit for purpose'. In essence this means meeting customers' minimum expectations.

#### **Benefits of improved quality**

- ✓ The product establishes a good brand image. Customers prefer to buy brands that are of high quality and this will increase sales
- ✓ It builds brand loyalty. Customers will be loyal to the company's products that they will not be willing to buy competitor's products
- ✓ Higher prices can be charged. Customers are willing to pay more for quality products. This may boost business profits.
- ✓ Less legal cases from customers. Satisfied customers will not sue the company.

- ✓ The business can benefit from positive publicity from its customers. Customers will only say good things about the company.
- ✓ Reduces the cost of reworking the product.

#### **Possible costs involved in improving quality**

- ✓ Market research must be done to establish customer expectations
- ✓ Inspection may be expensive in a quality control system
- ✓ Workers must be trained which may increase costs
- ✓ Production may need to be stopped to trace and correct faults

#### **Three Elements of Quality**

- ❖ Quality control
- ❖ Quality assurance
- ❖ Total Quality Management (TQM)

#### **QUALITY CONTROL**

A refers to a system for improving quality based on inspecting finished products to find any faults that exist and remove them. It involves inspecting (through testing and random sampling) of a product or service before it is provided to the customer. This is to ensure that the products produced are of quality and that the products are defect free.

### **Methods of Quality Control**

**Preventive Control:** it is control maintained on the inputs to ensure that raw materials are defects free. All inputs are checked for quality before use. When the product is designed the designers should take into account the customers' quality requirements. Processes (such as manufacturing, providing a service) should be designed to achieve this level of quality.

**Concurrent Control/Pro-active control:** it is the monitoring of an on-going production process. Quality checking will be done while the process is running. Products are regularly inspected/ tested to see if quality standards have been met.

**Feedback Control/ Post action control:** This is the checking of outputs for errors so that the next production process can be corrected. Faulty products/ service need to be corrected and design or processes adjusted to ensure that the problem is not repeated.

#### **Limitations of Quality Control**

- It finds problems only after they have happened
- It is difficult to identify the process that will be causing problems
- Quality control process relies on the skills of those involved in the inspection process.

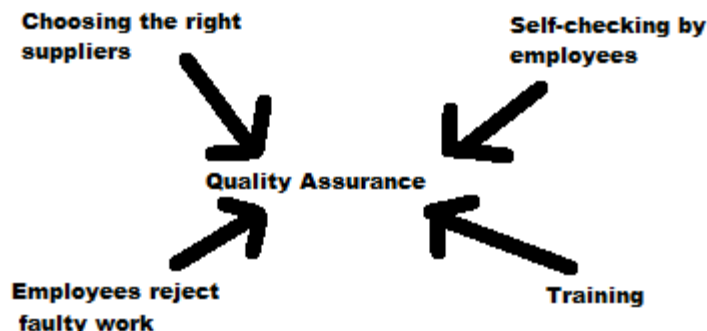
#### **Quality Assurance**

A system for making sure agreed standards are met at each stage of a process in order to ensure customer satisfaction. Thus, it is the checking of products or services to see if they meet minimum quality standards throughout the production process. Quality assurance put more emphasis on preventing mistakes. An important

part of this approach is that employees check their own work rather than relying on someone else to check it for them at the end of the process. It stresses the need for employees to get it right first time. The purpose of quality assurance is to make sure that the customers are satisfied. This will increase sales, increase value addition and profits.

**At General Motors**, for example, employees are told, 'don't accept errors don't build errors and don't pass them on'.

## Requirements for quality assurance



NB: Quality control focuses on the end result: quality assurance focuses on the processes to ensure that the end result meets an agreed standard.

## Benefits of Quality assurance

- Problems should be identified before the end of the process thereby saving costs of putting things right
- There is little need for final inspection thus saving the costs of an inspectorate
- When there are problems it should be easier to trace back to where the fault is occurring in the processes, saving future costs or problems
- Improves accountability since employees are responsible for quality at every stage of production
- There are greater opportunities for employees to take pride in their work thus improving motivation
- The business can get industry or government awards which improves the reputation of the business

## Total Quality Management

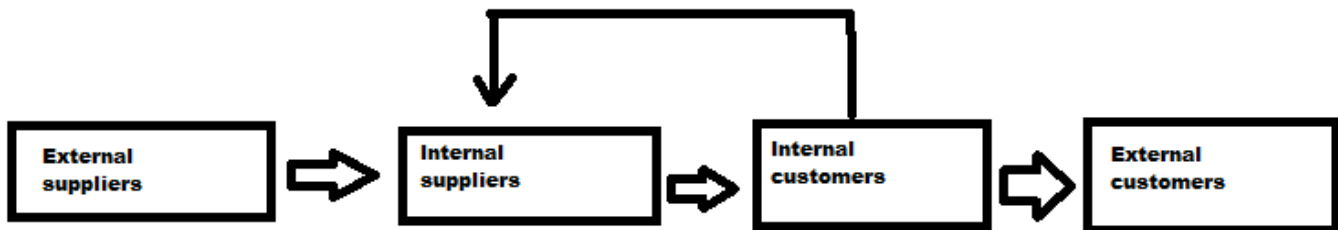
Refers to an approach to quality that aims to involve all employees in quality-improvement. It is the continuous improvement of a product through involving all workers in quality control focusing on quality at each production stage. TQM recognises that all employees are of equal importance, including the factory floor, the office staff, the cleaners, the maintenance staff and the delivery drivers. The way in which customers are dealt with when they ring up, the accuracy of invoices sent out and the reliability of the vans all have an impact on how customers view the firm. It is not just the people who directly make or provide the product who matter. TQM approach considers that employees should always aim to improve the quality of what they do. People should be committed to **zero defects** principle. Zero defect principle seeks to achieve perfect products every time.

## SUMMARISED VERSION

<b>TOTAL</b>	based on participation of all people involved in a business, including employees on the lowest level of the business to top management
<b>QUALITY</b>	TQM aims to improve the quality of goods, services, systems and processes in a business
<b>MANAGEMENT</b>	The process of supervising or managing all activities needed to ensure a business produces goods and services of consistently high standard

## Key aspects of TQM

**Quality Chains:** setting up a procedure so that parts of the procedure can be identified as 'internal customers'. Each stage of the process behaves as part of a supplier/ customer relationship.



**Quality Circles:** refers to groups of employees who meet regularly to discuss work-related issues and problems and to identify potential improvements. These groups are empowered to put their ideas into practice, making improvements at their stage in the quality chain. They usually meet to discuss ways in which they can improve the quality of their work and cut out waste.

**Internal customer:** businesses are set up as if each stage of a process is a new 'customer', providing checks and balances in the process. Thus the business must be aware of the fact that they have internal and external customers

- **Internal customers:** people within the organisation who depend upon the quality of work being done by others. Employees need to think of the requirements of all the people they produce work for and ensure they are providing exactly what is required.
- **External customers:** the people from outside the business who buy the product.

### Elements of Total Quality Management

1. Top management commitment and involvement – 'leadership through quality'
2. Customer involvement – "focus groups"
3. Design products for quality – "designing for robustness"
4. Design production processes for quality
5. Control production processes for quality
6. Developing supplier partnerships
7. Customer service, distribution and installation
8. Building teams of empowered employees – quality circles

9. Benchmarking and continuous improvement. Benchmarking is the practice of establishing internal standards of performance by looking at how world-class companies run their business.

### **Benefits of TQM**

- Improved customer satisfaction
- Repeated sales due to brand loyalty
- High profits
- All a higher price to be charged
- The firm will gain a competitive advantage over its rivals
- It will be easy for the business to introduce new products in the future
- Avoiding heavy penalties when customers complain
- Cut on costs of remaking the product
- Promotes team work

### **Potential costs of TQM**

- Training of staff which may be expensive
- Inspection costs may increase
- Stopping production to trace and correct quality problems will disrupt output
- Resistance to implement TQM from staff
- Market research to establish expected customer requirement needs to be done.

### **The potential of Kaizen in TQM**

Although the origins of Kaizen are in improving production processes to achieve greater efficiency, it can clearly be applied to a product or service to focus on quality. Indeed the best uses of Kaizen will aim to improve both the process and quality at the same time. Kaizen is a Japanese word meaning continuous improvement. The Kaizen approach tries to get employees to improve what they do in some small way every day of every week of every year.

## **BERCHMARKING**

Involves management identifying the best firms in the industry and then comparing the performance standards of these businesses with those of their own business. The business will investigate the product/ service or procedure. The product/service or procedure is then compared with other businesses in the same field of activity to identify 'best practice' i.e better methods than those currently used. Weaknesses can be identified, acted upon and new standards and procedures can be set.

### **Stages in the benchmarking process**

- 1. Identify the aspects of the business to be benchmarked:** ask customers and find out what they consider to be most important
- 2. Measure performance in these areas** e.g reliability records; delivery records and possibly the number of customer complaints
- 3. Identify the firm in an industry that are considered to be the best:** get information from management consultants or government benchmarking schemes
- 4. Use comparative data from the best firms to establish the main weaknesses in the business:** obtain data from published accounts; contacting suppliers or customers
- 5. Set standards for improvement:** use or modify standards set by the best firm
- 6. Change process to achieve the standards set:** introduce a new way of doing things

**7.Re-measurement:** The changes to the process need to be checked to see if the new, higher standards are being reached.

### **Benefits of benchmarking**

- Encourages the generation of new ideas
- If workforce is involved in the comparison exercise, then employees may be motivated by their participation in the program
- It is a faster and cheaper way of solving problems
- Increased market share when the identified problems are solved

### **Limitations of Benchmarking**

- It can be expensive when the firm fails to recover all the cost incurred in the comparison exercise
- The business is relying on copying ideas from other firms which then discourages innovation
- Benchmarking exercise may be misleading if the information obtained is not relevant or up-to-date.

## **Link between Quality and Training**

**Quality Control:** employees will need to know how to select samples, what to do when samples are selected, and what to do when samples show up unacceptable errors. Training is required for the employees to be able to handle all these issues

**Quality Assurance:** employees will need to know the standards of assurance and the methods used to achieve the desired standards. They will also need to know how to react when standards do not meet assured levels.

**Total Quality Management:** a business will need to train employees so that they know how concepts like the internal customer and quality circles work. They need to understand and able to implement Kaizen. The culture of the organisation will need to change. For all of these methods, it will be essential for managers and employees to be trained effectively.

## **International Organisation for Standardisation (ISO)**

The ISO is an international body that develops international standards that cover most areas of technology and business. A standard is a document that provides requirements and specifications against which processes, goods, services and materials are measured to ensure good quality

### **Examples of ISO standards**

- ISO 9 000: quality management
- ISO 14 000 : environmental management
- ISO 22 000 : food safety management
- ISO 26 000 : Social responsibility

**ISO 9000:** This an internationally recognised certificate that acknowledge the existence of quality procedure that meet certain conditions

**To obtain the ISO certificate the firm has to demonstrate that it has**

- ✓ Staff training and appraisal methods



- ✓ Methods of checking on suppliers
- ✓ Quality standards on all areas of the business
- ✓ Procedures for dealing with defective products and quality failures
- ✓ After-sales service

## Questions

- 1.a).What is meant by lean production [2]  
 b)Explain one benefit of lean production [3]  
 2.a)What is benchmarking [2]  
 b)Explain ONE advantage of benchmarking [3]  
 3.a)What is meant by quality [2]  
 b).Explain one cost of improving quality [3]  
 4.a)What is just-in-time production [2]  
 b)Explain one reason for adopting a just-in-time approach [3]  
 5.a)Define Kaizen? [2]  
 b)Explain one benefit of Kaizen to a business [3]  
 6.a)Explain why the involvement of employees is key to implementing Total Quality Management (TQM) [2]  
 b)Outline two features of cell production [3]  
 Answer: Occurs when the production is divided into stages undertaken by teams (cells).  
 7.Explain reasons why workers may resist Total Quality Management [5]  
 8.a)What is Total Quality Management? [2]  
 b)Explain One reason why staff may resist total quality management [3]  
 9.Explain the link between training and quality [3]

## Essays

- 10.To what extent do you think Lean production guarantees the success of a business? [20]  
 11.To what extent is improving quality expensive [20]  
 12.Discuss the issues that should be considered by a small manufacturing firm specialising in quality dining tables before adopting lean production techniques [20]  
 13.Evaluate how a business that owns and operate ten hotels might attempt to ensure a high quality of customer service [20]

# PROJECT MANAGEMENT

Refers to a discipline of planning, organising, securing and managing resources to achieve specific targets. It entails the use of modern management techniques to carry out and complete a project from start to finish in order to achieve pre-set targets of quality, time and cost. Very often these targets have been set in response to the need for the business to change. A project involves a sequence of activities that have a clearly defined beginning and end designed to achieve a desirable business outcome. On the other hand an activity is a clearly identifiable stage or task, in the completion of a project. A project usually involves individuals collaborating in a team to achieve a particular aim. Managing a project therefore involves managing a team of people to complete a task on time, to a given standard and within given budget constraints.

## Examples of Projects

- Building a new factory
- Organising a staff training day
- Rationalising business operations
- Designing a new piece of computer software.

## Project management skills required

- Good communications skills to communicate to people what is being done and what has to be done
- Good people skills to pick the right team and to keep the team working well together
- Good planning skills to establish what can be done by when and by whom
- Good management skills to review progress and keep project moving forward

## Why do projects fail?

We know of buildings that took longer to build than planned, major construction projects that ended up costing far more than originally planned, new products that nobody wanted etc.

- legal changes which force new standards on a business
- changes to the economic environment, i.e. recession
- political changes in the government
- technological changes
- new competition in the market.
- Insufficient resources allocated
- Poor planning
- Lack of consultation with the customer
- Lack of effective management.
- Poor quality control

## Impact of project failure

- Business may have to make penalty payments if the project is late
- Business may lose money if cost are higher than planned
- The business may have its reputation damaged and lose future customers
- The customer is dissatisfied and may, in turn, let down its customers
- Customers might face financial penalties.

## Network Analysis

A planning tool that identifies all of the activities in a project and allows analysis of the project in terms of completion times and other key features. It is a method of organising the different activities involved in a particular process in order to find the most efficient means of completing the task. The main aim is to complete the project in as short a time as possible. To do this a firm will determine the exact order in which activities have to be undertaken and identify those which can be undertaken simultaneously to save time.

### Important elements of network analysis

- Identify all the different tasks involved in the process
- Estimate the expected length of time each task will take
- Determine the order in which tasks must be completed.

### Critical Path Analysis ( or network analysis)

Refer to a planning technique that identifies all tasks in a project, puts them in the correct sequence and allows for identification of the critical path. CPA indicates the shortest possible time in which a project can be completed. Thus the critical path is the sequence of all the activities that must be completed to achieve this shortest time or the sequence of activities that are critical to completing the project on time. Critical activity is an activity within a project that cannot be delayed without delaying the overall project.


### Steps to be followed when implementing critical path analysis

- Identify the objective of the project e.g opening a new branch within 5 months
- Put the tasks that make up the project into the right sequence and draw a network diagram
- Add the durations of each of the activities
- Identify the critical path:- those activities that must be finished on time for the project to be finished in the shortest time
- Use the network as a control tool when problems occur during the project.

### Network Diagrams/ Network Charts

Refer to a diagram that shows, in a logical progression, the activities involved in a project together with their time sequence. All the activities involved in the project are shown, in the order in which they must be undertaken and the times each one will take.

### When drawing a network diagram the following features are used:

- ❖ A circle (called a node) represents the start and end of each activity
- ❖ A straight line represents the activity itself
- ❖ Arrows to show the sequence of activities/ the flow of the logic of sequences
- ❖ Critical activity is shown by a pair of double lines 

## Key terms

**Earliest Start Time (EST):** the earliest possible time an activity can start relative to the beginning of the project. To calculate EST work from left to right.

EST = earliest start time of the activity before + duration of the activity

If there is a choice choose the largest number

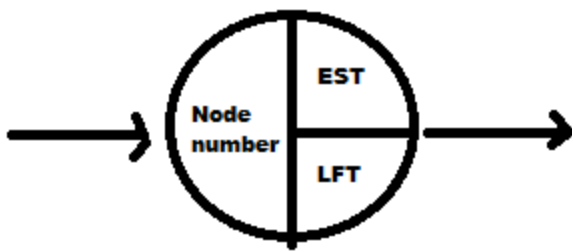
**Latest Finish Time (LFT):** the latest possible time an activity can finish relative to the beginning of the project. It shows the latest an activity can be finished without holding up the whole project. To calculate the latest finish time work from right to left

$LFT \text{ of the activity} = LFT \text{ of the next node} - \text{duration of the activity}$

If there is a choice choose the smallest number to use

**Minimum Project Duration:** the shortest possible time within which a project can be completed

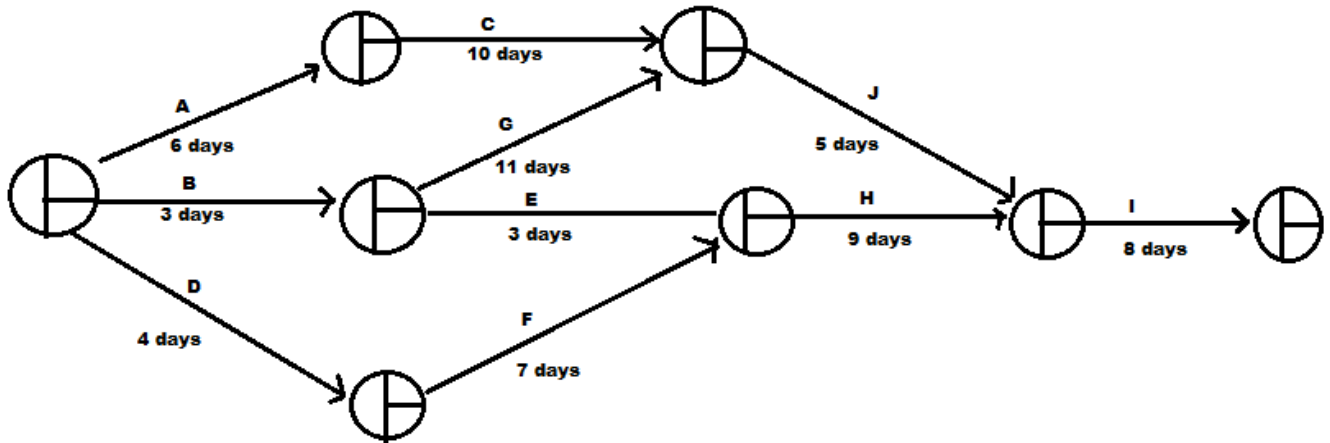
**Illustration**



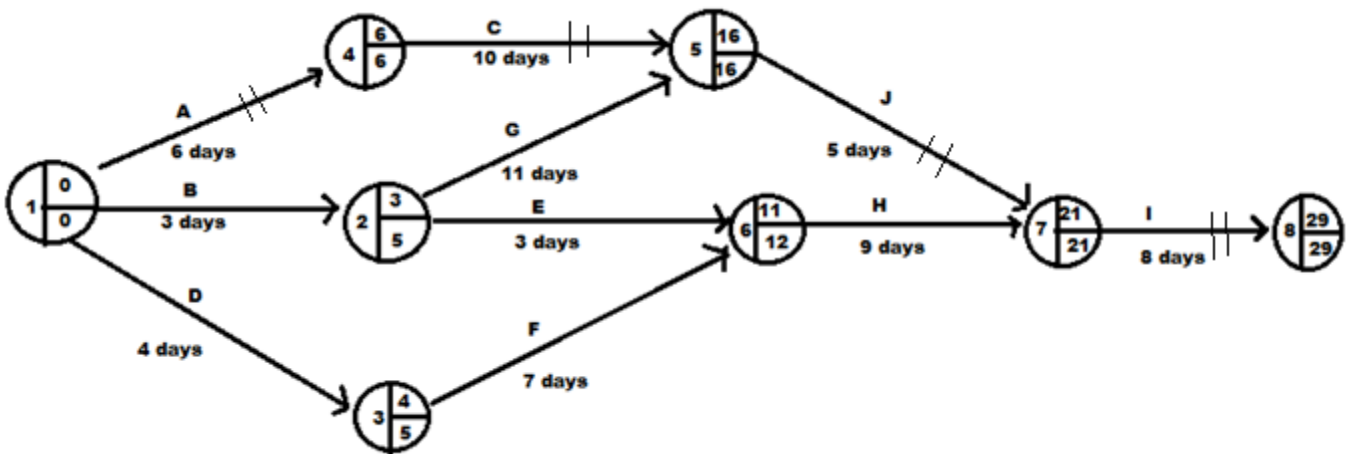
**Illustration:** The objective of this project is to construct a building in 29 days. The tasks to be performed in order to construct the building have been broken down into ten main activities from digging the foundation up to roofing. The duration of the activity is shown in the table below and the network diagram for this diagram is shown in the figure below

Activity	Duration
A	6 days
B	3 days
C	10 days
D	4 days
E	3 days
F	7 days
G	11 days
H	9 days
I	8 days
J	5 days

Figure



Solution



**Note:**

**Calculation of EST**

EST NODE 1 = 0

EST NODE 2 = 0+3= 3 days

EST NODE 3 =  $0+4= 4$  days

EST NODE 4 =  $0 +6= 6$  days

EST NODE 5 =  $6+10= 16$  days/  $3+11= 14$  days (choose largest number = 16 days)

EST NODE 6 =  $3+3 =6$  days/  $4+7= 11$  days (choose largest number= 11 days)

EST NODE 7 =  $16+5=21$  days/ $11+9=20$  days (choose the largest number =21 days)

## Calculation of LFT

LFT NODE 8 = 29 days

LFT NODE 7 =  $29-8= 21$  days

LFT NODE 6 =  $21-9= 12$  days

LFT NODE 5 =  $21-5= 16$  days

LFT NODE 4 =  $16-10= 6$  days

LFT NODE 3 =  $12-9 =5$ days

LFT NODE 2 =  $16-11=5$  days/ $12-3= 9$  days (choose the smallest number =5 days)

LFT NODE 1=  $6-6= 0$  days/  $5-3= 2$ days/  $5-4= 1$  day (choose the smallest number = 0 days)

## Calculation of the minimum project Duration (MPD)

**MPD**= the LFT of the final activity

= 29 days ( in the illustration above)

## Determination of the Critical Activity

This is an activity within a project that cannot be delayed without delaying the overall project. Critical activities can be identified by nodes which have EST which is equal to LFT (EST=LFT). What it means is that the earliest time an activity can start is the same as the latest time the preceding activity can start. Completion of critical activity in time is necessary to ensure the project as whole is completed in the shortest possible time.

### Determination of Non-Critical Activities

These are activities that can be delayed without delaying the whole project. Non-Critical activities can be identified by nodes which have EST which is less than LFT (EST < LFT). i.e B;D;E;F;G and H

### Critical Path

Refers to a sequence if critical activities. In the question above the critical path is from ACJI. i.e they have a pair of short parallel lines

## Summary: Importance of critical path analysis

- The earliest the whole project can be completed
- Activities that are critical to the completion of the project and this is where the managers must focus their attention on. i.e A; C; J and I

- Activities that non-critical i.e B;D;E;F;G and H

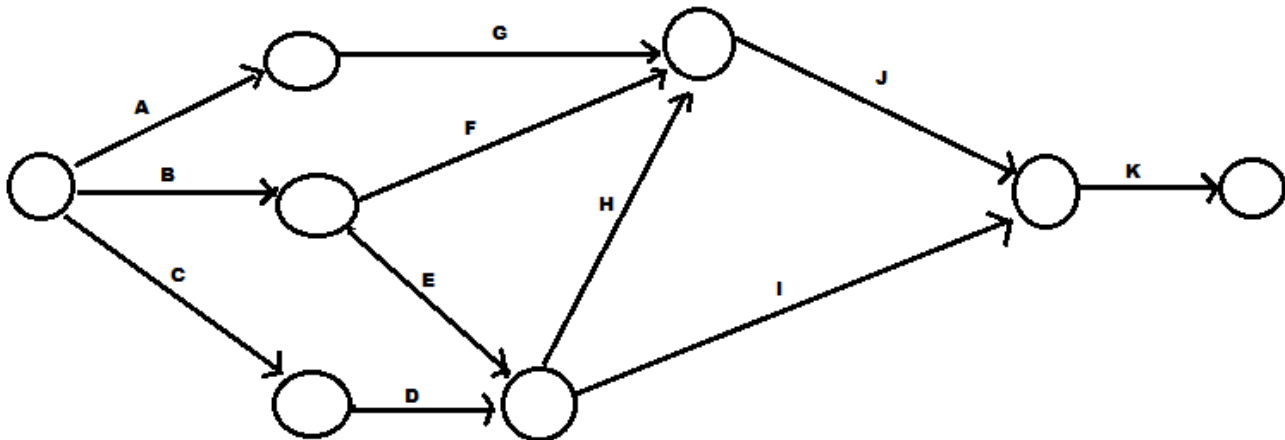
## Question

**Illustration:** The objective of this project is to construct a building in 34 days. The tasks to be performed in order to construct the building have been broken down into eleven main activities from digging the foundation up to roofing. The duration of the activity is shown in the table below and the network diagram for these activities is shown in the figure below

**Table**

Activity	Duration
A	4 days
B	6 days
C	7 days
D	3 days
E	8 days
F	5 days
G	10 days
H	11 days
I	12 days
J	6 days
k	3 days

**Figure**



[25 marks]

## Float Time

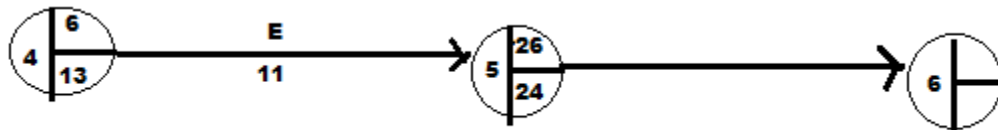
Using the EST and LFT it is possible to calculate the float of an activity. Float time refers to the time an activity can be delayed without either delaying the next activity or the overall project. There are two types of float time

**a) Free Float:** Refers to the maximum time an activity can be delayed without delaying the next activity in the sequence.

**Formula:**

**Free Float** = EST of the next activity- EST of this activity- duration.

**Illustration**



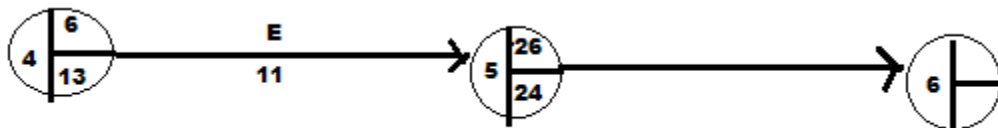
**Free Float** = EST of the next activity- EST of this activity- duration.  
 =26-6-11  
 = **9 days**

**NB:** Free float is zero for a critical activity

**Total Float:** refers to the maximum time an activity can be delayed without delaying the overall project.

**Total Float** = LFT- EST- duration

**Illustration**



**Total Float** = LFT- EST- duration  
 = 24- 6- 11  
 = **7 days**

**NB:** Total float is zero for a critical activity

## DUMMY

Refers to an artificial activity used to ensure the logical representation of a project in not ambiguous. Sometimes when constructing network diagrams the relationships get so complex and to be able to draw then you need a dummy. This is an activity that has no time or costs involved, it is included in the diagram to help show the relationships between real activities. The dummy has no other impact on any other aspect of the CPA other than resolving ambiguities

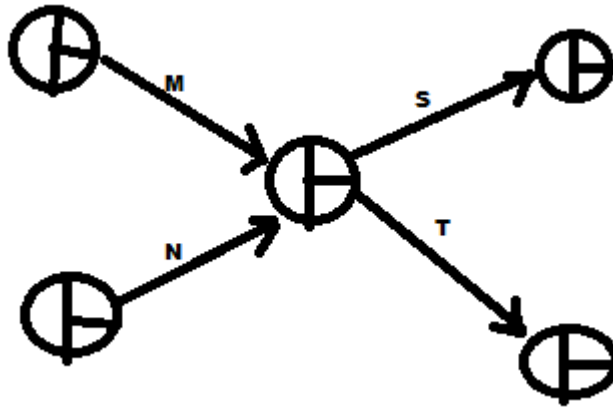


**Example:**

S follows M and N

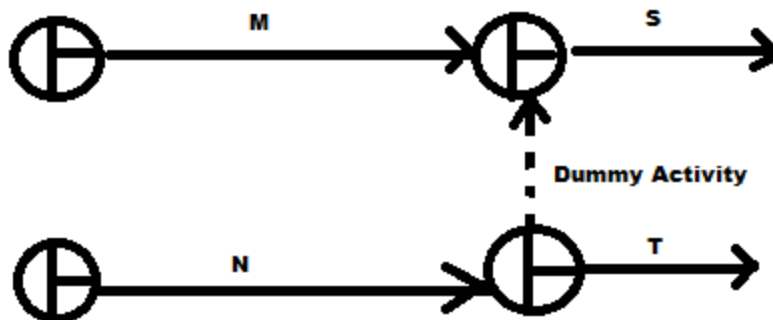
T follows N

**A network to show this:**



It is ambiguous in the sense that it's like T also follows M. T follows N not M. Thus a dummy is required to eliminate the ambiguity involved.

**Logical Presentation including a dummy**



**The importance of CPA as a management tool**

- It is important in calculating project duration. This means that delivery dates can be estimated and negotiated and other operations can be planned
- It enables the managers to know when activities should start. This means that managers can allocate resources to activities at the right time. This helps co-ordination
- Knowing latest finish times. This means that managers are able to monitor progress and see the possible consequences if activities are running late
- Knowing the critical path. This means that managers can focus on the timely completion of these with greater priority than non-critical activities
- Knowing floats on non-critical activities. This means that managers are able to assess the significance of delays to non-critical activities. Where there are significant floats managers can divert resources from those non-critical activities to critical activities to ensure the latter are completed on time.

## Limitations of CPA

- Guess work is common for new projects as there will be no previous experience.
- The manager may have a good project plan but the project may fail if the employees are less skilled and less motivated. All projects must be managed properly if they are to be completed on time.
- The ability to complete a project on time will depend on the reliability of suppliers. If raw materials are delivered late, this may prevent the next activity starting on time.
- Critical path analysis simply shows the quickest way to complete a project; it does not guarantee that this is the right project to be implemented in the first place.
- The project can be done quickly but the quality may be poor. Subordinates may cut corners to get the project done on time.

## Questions 1.

## Media Marketing

MM is planning a new marketing campaign for a chocolate bar. It has collected the following information

Activity	Description	Weeks' duration	Sequence of activities
A	Design leaflets	2	start of project
B	Negotiate advertising with television channels	3	can be done at same time as A
C	Get materials for producing chocolates bars	4	can be done at same time as A
D	Make chocolates bars and build up stocks	6	must follow C
E	Get leaflets printed	3	must follow A
F	Make TV adverts	5	must follow B
G	Distribute chocolate bars to shops	3	must follow D
H	Post leaflets	1	must follow E
I	Start advertising on television	2	must follow F
J	Launch product	3	must follow G; H; I

- 1.a) Draw a network [6]  
b).Identify the minimum project duration [4]  
c).Identify the critical path [2]  
d) Calculate the free float and total float for activity E [2]  
e). Evaluate the usefulness of CPA to the management of MM [10]

**[Total 24]**

## Question 2

Activity	Preceded by	Duration
A	-	3
B	A	5
C	-	2
D	B	10
E	C;D	4
F	-	1
G	F	12
H	E	3
I	E;G	5
J	H;I	3

- 1.a) Construct the network diagram given the data in the table. [6]
- b) What is the critical path? [3]
- c) Calculate the duration of the critical path [2]
- d) Calculate the total float and free float for each of the activities in the network. [10]
- e) To what extent will critical path analysis guarantee that this project will be successfully completed [14]

[Total 35]

## Short answer questions

1. What is a project [2]
- b) What does a node show [2]
- 2.a) What is network diagram [2]
- b) Explain **ONE** benefit of constructing a network diagram [2]
3. a) What is the critical path on a network diagram [2]
- b) What is the effect of a critical activity overrunning? Why? [2]
4. What is meant by a dummy activity [2]
- 5.a) What is meant by the earliest start time? [1]
- b) What is meant by free float? How is it calculated [3]

## Essays

- 1.a) Explain why efficient project management is important for a business operating in a competitive market. [8]
- b) Evaluate the usefulness of critical path analysis to a construction business building a new sports complex to a completely new design [12]
2. Evaluate the usefulness of critical path analysis to an operations manager when planning the relocation of production facilities to another country. [20]
3. To what extent does using network diagrams ensure the success of a project? [20]
4. To what extent is effective project management the key business success these days [20]