STRATEGIC COST MANAGEMENT

According to Horvath and Brokemper (1998:585)

- Strategic cost management has emerged as a key element to attain and sustain a strategic competitive advantage through long-term anticipation and formation of costs level, costs structure, and costs behavior pattern for products, processes, and recourses. For this purpose, strategic cost management must provide managers with different information.
- Strategic cost management sees products, processes, and resources themselves as creative objects for attaining a strategic competitive advantage.

The emergence of SCM results from a blending of three underlying themes, each taken from the strategic management literature:

1. **Value chain analysis**
2. **Strategic positioning analysis**
3. **Cost driver analysis**

Each of these three themes represents a stream of research and analysis in which cost information is cast in a light very different from that in which it is viewed in conventional management accounting

Strategic Cost Analysis (SCA)

- Strategic Cost Analysis (SCA) focuses on an organization's various activities, identifies the reasons for their costs, and financially evaluates strategies for creating a sustainable competitive advantage.
- The technique provides organizations with the total costs and revenues of strategic decisions.
- This requires creative thinking, and managers need to identify and solve problems from an integrative and cross functional viewpoint.

Example of SCA include the following

- Deciding on product mixes and production volumes
- Outsourcing decisions
- Cost reductions
- Investment and profit growth in different markets
- Responses to suppliers' and competitors' activities
- Changes in consumer demand

State the areas where Management Accountant can take the decision

Some of the areas involving decisions to be taken by Management Accountant are:-

- Stock Management and Inventory Control Decisions,
- Plant Location Decisions;
- Machinery Replacement/ Capital Budgeting Decisions;
- Sale at Split-off or Further Processing Decisions;
- Product Decisions – Dropping or adding a product line,
- Marketing decisions,
- Submitting Tenders and Quotations for new jobs based on relevant cost analysis,
- Acceptance of incremental order in different situations like spare capacity, full capacity etc.
- Make or Buy Decisions,
- Operate or Shut Down Decisions,
- Product Pricing Decision – Reduction or maintenance of price,
- Opening of new sales territory or branch,
- Intra-Company Transfer Pricing Decisions,
- Purchasing vs. Lease Financing Decisions

The difference between Traditional Cost Management and Strategic Cost Management

Basis	Traditional Cost Management	Strategic Cost Management
Focus	Internal	External
Perspective	Value-added	Value chain
Cost analysis-way	In term of: product, customer, and function With a strongly internal focus Value added is a key concept	In terms of the various stages of the overall value chain of which the firm is a part With a strongly external focus Value-added is seen as a dangerously narrow concept
Cost analysis-objective	Three objectives will apply, without regard to the strategic context: Score keeping, attention directing, and problem solving.	Although the three objectives are always present, the design of cost management system changes dramatically depending on the basic strategic positioning of the firm: either under a cost leadership strategy, or under a product differentiation strategy.
Cost driver concept	A single fundamental cost driver pervades literature - cost is a function of volume. Applied too often only at the overall firm level	Multiple cost drivers such as: Structural drivers (e.g. scale, scope, experience, technology, complexity) Executional drivers (e.g. participative management, total quality management) Each value activity has a set of unique cost drivers.
Cost containment philosophy	Cost reduction approached via responsibility centers or product cost issues	Cost containment is a function of the cost driver(s) regulating each value activity.
Primary concern	Cost impact	Cost/Value/Revenue relationship
Key disciplines	Finance/Accounting	Marketing/Economies
Primary role	Scorekeeper	Analyst and consultant
Management responsibility	Follower/reactive Risk-averse	Leader/proactive Comfortable with ambiguity

MATERIAL REQUIREMENT PLANNING (MRP)

How MRP II differs from MRP I? Answer. Material requirement planning (MRP) is a —push through‖ system that manufactures finished goods for inventory on the basis of demand forecasts. MRP uses (1) demand forecasts for the final products; (2) a bill of materials outlining the materials, components, finished products, and product inventories to predetermine the necessary outputs at each stage of production. Taking into account the lead time required to purchase materials and to manufacture components and finished products, a master production schedule specifies the quantity and timing of each item to be produced. The EOQ model can be used within MRP systems provided the major assumption of the EOQ model of constant demand broadly applies. After the introduction in the 1906s, MRP was later extended to the management of all manufacturing resources. In particular, it focuses on machine capacity planning and labour scheduling as well as materials requirement planning. This extended system is known as manufacturing resource planning or MRP II.

Aims and benefits of Material Requirement Planning

1. To determine quantity and timing of finished goods production as per the master production.
2. To ascertain quantity of raw materials, sub-assemblies and components required for budged production, based on bill of materials.
3. To compute the inventories, work-in-progress, batch sizes and manufacturing and packaging lead times.
4. To control inventory by ordering bought-in components and raw materials in relation to the orders received or forecast.
5. To forecast the inventory position period-by-period for a future time period of a manufacturing operation.
6. To serve as an inventory information system helpful in planning for raw materials and component parts.
7. To generate purchase requisition notes and purchase orders through computer system automatically.

MAKE OR BUY DECISION

Non-cast factors in make / buy decisions:

1. Possible use of released production capacity and facility as a result of buying instead of making.
2. Sources of supply should be reliable and they are capable of meeting un-interruptedly the requirement of the concern.
3. Assurance about the quality of goods supplied by outside supplier.
4. Reasonable certainty, from the side of supplier about, meeting the delivery dates.
5. The decision of buying the product / component from outside suppliers should be discouraged, if the technical knowhow used is highly secretive.
6. The decision of buying from outside sources should not result in the laying off of workers and create industrial relation problems. In fact, on buying from outside the resources freed should be better utilized elsewhere in the concern.
7. The decision of manufacturing product / component should not adversely affect the concern's relationship with suppliers.
8. Ensure that more than one supplier of product/component is available to reduce the risk of outside buying.
9. In case the necessary technical expertise is not available internally then it is better to buy the requirements from outside.

KAIZEN COSTING

KAIZEN costing is a cost-reduction system that is applied to a product in production.

- Kaizen costing is based around ***improving the manufacturing process*** on a continual basis, with changes being implemented throughout the year.
- Cost-reduction targets are set on a monthly basis. The goal here is to ***reduce the difference*** between profit estimates and target profits.
- The cost deviation analysis done in Kaizen costing examines the difference between the target Kaizen costs and the actual cost reduction achieved. The basic idea here is to make tiny incremental cost reductions on a continual basis in a product's life cycle
- The Kaizen approach calls for analyzing every part of the process and generating ideas on how they can be further improved.
- Kaizen costing takes into account aspects such as time-saving strategies, employee efficiency and wastage reduction while incorporating better equipment and materials.
- Kaizen costing is applied to products that are already in production phase. Prior to kaizen costing, when the products are under development phase, target costing was applied.
- Kaizen Costing is a process wherein a product undergoes **cost reduction** even when it is already on the **production stage**. The **cost** minimization can include **strategies** in effective waste management, continuous product improvement or better deals in the acquisition of raw materials.

Benefits of Kaizen Costing

1. **Focus on customers**
2. **Make improvements continuously**
3. **Acknowledge problems openly**
4. **Promote openness**
5. **Create work teams**
6. **Cross functional teams**

1. Focus on customers

- The Kaizen philosophy has only one prime objective of customers' satisfaction. Kaizen permits no middle ground it's either you provide best products and customer satisfaction or not.
- All the activities should aim at providing customer with whatever he wants and should help the firm long term objective of customers' satisfaction at the same time building up good relationship.
- It is a responsibility of each and every person working in a Kaizen company to make sure that the product is up to the mark and it satisfies customers need.

2. Make improvements continuously

- There is not a best way to do a thing, there is still a better way. In a Kaizen company, the search for excellence just does not end.
- We should work on the improvement implemented and see if we can make it even more effective.

3. Acknowledge problems openly

- Every company has certain problems related to finance, competition, change in demand etc.
- Kaizen companies are no exception, but by fostering an appropriately supportive, constructive culture it becomes easier for any team to get its problem in the open.
- The whole organization works as a team to solve the problem. The problems are openly shared by the management with the employees which avoids rumors. It simply means FIGHT WITH YOUR PROBLEMS DON'T RUN AWAYFROM THEM.

4. Promote openness

- There seems to be less functional ring fencing i.e. only the senior managers have private cabins. Otherwise the workplace is generally open and in many companies even the dress code and canteen for everyone is the same.

5. Create work teams

- Each individual in a Kaizen company belongs to work team headed by a leader. Working in various overlapping teams draws employees into corporate life and reinforces the mutual understanding.

6. Cross functional teams

- Kaizen states that no individual or team has all the required skill and knowledge to complete a task. Cross-functional teams help in getting all the valuable information's from the view of all the related people. It calls for letting ideas to flow as wide as running on moon

Basic Principles of Kaizen Costing

1. **Focus on Customers**

   The Kaizen philosophy has only one prime objective of customers' satisfaction.

2. **Make improvements continuously**

   There is not a best way to do a thing. There is still a better way. In a Kaizen company, the search for excellence just does not end. We should work on the improvement implemented and see if we can make it even more effective.

3. **Acknowledge Problems openly**

   Every company has certain problems. Kaizen is based on the assumption that "Fight with your problems, Do not run away from them", Promote openness: All the senior managers shall have open cabins, having the same dress code and with the same canteen for all.

4. **Create work teams.**

5. **Cross functional teams**

   Kaizen states that no individual or team has all the required skill and knowledge to complete a task. Cross-functional teams help in getting all the valuable information from the view of all the related people. It calls for letting ideas to flow as wide as running on moon.

Reasons for Failure

The following major reasons have been found contributed to it:

1. Lack of interest and supported from Top Management.
2. Lack of proper motivation by Management.
3. Lack of proper training of Listening Skills, Presentation Skills, and Communication Skills etc. to the participants.
4. Criticising the efforts of failures by the Group members.
5. Ignoring the basic concept ‘Improvements is a part of daily routine' by all concerned.

TARGET COSTING

Target costing is a pricing method used by firms.

- It is a process of determining the actual cost price of any product or service after considering the desired profit margin behind the same.
- It helps in completing the product within the set price by changing the process for the same or by making the existing process more efficient.
- With target costing, a management team has a powerful tool for continually monitoring products from the moment they enter the design phase and onward throughout their product life-cycles.
- It is considered to be one of the most important tools for achieving consistent profitability.

"***Target Costing is a disciplined process for determining and achieving a full-stream cost at which a proposed product with specified functionality, performance, and quality must be produced in order to generate the desired profitability at the product's anticipated selling price over a specified period of time in the future.***"

Target Cost = Anticipated selling price – Desired profit

Which Type of Company Would Benefit From Target Costing?

- Assembly-oriented industries, as opposed to repetitive-process industries that produce homogeneous products;
- Involved heavily with the diversification of the product lines;
- Use technologies of factory automation, including computer-aided design, flexible manufacturing systems, office automation, and computer-aided manufacturing;
- Have experienced shorter product life cycles where the pay-back for factory automation typically must be achieved in less than eight years;
- Must develop systems for reducing costs during the planning, design and development stages of a product's life cycle;
- Are implementing management methods such as just-in-time, value engineering, and total quality control.

Principles

There are six key principles in target costing:

1. Price – led costing (i.e. target price less desired mark-up = target costs);
2. Customer focus;
3. Focus on design of products and processes;
4. Cross- functional teams;
5. Life cycle cost reduction; and
6. Value chain involvement.

Advantages and Disadvantages of Target Costing Approach

Target costing has the following main advantages or benefits:

1. **Proactive approach to cost management.**
2. **Orients organizations towards customers.**
3. **Breaks down barriers between departments.**
4. **Implementation enhances employee awareness and empowerment.**
5. **Foster partnerships with suppliers.**
6. **Minimize non-value-added activities.**
7. **Encourages selection of lowest cost value added activities.**
8. **Reduced time to market.**

Target costing approach has the following main disadvantages or limitations:

1. **Effective implementation and use requires the development of detailed cost data.**
2. **it's implementation requires willingness to cooperate**
3. **Requires many meetings for coordination**
4. **May reduce the quality of products due to the use of cheap components which may be of inferior quality.**

Role of a Cost Accountant in Target Costing Environment

1. **Cost Estimation**

   To provide other members of the design team a running series of cost estimates based on initial design sketch, activities based costing reviews of production processes, and "best guess" costing information from suppliers based on estimated production volumes

2. **Permissible cost Ranges**

   To provide estimates within a high low range costs, since preliminary data will necessarily be vague. However, this estimated cost range should be tightened as more information becomes available.

3. **Capital Budgeting Analysis**

   To cater to capital budgeting requests generated by the design team based on types of equipment needed for the anticipated product design, product revenues and costs, rates of return etc. The cost accountant should also able to answer questions uncertainties and risk analysis.

4. **Cost Principles Explanations**

   To work with the design team to help it understand the nature of various costs (as such as cost allocation based on an activity –based costing system), as well as the cost –benefit trade-offs of using different design or cost operations in the new product

5. **Review of cost reduction targets**

   To Track the gap between the current costs and the target cost that is the design team's goal providing an itemization of where cost savings have already been achieved and where there has not been sufficient degree of progress.

SOURCES OF TARGET COSTING DATA

Unorganized preliminary Information:

- Information about preliminary cost estimates can be garnered through careful review of possible component parts, as well as a comparison to the costs of existing products with designs similar to those under review.
- This results in relatively rough cost estimates, especially during the earliest stages of product development.
- The Cost Accountant must have a wide-ranging view of costing systems and a willingness to start with rough estimates and gradually refine them into more concrete information as designs gradually solidify.

Risk Analysis – Highest Possible Costs:

- Cost estimates are rough in the earliest stages of a new product design. However, it is possible to include with the best estimate, an additionally estimate of the highest possible cost that will be incurred.
- This helps the management to know whether there is a significant degree of risk that the project may not achieve its desired cost target.
- This may result in either outright termination of the project or redefining targets in order to launch the product.

Market and Competitor Information:

Competitor information collected by the marketing staff or an outside research agency, gives ideas on

(a) Prices at which competitors sell their products
(b) Prices of ancillary products
(c) Discounts given at various points
(d) Market share data for individual products or by firm
(e) Opinion of customers regarding the offerings of various companies, and
(f) Financial conditions of competitors.

Competitor Cost Information:

- Cost structure of competitors is compiled by a combined effort of the marketing and engineering staffs through a process called reverse engineering or tear-down analysis.
- Under this process, a company buys a competitor's product and disassembles it in order to determine the process and materials used to create it, and their costs.
- This information helps in determining the greatest allowable cost of a new product design since a company can copy the methods and materials used by a competitor, and see if the reduction in costs can be achieved. The information is also of use from a pricing perspective.

Steps involved in implementing target costing system

1. Create a Project Charter

Project Charter is a document, approved by top management that describes its goals and what it is authorized to do. This Charter is based on the corporate mission statement and related goals. Written approval of Project Charter by the top management provides the target costing effort with a strong basis of support and direction in all subsequent efforts.

2. Obtain a Management Sponsor

Management Sponsor is an individual belonging to top management. His role will be to support the initiative in all respects, to obtain funding, to co-ordinate with other members of top management, to eliminate problems in a timely manner.

3. Obtain a Budget

The funding should be based on a formal allocation of money through the corporate budget. The fund should be given unreservedly to the target costing effort.

4. Assign a Strong Team Manager

The Target Costing Team involves the active participation of many members with diverse backgrounds. A strong Team Manager is required to bring the group together as a smooth functioning team focused on key objectives. He should be skilled in dealing with management, the use of project tools and working with a diverse group of people. This manager should be a full-time employee, so that his or her complete attention can be directed towards the welfare of the project.

5. Enroll Full-time Participants

It is essential that the members of the team be devoted to it full-time rather than trying to fulfill other commitment elsewhere in the company at the same time. They should have a single focus on ensuring the success of the target costing program.

6. Use Project Management Tools

Target costing can be a highly complex effort especially for high-cost products with many features and components. The team should use all available project management tools, such as Microsoft Project (for tracking the 75 completion of specific tasks), a company database containing various types of costing information and a variety of product design tools.

Enumerate the steps involved in target costing

The following are the steps involved in target costing.

1. Ascertain from market studies the demand and the price at which the product can be sold.
2. Deduct the required profit percentage from the selling price.
3. The balance represents the target cost.
4. Compare the actual/estimated cost with the target cost.
5. If the actual/estimated target cost is greater than the target cost, introduced cost reduction measures to bring down the cost to the level of target cost. If the required reduction in cost is not possible, reject the proposal to produce the product.

Explain the impact of Target Costing on Profitability.

Target Costing improves profitability I two ways:-

1. **Assured Profit by Constant review**
   - Target Costing places detailed continuing emphasis on product costs throughout the life cycle of every product.
   - Also the management is fully aware of costing issues since it receives regular monitoring and review reports.
2. **Price Determination and Consequent Cost Control:**
   - Target Costing improves profitability through precise targeting of the prices at which the Company can market a profitable product.
   - Thus, Target Costing results in better cost control and also in better price control, than the traditional cost plus approach.
   - Target Costing have positive impact on profitability, depending on the commitment of the management to its use, the constant involvement of cost accountants in all phases of a product's life cycle, and the type of strategy a company follows.
   - Target Costing is part of a larger concept called Concurrent Engineering, which requires participants from many departments to work together on project teams.

LIFE CYCLE COSTING

The term 'Life Cycle Cost' has been defined as follows,

It includes the costs associated with acquiring, using, caring for and disposing of physical asset including the

- ***Feasibility studies***
- ***Research***
- ***Design***
- ***Development***
- ***Production, maintenance, replacement and disposal as well as support, training and operating costs***

There are four principal lessons to be learned from lifecycle costing:

- **All costs should be taken** into account when working out the cost of a unit and its profitability.
- **Attention to all costs** will help to reduce the cost per unit and will help an organisation achieve its target cost.
- **Many costs will be linked**. For example, more attention to design can reduce manufacturing and warranty costs. More attention to training can reduce machine maintenance costs. More attention to waste disposal during manufacturing can reduce end-of life costs.
- **Costs are committed and incurred at very different times**. A committed cost is a cost that will be incurred in the future because of decisions that have already been made. Costs are incurred only when a resource is used.

PRODUCT LIFE CYCLE

- Product life cycle is a pattern of expenditure, sale level, revenue and profit over the period from new idea generation to the deletion of product from product range.
- Product life cycle spans the time from initial R&D on a product to when customer servicing and support is no longer offered for the product.
- For products like motor vehicles this time span may range from 5 to 7 years.

The innovation of a new product and its degeneration into a common product is termed as the life cycle of a product.

Phases In the life cycle of a product

1. Introduction Phase

- Research and engineering skill leads to product development. The product is put on the market and its awareness and acceptance are minimal.
- Promotional costs will be high, sales revenue low and profits probably negative. The skill that is exhibited in testing and launching the product will rank high in this phase as critical factor in securing success and initial market acceptance. Sales of new products usually rise slowly at first.

2. Growth Phase

- In the growth phase product penetration into the market and sales will increase because of the cumulative effects of introductory promotion, distribution.
- Since costs will be lower than in the earlier phase, the product will start to make a profit contribution. Following the consumer acceptance in the launch phase it now becomes vital or secure wholesaler/retailer support. But to sustain growth, consumer satisfaction must be ensured at this stage.
- If the product is successful, growth usually accelerates at some point, often catching the innovator by surprise.

3. Maturity phase

- This stage begins after sales cease to rise exponentially. The causes of the declining percentage growth rate is the market saturation – eventually most potential customers have tried the product and sales settle at a rate govern by population growth and the replacement rate of satisfied buyers. In addition there were no new distribution channels to fill.
- This is usually the longest stage in the cycle, and most existing products are in this stage.
- The period over which sales are maintained depends upon the firm's ability to stretch the cycle by means of market segmentation and finding new uses for it.

4. Decline phase

Eventually most products and brands enter a period of declining sales. This may be caused by the following factors:

- Technical advances leading to product substitution.
- Fashion and changing tastes.
- Exogenous cost factors will reduce profitability until it reaches zero at which point the product's life is commercially complete.

A comparative analysis of these phases is given below

Particulars	Introduction	Growth	Maturity	Decline
Phases	**1**	**2**	**3**	**4**
Sales Volumes	Initial stages, hence low	Rise in sales levels at increasing rat	Rise in sales levels at decreasing rates.	Sales level off and then start decreasing
Prices of products	High levels to cover initial costs and promotional expenses.	Retention of high level prices excess	Prices fall closer to cost, due to effect of competition	Gap between price and cost is further reduced.
Ratio of promotion expenses to sales	Highest, due to effort needed to inform potential customers, launch products, distribute to customers etc.	Total expenses remain the same, while ratio of S&D OH to sales is reduced due to increase in sales	Ratio reaches a normal % of sales. Such normal % becomes the Industry standard.	Reduced sales Promotional efforts as the product are no longer in demand
Competition	Negligible and Insignificant.	Entry of a large number of competitors.	Fierce Competition	Starts disappearing due to withdrawal of products.
Profits	Nil, due to heavy initial costs	Increase at a rapid pace.	Normal rate of profits since costs and prices are normalized.	Declining profits due to price competition, new products etc.

Characteristics of product life-cycle

The major characteristics of product life-cycle concept are as follows:

- The products have **finite lives** and pass through the cycle of development, introduction, growth, maturity, decline and deletion at **varying speeds.**
- Product cost, revenue and profit patterns tend to **follow predictable courses** through the product life-cycle. Profits first appear during the growth phase and after stabilizing during the maturity phase, decline thereafter to the point of deletion.
- **Profit per unit** varies as products move through their life-cycles.
- Each phase of the product life-cycle poses **different threats and opportunities** that give rise to different strategic actions.
- Products require **different functional emphasis** in each phase-such as an R &D emphasis in the development phase and a cost control emphasis in the decline.

Importance

Product Life Cycle Costing is considered important due to the following reasons-

1. **Time based analysis**

   Life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their life cycle. Costs and revenues can be analyzed by time periods. The total magnitude of costs for each individual product can be reported and compared with product revenues generated in various time periods.

2. **Overall Cost Analysis**

   Production Costs are accounted and recognized by the routine accounting system. However non-production costs like R&D, design, marketing, distribution, customer service etc. are less visible on a product-by-product basis. Product Life Cycle Costing focuses on recognizing both production and non-production costs.

3. **Effective Pricing Decisions**

   Pricing Decisions, in order to be effective, should include market considerations on the one hand and cost considerations on the other. Product Life Cycle Costing and Target Costing help analyze both these considerations and arrive at optimal price decisions.

4. **Better Decision Making**

   Based on a more accurate and realistic assessment of revenues and costs, at least within a particular life cycle stage, better decisions can be taken.

5. **Long Run Holistic view:**

   Product life cycle thinking can promote long-term rewarding in contrast to short-term profitability rewarding. It provides an overall framework for considering total incremental costs over the entire life span of a product, which in turn facilitates analysis of parts of the whole where cost effectiveness might be improved.

6. **Life Cycle Budgeting:**

   Life Cycle Budgeting, i.e. Life Cycle Costing with Target Costing principles, facilitates scope for cost reduction at the design stage itself. Since costs are avoided before they are committed or locked in the Company is benefited.

7. **Review:**

   Life Cycle Costing provides scope for analysis of long term picture of product line profitability, feedback on the effectiveness of life cycle planning and cost data to clarify the economic impact of alternatives chosen in the design, engineering phase etc.

Project life – cycle costing

- Project life-cycle costing is a technique which takes account of the total cost of owning a physical asset, or making a product, during its economic life.
- In many instances, the purchase of equipment is decided solely on the criteria of initial acquisition costs. Operating plans do not usually spell out the implications for the cost of operating physical assets during the current or future financial periods. Maintenance policies may be only infrequently reviewed.

❖ Project life-cycle costs

- Product life-cycle costs are incurred for products and services from their design stage through development to market launch, production and sales, and their eventual withdrawal from the market. In contrast project life-cycle costs are fixed assets, i.e., for capital equipment and so on.

The component elements of a project's cost over its life-cycle could include the following:

a) **Acquisition cost,** i.e., costs of research, design, testing, production, construction, or purchase of capital equipment.
b) **Transportation and handling costs of capital equipment.**
c) **Maintenance costs of capital equipment.**
d) **Operations costs,** i.e., the costs incurred in operations, such as energy costs, and various facility and other utility costs.
e) **Training costs** i.e., operator and maintenance training.
f) **Inventory costs** i.e., cost of holding spare parts, warehousing etc.
g) **Technical data costs** i.e., cost of purchasing any technical data.
h) **Retirement and disposal costs** at the end of life or the capital equipment life.

Life Cycle costing models

LCC model is an accounting structure containing terms and factors which enable estimation of an asset's component costs.

A number of commercially available models can be used for LCC analysis. However, in some cases it may be appropriate to develop a model for a specific application. In either case, the LCC model should:

- **Represent the characteristics** of the asset being analyzed including its intended use environment, maintenance concept, operating and maintenance support scenarios and any constraints or limitations
- **Be comprehensive** enough to include and highlight the factors relevant to the asset LCC
- **Be easily understood** to allow timely decision- making, future updates and modification
- Provide for the evaluation of specific LCC elements independently of other elements.

Methods of analyses

One or more of the following methods for analyzing cost data should be used.

1. Engineering cost method

- The Engineering Cost Method is used where there is detailed and accurate capital and operational cost data for the asset under study.
- It involves the direct estimation of a particular cost element by examining the asset component-by-component.
- It uses standard established cost factors (e.g. firm engineering and/or manufacturing estimates) to develop the cost of each element and its relationship to other elements (known as Cost Element Relationships - CER).

2. Analogous cost method

- This method provides the same level of detail as the Engineering Cost Method but draws on historical data from components of other assets having analogous size, technology, use patterns and operational characteristics.

3. Parametric cost method

- The Parametric Cost Method is employed where actual or historical detailed asset component data is limited to known parameters.
- This available data from existing cost analyses is used to develop a mathematical regression or progression formula that can be solved for the cost estimate required.

The Life Cycle costing process

Stage 1: Plan LCC Analysis

The Life Cycle Costing process begins with development of a plan, which addresses the purpose, and scope of the analysis. The plan should:

1. **Define the analysis objectives in terms of outputs required to assist management decisions. Typical objectives are:**
   - Determination of the LCC for an asset in order to assist planning, contracting, budgeting or similar needs
   - Evaluation of the impact of alternative courses of action on the LCC of an asset (such as Design approaches, asset acquisition, support policies or alternative technologies)
   - Identification of cost elements which act as cost drivers for the LCC of an asset in order to focus design, development, acquisition or asset support efforts.
2. **Delineate the scope of the analysis in terms of the asset(s) under study, the time period (life cycle phases) to be considered, the use environment and the operating and maintenance support scenario to be employed.**
3. **Identify any underlying conditions, assumptions, limitations and constraints (such as minimum asset performance, availability requirements or maximum capital cost limitations) that might restrict the range of acceptable options to be evaluated.**
4. **Identify alternative courses of action to be evaluated. The list of proposed alternatives may be refined as new options are identified or as existing options are found to violate the problem constraints.**
5. **Provide an estimate of resources required and a reporting schedule for the analysis to ensure that the LCC results will be available to support the decision-making processes for which they are required.**

Stage 2: Select/develop LCC model

The model should:

- **Create or adopt a cost breakdown structure (CBS) that identifies all relevant cost categories in all appropriate life cycle phases. Cost categories should continue to be broken down until a cost can be readily estimated for each individual cost element. Where available, an existing cost breakdown structure may provide a useful starting point for development of the LCC breakdown structure.**
- **Identify those cost elements that will not have a significant impact on the overall LCC of the asset(s) under consideration or those that will not vary between alternatives. These elements may be eliminated from further consideration.**
- **Select a method (or methods) for estimating the cost associated with each cost element to be included in the model.**
- **Determine the data required to develop these estimates, and identify sources for the data.**
- **Identify any uncertainties that are likely to be associated with the estimation of each cost element.**
- **Integrate the individual cost elements into a unified LCC model, which will provide the LCC outputs required to meet the analysis objectives.**
- **Review the LCC model to ensure that it is adequate to address the objectives of the analysis.**
- **The LCC model including all assumptions should be documented to guide and support the subsequent phases of the analysis process**

Stage 3: Apply LCC model

Application of the LCC Model involves the following steps:

- **Obtain data and develop cost estimates and their timing for all the basic cost elements in the LCC model.**
- **Validate the LCC model with available historical data if possible.**
- **Obtain the LCC model results from each relevant combination of operating and support scenarios defined in the analysis plan.**
- **Identify cost drivers by examining LCC model inputs and outputs to determine the cost elements that have the most significant impact on the LCC of the asset(s).**
- **Quantify any differences (in performance, availability or other relevant constraints) among alternatives being studied, unless these differences are directly reflected in the LCC model outputs.**

- **Categories and Summarize LCC model outputs according to any logical groupings, which may be relevant to users of the analysis results (e.g. fixed or variable costs, recurring or non-recurring costs, acquisition or ownership costs, direct or indirect costs).**

- **Conduct sensitivity analyses to examine the impact of variations to assumptions and cost element uncertainties on LCC model results. Particular attention should be focused on cost drivers, assumptions related to asset usage and different discount rates.**

- **Review LCC outputs against the objectives defined in the analysis plan to ensure that all goals have been fulfilled and that sufficient information has been provided to support the required decision. If the objectives are not met, additional evaluations and modifications to the LCC model may be required.**

- **The LCC analysis (including all assumptions) should be documented to ensure that the results can be verified and readily replicated by another analyst if necessary.**

Stage 4: Document and review LCC Results

The report should contain the following.

1. **Executive Summary:** a brief synopsis of the objectives, results, conclusions and recommendations of the analysis.

2. **Purpose and Scope:** a statement of the analysis objective, asset description including a definition of intended asset use environment, operating and support scenarios, assumptions, constraints and alternative courses of action considered.

3. **LCC Model Description:** a summary of the LCC model, including relevant assumptions, the LCC breakdown structure and cost elements along with the methods of estimation and integration.

4. **LCC Model Application:** a presentation of the LCC model results including the identification of cost drivers, the results of sensitivity analyses and the output from any other related analyses.

5. **Discussion:** discussion and interpretation of the results including identification of uncertainties or other issues which will guide decision makers and users in understanding and using the results.

6. **Conclusions and Recommendations:** a presentation of conclusions related to the objectives of the analysis and a list of recommendations along with identification of any need for further work or revision of the analysis.

BUSINESS PROCESS RE-ENGINEERING (BPR)

- Business Process Reengineering involves **changes in structures and in processes within the business environment**.
- The entire technological, human, and organizational dimensions may be changed in BPR.
- Business process re-engineering is also known ***as business process redesign, business transformation, or business process change management***

Hammer and Champy provide the following definitions:

a) **Reengineering** is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance such as cost, quality, service and speed.

b) **Process** is a structured, measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on how work is done within an organization.

Characteristics

The BPR characteristics - outcomes include the following:

- Several jobs are **combined into one**.
- Decision-making becomes part of the job of employees **(employee empowerment).**
- Steps in the processes are performed in natural order, and several **jobs get done simultaneously**.
- Processes have multiple versions. This enables the economies of scale that result from mass production, yet allows **customization of products and services**.
- Work is performed where it makes the most sense.
- **Controls and checks** and other non-value-added work are minimized.
- Reconciliation is minimized by cutting back the number of external contact points and by creating business alliances.
- **A single point** of contact is provided to customers.
- A hybrid centralized/decentralized operation is used.

Expected Results / Benefits

The expected results for a company that implements business process reengineering are the following:

- Reallocation of jobs and processes so as to be combined into fewer, to be executed in natural order, simultaneously and by the least possible number of employees.
- Reorganization of the company's structure (downsizing) and employee empowerment.
- Jobs and processes become flexible so as to be executed according to the needs of each case, company's and customer's need's (hybrid centralized/decentralized operations)

Objectives of BPR

When applying the BPR management technique to a business organization the implementation team effort is focused on the following objectives:

(Customer Focus-Speed-Compression-Flexibility-Quality-Innovation-Productivity)

1. **Customer focus.** Customer service oriented processes aiming to eliminate customer complaints.
2. **Speed.** Dramatic compression of the time it takes to complete a task for key business processes. For instance, if process before BPR had an average cycle time 5 hours, after BPR the average cycle time should be cut down to half an hour.
3. **Compression.** Cutting major tasks of cost and capital, throughout the value chain. Organizing the processes a company develops transparency throughout the operational level reducing cost. For instance the decision to buy a large amount of raw material at 50% discount is connected to eleven cross checkings in the organizational structure from cash flow, inventory, to production planning and marketing. These checkings become easily implemented within the cross-functional teams, optimizing the decision making and cutting operational cost.
4. **Flexibility.** Adaptive processes and structures to changing conditions and competition**.** Being closer to the customer the company can develop the awareness mechanisms to rapidly spot the weak points and adapt to new requirements of the market.
5. **Quality.** Obsession with the superior service and value to the customers. The level of quality is always the same controlled and monitored by the processes, and does not depend mainly on the person, who servicing the customer.
6. **Innovation**. Leadership through imaginative change providing to organization competitive advantage.
7. **Productivity**. Improve drastically effectiveness and efficiency. In order to achieve the above mentioned objectives the following BPR project methodology is proposed.

Methodology of a BPR project implementation / alternative techniques

In order to implement BPR to an enterprise the followings key actions need to take place:

- **Selection of the strategic** (added-value) processes for redesign.
- **Simplify new processes** - minimize steps - optimize efficiency (modeling).
- **Organize a team of employees** for each process and assign a role for process coordinator.
- **Organize the workflow** - document transfer and control.
- **Assign responsibilities** and roles for each process.
- **Automate processes using IT**(Intranets, Extranets, Workflow Management)
- **Train the process team** to efficiently manage and operate the new process
- **Introduce the redesigned process** into the business organizational structure

Types of firms / organizations that BPR can be applied

BPR could by implemented to all firms (manufacturing firms, retailers, services, etc.) and public organizations that satisfy the following criteria:

- Minimum Number of employees: 20 (at least 4 in management positions).
- Strong management commitment to new ways of working and innovation.
- Well-formed IT infrastructure.

Business Process Reengineering could be applied to companies that confront problems such as the following:

- High operational costs
- Low quality offered to customers
- High level of ''bottleneck" processes at pick seasons
- Poor performance of middle level managers
- Inappropriate distribution of resources and jobs in order to achieve maximum performance, etc.

Steps of Business process Re- Engineering

1. **Develop Business Vision and Process Objectives**
2. **Identify Processes to be Redesigned**
3. **Understand and Measure the Existing Processes**
4. **Identify IT Levers:**
5. **Design and Build a Prototype of the New Process**

1. Develop Business Vision and Process Objectives

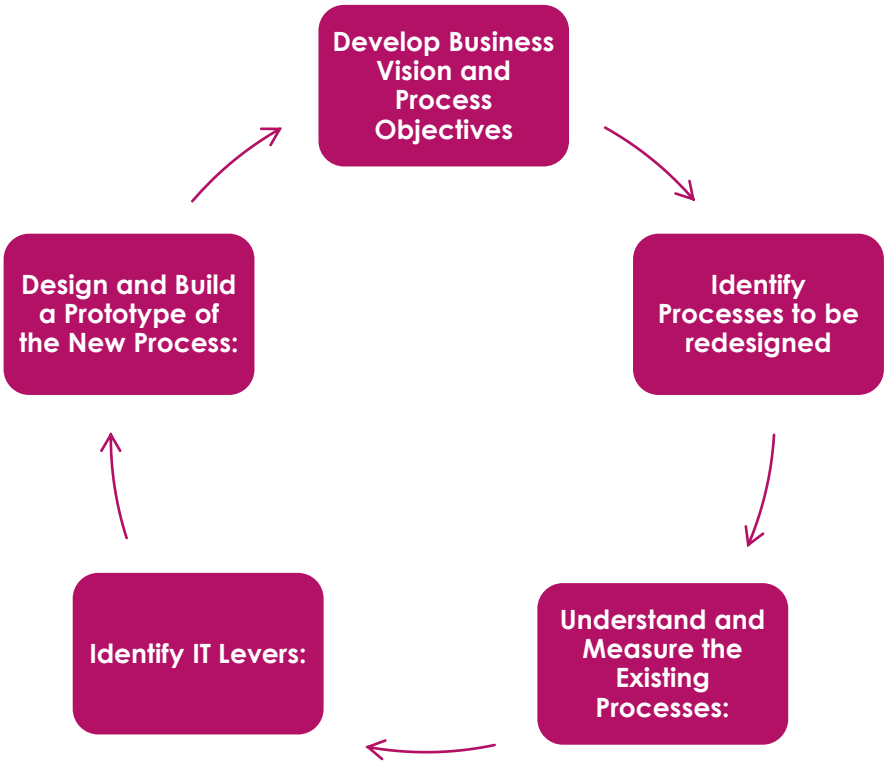
- BPR is driven by a business vision which implies specific business objectives such as Cost Reduction, Time Reduction, Output Quality Improvement, Quality of Work life (QWL)/Learning/Empowerment.

2. Identify Processes to be redesigned

- Most firms use the *High-Impact* approach which focuses on the most important processes or those that conflict most with the business vision.
- Lesser number of firms use the *Exhaustive* approach that attempts to identify all the processes within an organization and then prioritize them in order of redesign urgency.

3. **Understand and Measure the Existing Processes:**
    - Understanding and measuring the existing processes before redesigning them is especially important, because problems must be understood so that they are not repeated.
    - On the other hand, accurate measurement can serve as a baseline for future improvements.
4. **Identify IT Levers:**
    - In the broadest sense, all of IT's capabilities involve improving coordination and information access across organizational units, thereby allowing for more effective management of task interdependence.
    - An awareness of IT capabilities can -and should- influence process design.
    - Therefore, the role of IT in a process should be considered in the early stages of its redesign.
5. **Design and Build a Prototype of the New Process:**
    - The actual design should not be viewed as the end of the BPR process. Rather, it should be viewed as a prototype, with successive iterations expected and managed.
    - Key factors and tactics to consider in process design and prototype generation include using IT as a design tool, understanding generic design criteria, and creating organizational prototypes.

Another views for BPR of pictorial description is given below



BPR Tools and Techniques

The various definitions of BPR suggest that the radical improvement of processes is the goal of BPR. They do not, however, refer specifically to the tools and techniques used in reengineering business processes.

1. **Process visualization:**

   While many authors refer to the need to develop an ideal "end state" for processes to be reengineered, some suggest that the key to successful reengineering lies in the development of a vision of the process.

2. **Process mapping /operational method study:**

   Process mapping and operational method studies have been incorporated into tools such as IDEF0 (Integrated Definition Method), DFD (Data Flow Diagrams), OOA (Object Oriented Analysis), and Prince2 (Process Based Project Management).

3. **Change management:**

   Since management of change is the largest task in reengineering, the human side of reengineering, in particular the management of organizational change should not be neglected.

4. **Benchmarking:**

   Benchmarking forms an integral part of reengineering, since it allows the visualization and development of processes which are known to be in operation in other organizations.

5. **Process and customer focus:**

   The primary aim of BPR, is to redesign processes with regard to improving performance from the customer's perspective. It should be noted that few authors refer to any single technique when discussing BPR. Most incorporate a mixture of tools, although the nature of the mix depends on the application, whether it be hard (technological) or soft (management of people).

The Role of Information Technology

Information technology (IT) has historically played an important role in the reengineering concept. It is considered by some as a major enabler for new forms of working and collaborating within an organization and across organizational borders

- Shared databases, making information available at many places
- Expert systems, allowing generalists to perform specialist tasks
- Telecommunication networks, allowing organizations to be centralized and decentralized at the same time
- Decision-support tools, allowing decision-making to be a part of everybody's job
- Wireless data communication and portable computers, allowing field personnel to work office independent
- Interactive videodisk, to get in immediate contact with potential buyers
- Automatic identification and tracking, allowing things to tell where they are, instead of requiring to be found
- High performance computing, allowing on-the-fly planning and revisioning.

The major differences between Quality Improvement and Process Reengineering

Differences between Total Quality Management (TQM) and Business Process Reengineering (BPR)

Major Factor	TQM Approach	BPR
Senior-management involvement	Hands-on initially, and becoming more reinforcement-oriented	Hands-on, active involvement throughout the effort
Intensity of team-member involvement	Ongoing involvement on an as-needed, part-time basis	Ongoing involvement for a specified duration on a full-time basis
Improvement goals	Focus on incremental improvements over a period of time	Focus on dramatic improvements in a short time frame
Implementation approach	Emphasis on improving current work processes	Emphasis on creating new ways of doing things
Magnitude of organizational change	Limited disruption to existing systems and structures	Radical changes to existing systems and structures
Breadth of focus	Addresses narrowly defined work processes	Addresses processes that span entire business units
Use of benchmark data	Used after process improvement, to compare data	Used on front end, to assist with process selection
Dependence on information systems	Information systems used for data collection and interpretation	Information systems used as a central enabler with on-line access

Failure of BPR Projects

The common barriers to effective implementation of BPR projects as follows:

- **Misunderstanding of the concept:** Lack of understanding the concept because managers label any organizational change as reengineering which results with a failure to appreciate the promise of reengineering.
- **Misapplication of the term:** Reengineering is not cheap, and it cannot be successful without a continuous improvement process.
- **Lack of proper strategy:** A major reason for the high failure rates of BPR efforts is that the efforts are not connected to the corporate goals.
- **Unrealistic objectives:** Reengineering always takes longer than expected, always involve more people resources than are available, and always presents problems no one anticipates.
- **Management failure to change:** Lack of leadership is a frequent cause for the high failure rate of BPR projects.
- **Failing to recognize the importance of people:** Many companies who attempt reengineering focus on process design and ignore or underestimate the importance of people.
- **IT failure to change:** IT can be one of the greatest barriers to BPR. Many reengineering efforts have been stopped because radical change would require IT redesign. Resistance on the part of IT personnel has more often been a failure in implementation than an enabler

The Myths about BPR

Besides the common barriers to effective implementation of BPR described by Attaran (2003), as time passes, some myths concerning the BPR concept also represent obstacles in front of BPR projects.

The seven myths of BPR described by Grover & Malhotra (1997) are as follows:

Myth 1*:* "**Reengineering is a radical one-time approach**"

- It is changing as many firms are not willing to invest the money and time to implement change from a "clean state".

Myth 2: "**Reengineering involves breakthrough performance gains**"

- It is being challenged as benchmarking and measurement of these gains can prove elusive.

Myth 3: "**Reengineering enables change primarily through IT**"

- It is being moderated by the numerous organizational innovations involving people, jobs, skills and structures that facilitate process-oriented behaviors.

Myth 4: "Reengineering should focus on cross-functional core business processes"

- It is fine, but many piecemeal improvements within functions can also add up to significant change and have proven very successful.

Myth 5: "Reengineering enhances individual capacities through empowerment and teams"

- It is all well and good but many process-change projects are being defended based on cost objectives achieved through downsizing with few opportunities for retraining.

Myth 6: "Reengineering can use a standardized set of methods touted by armies of consultants"

- It is being questioned given that no standardized approach exists to date.

Myth 7: "Reengineering must be conducted from the top down"

- It is being challenged since often detailed understanding of process design resides with people who do the work.

Summary of BPR

Characteristics	Objectives	implementation	Steps	Tools and Techniques	Failure
Combined into one	Customer focus	Selection of the strategic	Develop business vision and process objectives	Process visualization	Misunderstanding of the concept
Employee empowerment	Speed	Simplify new processes	Identify processes to be redesigned	Process mapping /operational method study:	Misapplication of the term
Jobs get done simultaneously	Compression.	Organize a team	Understand and measure the existing processes	Change management:	Lack of proper strategy
Allows customization of products and services	Flexibility	Organize the workflow	Identify it levers	Benchmarking	Unrealistic objectives
Controls and checks	Quality.	Assign responsibilities	Design and Build a Prototype of the New Process	Process and customer focus	Management failure to change
Single point	Innovation.	Automate processes using it			Failing to recognize the importance of people
	Productivity	Train the process team			IT failure to change
		Introduce the redesigned process			

JUST-IN-TIME

- JIT is a philosophy of continuous improvement in which non-value-adding activities (or wastes) are identified and removed for the purposes of:
    a) **Reducing Cost**
    b) **Improving Quality**
    c) **Improving Performance**
    d) **Improving Delivery**
    e) **Adding Flexibility**
    f) **Increase innovativeness**
- JIT eliminates waste by providing the environment to perfect and simplify the processes.
- JIT is a collection of techniques used to improve operations.
- It can also be a new production system that is used to produce goods or services.

Advantages of Just-In-Time System

Following are the advantages of adopting Just-In-Time Manufacturing System:

1. **REDUCE COST**
    - Just-in-time manufacturing keeps stock holding costs to a bare minimum.
    - The release of storage space results in better utilization of space and thereby bears a favorable impact on the rent paid and on any insurance premiums that would otherwise need to be made.
2. **ELIMINATION OF WASTE**
    - Just-in-time manufacturing eliminates waste, as out-of-date or expired product; do not enter into this equation at all.
3. **ORDER OF ESSENTIAL STOCK**
    - As under this technique, only essential stocks are obtained, less working capital is required to finance procurement.
    - Here, a minimum re-order level is set, and only once that mark is reached fresh stocks are ordered, making this a boon to inventory management too.
4. **HIGH RETURN ON INVESTMENT**
    - Due to the afore-mentioned low level of stocks held, the organization's return on investment (referred to as ROI, in management parlance) would generally be high.

5. **PRODUCTION ON DEMAND PULL BASIS**
    - As just-in-time production works on a demand-pull basis, all goods made would be sold, and thus it incorporates changes in demand with surprising ease.
    - This makes it especially appealing today, where the market demand is volatile and somewhat unpredictable.
6. **REDUCE OF INSPECTION AND REWORK COST**
    - Just-in-time manufacturing encourages the right first time concept, so that inspection costs and cost of rework is minimized.
7. **High quality products** and greater efficiency can be derived from following a just-in-time production system.
8. **Close relationships** are fostered along the production chain under a just-in-time manufacturing system.
9. **Constant communication** with the customer results in high customer satisfaction.

Disadvantages

Following are the disadvantages of adopting Just-In-Time Manufacturing Systems:

1. **ZERO TOLERANCE**
    - Just-in-time manufacturing provides zero tolerance for mistakes, as it makes re-working very difficult in practice, as inventory is kept to a bare minimum.
2. **HIGH RELIANCE ON SUPPLIERS**
    - There is a high reliance on suppliers, whose performance is generally outside the purview of the manufacturer.
3. **NO BUFFERS STOCK**
    - As there will be no buffers for delays, production downtime and line idling can occur, which would bear a detrimental effect on finances and on the equilibrium of the production process.
4. **UNABLE TO MEET INCREASED DEMAND**
    - The organization would not be able to meet an unexpected increase in orders, due to the fact that there are no excess finish goods.
5. **TRANSACTION COSTS**
    - Transaction costs would be relatively high, as frequent transactions would be made.
6. **DETRIMENTAL EFFECTS ON THE ENVIRONMENT**
    - Just-in-time manufacturing may have certain detrimental effects on the environment, due to the frequent deliveries that would result in increased use of transportation which in turn would consume more fossil fuels.

Precautions

Following are the things to remember When Implementing a Just-In-Time Manufacturing System:

- Management buy-in and support at all levels of the organization are required; if a just-in-time manufacturing system is to be successfully adopted.
- Adequate resources should be allocated, so as to obtain technologically advanced software, that is generally required if a just-in-time system is to be a success.
- Building a close, trusting relationship with reputed and time-tested suppliers will minimize unexpected delays in the receipt of inventory.
- Just-in-time manufacturing cannot be adopted overnight. It requires commitment in terms of time and adjustments to corporate culture would be required, as it is starkly different to traditional production processes.
- The design flow process needs to be redesigned and layouts need to be re-formatted, so as to incorporate just-in-time manufacturing.
- Lot sizes need to be minimized.
- Work station capacity should be balanced whenever possible.
- Preventive maintenance should be carried out, so as to minimize machine breakdowns.
- Set up times should be reduced wherever possible.
- Quality enhancement programs should be adopted, so that total quality control practices can be adopted.
- Reduction in lead times and frequent deliveries should be incorporated.
- Motion waste should be minimized, so the incorporation of conveyor belts might prove to be a good idea when implementing a just-in-time manufacturing system.

JIT system also uses following performance measures

1. **Inventory turnover**
2. **Set-up time reduction**
3. **Customer complaints**
4. **Scrap**
5. **Cost of quality**
6. **Customer service**
7. **Ideas generated**

The following performance measurement criteria are relevant to JIT -

1. Inventory Turnover

- One of the primary objectives of JIT systems is the reduction of unnecessary inventory. Hence, Inventory Turnover is a suitable performance measure in JIT.
- This measure can be subdivided into separate ratios for Raw Materials, Work in Process, and Finished Goods.

2. Setup Time Reduction

- The average setup time per machine can be measured periodically and plotted on a trend line.
- The shortest possible setup intervals are crucial for the success of short production runs, so this is a major JIT measurement.
- It is best to measure it machine-wise, rather than in the aggregate for all machines.

3. Customer Complaints

- JIT presumes optimum product quality. Hence customer complaints on product problems should be investigated immediately.
- The accumulation of customer complaints and their dissemination to management should be considered a major JIT measure.

4. Scrap

- JIT aims to bring down materials scrap rates.
- The cost of scrap (along with a detailed list of items that were scrapped) is of particular concern as a JIT system is being implemented, since it helps to identify problem areas requiring further management attention.

5. Cost of Quality

- Under JIT, it is necessary to keep track of the full cost of quality (which comprises defect control costs, failure costs, and the cost of lost sales) on a trend line.
- Managers can analyses this information to know where the largest quality costs still reside in the Company and can then work to reduce them.

6. Customer Service

- **This measure has several components like –**
  1. Delivering products on the dates required by Customers,
  2. Dispatching full orders to Customers, and
  3. Reducing rejections and returns.

7. Ideas generated

- JIT system works best when employees provide suggestions for improvements that, when taken in total, result in a vastly improved, efficient operation.
- The amount of idea generation can be measured by the number of ideas per worker, the number of ideas suggested in total, the number of ideas implemented, or the proportion of ideas suggested that are implemented.

Backflushing in JIT System

1. Sequential Tracking

Traditional normal and standard costing systems use the Sequential Tracking method for accounting costs. This involves recording journal entries in the same order as transactions occur, i.e. purchase, issue of materials, production, OH absorption, etc.

2. Back flush Costing

3. Suitability in JIT:

Given the large transaction volumes associated in JIT, Backflush Costing is ideal when compared to Sequential Tracking method. However, the following issues must be corrected before effective implementation of Backflush Costing -

- ✓ ***Accurate Production Reports;*** the total production figure entered into the system must be absolutely correct, or else the wrong component type and quantities will be subtracted from stock. Errors in Production Reporting can be reduced by proper staff training and reducing staff turnover.
- ✓ ***Proper Scrap Reports:*** All abnormal scrap must be diligently tracked and recorded. Otherwise, these materials will fall outside the Backflushing System and will not be charged to inventory. Since Scrap can occur anywhere in a production process, lack of attention by any of the Production Staff can result in an inaccurate inventory.
- ✓ ***Lot Tracing:*** Lot tracing is impossible under Backflushing System. It is required when a Manufacturer needs to keep records of which production lots were used to create a product in case all the items in a lot must be recalled. Only a Picking System can adequately record this information. Some computer systems allow Picking and Backflushing System to co-exist.
- ✓ ***Inventory Accuracy:*** The inventory balance may be too high at all times because the Backflushing Transaction that 'relieves inventory usually does so only once a day, during which time other inventory is sent to the production process. This makes it difficult to maintain an accurate set of inventory records in the warehouse.

Summary

Advantages	Disadvantages	Performance measures	Backflushing in JIT System
Reduce cost	Zero tolerance	Inventory turnover	Sequential Tracking:
Elimination of waste	High reliance on suppliers	Set-up time reduction	Backflush Costing:
Order of essential stock	No buffers stock	Customer complaints	Suitability in JIT:
High return on investment	Unable to meet increased demand	Scrap	
Production on demand pull basis	Transaction costs	Cost of quality	
Reduce of inspection and rework cost	Detrimental effects on the environment	Customer service	
High quality products		Ideas generated	
Close relationships			
Constant communication			

COST CONTROL AND REDUCTION

Cost Reduction

- Cost Reduction is the achievement of the **real and permanent reduction** in the unit cost of goods manufactured or services rendered
- Without impairing their suitability for the use intended or diminution in the quality of the product.

The Cost Reduction efforts generally focus on the following two key areas -

a) Reduction in Expenditure: Reduction in unit cost resulting from reduction in expenditure in respect of a given volume of output.

b) Increased Productivity: Reduction in unit cost by an increase in productivity i.e. increase in yield or rate of output for a given expenditure.

Cost control

- Cost control is different from cost reduction.
- The word "control" indicates an exercise in restraint. When expenses are controlled, they are restrained from growing larger than they should grow.
- The process of cost reduction, on the other hand, concerns reducing expenses that are too high. Controlling is a very different concept than reducing.

Cost control affects every expense category in a company. But cost control is a lot more than just saying "no" to incurring an expense. It is a management technique that requires all business activities to be evaluated on several levels.

Difference between Cost Reduction and Cost Control

Particulars	Cost Reduction	Cost Control
1. Permanence	Permanent, Real and genuine savings in cost	Could be a temporary saving also
2. Nature of Saving	Saving in Cost per unit	Saving either in Total Cost or Cost per unit
3. Nature of process	It presumes the existence of concerned potential savings in norms or standards and therefore it is a corrective process	It does not focus on costs independent of revenue nor considers product attributes as given. It is a wholistic control process.

4. Performance Evaluation	It is not concerned with maintenance of performance according to standards.	The process involves setting up a target, investigating variances and taking remedial measures to correct them.
5.Nature of Standards	Continuous process of critical examination includes analysis and challenge of standards.	Control is achieved through compliance with standards. Standards by themselves are not examined.
6. Dynamism	Fully dynamic approach	Lacks dynamism when compared to cost reduction.
7. Coverage	Universally applicable to all areas of business. Does not depend upon standards, though target amounts may be set.	Limited applicability to those items of cost for which standards can be set.
8. Nature of Costs	Emphasis here is partly on present costs and largely on future costs.	Budgetary Control and Standard Costing.

Difference between Cost Reduction and Cost Management

Particulars	Cost Reduction	Cost Management
Meaning	It is the permanent reduction in the unit cost of goods or services without affecting their quality or suitability for their intended use.	It is a system that establishes linkages between costs and revenues and relates them with the product to maximize Firm's profits
Objective	Critical examination of each aspect of business and their analysis and review to improve the efficiency and effectiveness so as to reduce costs through techniques of Value Analysis, Work Study, Standardization etc.	Optimal utilization of resources to enhance the operating income of the business entity.
Nature of process	It presumes the existence of concealed potential savings in norms or standards and therefore it is a corrective process.	It does not focus on costs independent of revenue nor considers product attributes as given. It is a wholistic control process

The areas and techniques of cost reduction

1. Introduction of new design of the product to achieve savings in material usage.
2. Improvement of existing design to affect savings in materials by reduction of materials, substitution of cheaper materials.
3. Standardization and simplification of parts and components to improve productivity and reduce inventory.
4. Production planning to reduce costs through better layout, change of location etc.
5. Tool design and its standardization to eliminate materials wastage's and reduce labour time. (vi) Efficient use of support services.
6. Look out for alternate sources to type of materials.
7. Undertake energy saving schemes by reducing use of steam and power and undertaking improvements for recovery of heat or eliminating dissipation thereof.
8. Control transmission losses of power and steam by better insulations.
9. Look out for technical innovations and technological improvement to cut down on process step or to effect economies in yield or enable to increase production.
10. Try to achieve lower cost by better economies of scale.

Techniques to be employed for Cost Reduction

1. Value analysis to identify unnecessary costs.
2. Work and Time and Motion Study to eliminate wasteful movements and procedures.
3. ABC analysis to control inventory.
4. Vendor rating for better deals or trapping new sources.
5. Economic Order Quantity and other methodology for minimum /maximum quantity and improvement upon lead time.
6. Operation Research Techniques like linear programming, PERT / CPM, simulations etc.
7. Use of marginal costing technique in all marginal decisions on buy or make or exploration of new markets or improvements etc.

Value analysis aims at a critical review of the design, materials and manufacturing process used to bring down costs. Discuss the use of value analysis as a tool of cost reduction in a manufacturing organization.

Value analysis is a systematic and organized study of the functions of a materials part, component, design system or process. This is done mainly with a view to identify areas of unnecessary cost that can be eliminated without impairing the capacity of the item to satisfy the objective. Value analysis, therefore, has its significant role in the area of cost reduction and increasing productivity. As a part of this analysis, value of the functions served by the material and different components is examined in terms of their real worth. Both material and process is one, which can perform the function satisfactorily at the lowest cost.

Value analysis can embrace the following areas:

a) Material

b) Design of a product

c) Process of manufacture

(i) Materials: Cost reduction can be effected in following manner:

- Elimination of excess or unnecessary material or a component used.
- Economy in the usage of material
- Standardization of parts and components leading to inventory control on the one hand and economic purchases on the other hand.

(ii) Design of a product: In the area of design of product, cost reduction can be effected by value analysis as under:

- Simplification of the design so as to consume lesser quantity of material and avoid wastages.
- Redesigning products to allow for the standardization of components.
- Redesigning to improve productivity or control defectives.

(iii) Process of manufacture: Value analysis can help in cost reduction as under:

- Unnecessary operation can be eliminated.
- Standardization to cope with operation so that simplification in process and long run benefits can be achieved.
- Improvements in productivity.
- Savings in energy cost as well as achieving better yield from the material used.
- Better quality of product.

Value analysis is a continuous exercise and is an important element to be emphasized while preparing budget for cost reduction.

DECISION-MAKING AND PRICING STRATEGIES

- **Strategic decision making, or strategic planning,**
  - Describes the process of creating a company's mission and objectives and deciding upon the courses of action a company should pursue to achieve those goals.
  - An ongoing process that involves creating strategies to achieve goals and altering strategies based on observed outcomes.
- Effective strategic business decisions bring together the right resources for the right markets at the right time.
- The quality of a company's decision making helps it to gain an advantage over competitors.
- Business decisions must reflect an organisation's aims (its purpose), such as to maximise returns for its shareholders.
- A rational decision making approach can help to reduce uncertainty. However, the external environment of a business adds variable factors which can increase risk.

Areas involving decisions to be taken by Management Accountant are -

1. **Stock Management and Inventory Control Decisions,**
2. **Plant Location Decisions,**
3. **Machinery Replacement / Capital Budgeting Decisions,**
4. **Sale at Split-off or Further Processing Decisions,**
5. **Product Decisions - Dropping or adding a product line,**
6. **Marketing Decisions,**
7. **Submitting Tenders and Quotations for new jobs based on relevant cost analysis,**
8. **Acceptance of Incremental Orders in different situations like spare capacity, full capacity etc,**
9. **Make or Buy Decisions,**
10. **Operate or Shut Down Decisions,**
11. **Product Pricing Decisions - Reduction or maintenance of price,**
12. **Opening of new sales territory or branch,**
13. **Intra-Company Transfer Pricing Decisions,**
14. **Purchasing vs. Lease Financing Decisions.**

Product Development Decisions

Product Development embraces new development, major modification of existing products, manufacture of products which are similar to those of competitors, product line acquisition, etc.

In business and engineering, new product development (NPD)

- It is the complete process of bringing a new product to market.
- A product is a set of benefits offered for exchange of price and can be ***tangible*** (that is, something physical you can touch) or ***intangible*** (like a service, experience, or belief).

There are two parallel paths involved in the NPD process:

a) One involves the idea generation, product design and detail engineering;

b) The other involves market research and marketing analysis. Companies typically see new product development as the first stage in generating and commercializing new product within the overall strategic process of product life cycle management used to maintain or grow their market share.

Stages of product development process

1. **Idea Generation**
2. **Idea Screening**
3. **Concept Development and Testing**
4. **Business Analysis**
5. **Beta Testing and Market Testing**
6. **Technical Implementation**
7. **Commercialization**
8. **New Product Pricing**

Stages	Explanation
Idea Generation	It is often called the "NPD" of the NPD process. • Ideas for new products can be obtained from basic research using a SWOT analysis (Strengths, Weaknesses, and Opportunities & Threats). Market and consumer trends, company's R&D department, competitors, focus groups, employees, salespeople, corporate spies, trade shows, or ethnographic discovery methods (searching for user patterns and habits) may also be used to get an insight into new product lines or product features. • Lots of ideas are generated about the new product. The ideas are generated in many forms. Many reasons are responsible for generation of an idea. • Idea Generation or Brainstorming of new product, service, or store concepts - idea generation techniques can begin when you have done your OPPORTUNITY ANALYSIS to support your ideas in the Idea Screening Phase (shown in the next development step).

Idea Screening	**The object is to eliminate unsound concepts prior to devoting resources to them.** • The screeners should ask several questions • Will the customer in the target market benefit from the product? • What is the size and growth forecasts of the market segment / target market? • What is the current or expected competitive pressure for the product idea? • What are the industry sales and market trends the product idea is based on? • Is it technically feasible to manufacture the product? • Will the product be profitable when manufactured and delivered to the customer at the target price?
Concept Development and Testing	Develop the marketing and engineering details • Investigate intellectual property issues and search patent databases • Who is the target market and who is the decision maker in the purchasing process? • What product features must the product incorporate? • What benefits will the product provide? • How will consumers react to the product? • How will the product be produced most cost effectively? • Prove feasibility through virtual computer aided rendering and rapid prototyping • What will it cost to produce it? • Testing the Concept by asking a number of prospective customers what they think of the idea usually [citation needed] via Choice Modelling.
Business Analysis	Estimate likely selling price based upon competition and customer feedback • Estimate sales volume based upon size of market • Estimate profitability and break-even point
Beta Testing and Market Testing	• Produce a physical prototype or mock-up • Test the product (and its packaging) in typical usage situations • Conduct focus group customer interviews or introduce at trade show • Make adjustments where necessary • Produce an initial run of the product and sell it in a test market area to determine customer acceptance
Technical Implementation	• New program initiation • Finalize Quality Management System • Resource estimation • Requirement publication • Publish technical communications such as data sheets • Engineering operations planning • Department scheduling • Supplier collaboration • Logistics plan • Resource plan publication • Program review and monitoring • Contingencies - what-if planning

Commercialization (often considered post-NPD)	• Launch the product • Produce and place advertisements and other promotions • Fill the distribution pipeline with product • Critical path analysis is most useful at this stage
New Product Pricing	• Impact of new product on the entire product portfolio • Value Analysis (internal & external) • Competition and alternative competitive technologies • Differing value segments (price, value and need) • Product Costs (fixed & variable) • Forecast of unit volumes, revenue, and profit

Product Policy

- **Product Policy** plays a very significant and crucial role in the product establishment and its growth in the market. The marketer has to keep in mind the product policy decision while introducing a product. It acts as a tool in the hands of the marketer.
- **Product decision** is a very conscious decision made by a company for a product. There are many different decisions. At one extreme there are such things as a minor modification of the label or color of the package. At the other extreme, there are such things as diversification into new business fields, either through internal R&D or mergers and acquisitions.

Types of product policy decisions

1. **Individual product decision**
2. **Product line decision:**
3. **Product mix decision**
4. **Product positioning decision**

Stages	Explanation
Individual product decision	**Product attribute:** It consists of the quality, feature, style and design of the product. Quality of the product assures the customer that the manufacturer is giving the customer a good quality product. Feature helps the consumer in differentiating the product from other products in the market. Style and design of the product helps in bringing the attention of the customers towards the product. **Product branding** The product must have its own unique brand name. Only then the customer will be able to differentiate the product from the other products. Brand name also helps the marketers in promoting the product and making consumer brand conscious. **Product packaging:** Packaging means the outer cover which contains the product. Like a tooth paste has two covers first in shape of tube and another cardboard cover put the tube in it. Product packaging helps the customer to get the knowledge about the product quality, quantity, weight, priceetc. **Product labeling:** Labeling on the product is very essential as it gives the consumer information regarding the manufacturer's name, place, date of manufacturing, expiry date, calories, carbohydrates, nutritional value etc. **Product support services:** These are the services which are provided to the customer after selling the product to the customer like after sale services, installation etc.

Product line decision:	Product line means group of product where the marketer makes the decision regarding the product line length. The product line may be short which means the marketer can increase the profit by adding a new product or there may be long product line. There are two ways of adding the product. Line stretching occurs when the company stretches its product line beyond its current range. In this respect, when a company serves the upper market, it can stretch its line downward by offering a new product in a lower price/quality (for example, Mercedes Benz in cooperation with Swatch launched Smart). By contrast, companies that serve the lower end of the market can make an upward stretch of their line by offering a new product in a higher price/quality (for example, Toyota introduced Lexus). Line filling occurs when new products are added to a company's present line for reasons like establishing an image of a full-line company, taking advantage of excess capacity, filling gaps in the market and discouraging competitive actions. For instance, there are various Kinder chocolate products in the market, such as Kinder Milk Chocolate, Kinder Bueno, Kinder Delice, Kinder Chocolate Eggs and Kinder Happy Hippo.
Product mix decision	**Product Mix** In a product mix decision based on available resources and facilities, the end results should always aim at profit maximization. For this purpose, costs, to be relevant, should meet the following criteria (a) The costs should be expected as Future Costs. (b) The costs differ among the alternative courses of action i.e. Differential Cost. Variable costs are relevant costs in product mix decisions and consequently Contribution (PV Ratio) plays a major role in profit maximization. In addition to relevancy of costs, the other factors that should be considered in deciding the product mix are – (a) Available Production Capacity and Limiting Factors, if any. (b) Contribution per unit of the Limiting Factor. (c) Market Demand for the products. (d) Opportunity Costs, if any
Product positioning decision	It is the way by which the marketer communicate the information of the product to the prospective buyer. It can be done on the bases of price or size or usage of the product.

PRICING STRATEGY

- Pricing strategies for products or services encompasses three main ways to improve profits.
- These are the business owner can cut costs or sell more, or find more profit with a better pricing strategy.
- When costs are already at their lowest and sales are hard to find, adopting a better pricing strategy is a key option to stay viable.

Factors Influencing Price of a Product

Generally, marketers consider the following factors in setting price:

1. **Target customers**: Price of product depends on the capacity of buyers to buy at various prices, in other words, influence of price elasticity of demand will be examined.
2. **Cost of the product:** Pricing is primarily based on, how much it costs to produce and market the product, i.e., both the production and distribution cost.
3. **Competition:** Severe competition may indicate a lower price than when there is monopoly or little competition.
4. **The law:** Government authorities place numerous restrictions on pricing activities.
5. **Social responsibility:** Pricing affects many parties, including employees, shareholders and the public at large. These should be considered in pricing.
6. **Market position of the firm**: The position of the market may also influence the pricing decision of the firm. It is only why the different producers of identical products sell their products at different prices.
7. **Distribution channel policy:** The prices of products will also depend upon the policy regarding distribution channel. The longer the channel, the higher would be the distribution costs and consequently higher the prices.
8. **Price elasticity of Demand:** Price elasticity refers to consequential change in demand due to change in price of the commodity. It is the relative responsiveness to the changes in price. As there an inverse relationship between price and demand for product, the demand will increase with fall in price.
9. **Economic environment:** In recession, prices are reduced to a sizeable extent to maintain the level of turnover. On the other hand, prices are charged higher in boom period to cover the increasing cost of production and distribution.

General Objectives of a Pricing Policy

Each pricing decision of a firm has generally one of the following objectives:

- To achieve a given rate of return for the entire product line;
- To maintain or increase the existing market share of the firm;
- To maintain at least a particular level of price stability;
- To choose and adopt a pricing policy which fits into the market conditions faced by the different products in the product line; or
- To aim at discouraging entry of new firms into the industry.

Methods of Pricing

The main pricing practices can be classified into three broad categories:

1) Cost Oriented Pricing:

a) Cost-plus or full Cost Pricing

b) Target or Rate of Return Pricing

c) Marginal Cost Pricing

2) Competition-Oriented Pricing:

a) Going Rate Pricing

b) Trade Association Pricing

c) Customary Pricing

d) Price Leadership

e) Sealed-bid Pricing

3) Demand Oriented Pricing:

a) Differential pricing or price discrimination

B) Perceived Value Pricing

4) Pricing Based on Other Economic Considerations:

A) Administered Pricing

b) Dual Pricing

c) Shadow Pricing

5) Pricing Policies Based on Market Conditions:

a) Perfect competition

b) Monopoly

c) Temporary monopoly

d) Duopoly

e) Oligopoly

f) Monopolistic competition.

g) Skimming Price Policy

Cost – plus pricing

Cost-plus (or "mark-up") pricing

- It is widely used in retailing, where the retailer wants to know with some certainty what the gross profit margin of each sale will be.
- An advantage of this approach is that the business will know that its costs are being covered. The main disadvantage is that cost-plus pricing may lead to products that are priced un-competitively.
- The main advantage of cost-based pricing is that selling prices are relatively easy to calculate. If the mark-up percentage is applied consistently across product ranges, then the business can also predict more reliably what the overall profit margin will be.

Marginal Cost Pricing

- Marginal cost pricing is said to be better than full cost pricing. Under full cost pricing, price is based on total costs comprising fixed and variable costs.
- Under marginal cost pricing, fixed costs are ignored and pricing is determined on the basis of marginal cost which refers to the cost of producing additional units.
- The price fixed must cover the marginal cost and total cost-which will have to be covered in the long run. Price based on marginal cost will be much more aggressive than the one based on total cost. Besides, where a firm has large unused capacity, it should explore the possibility of producing and selling more-it should cover the cost of producing the additional units (Marginal cost).
- The real difficulty is that the management may not always be aware of the concept of marginal cost.

Rate of return (or Target) Pricing

It is a refined version of cost-plus pricing. When due to certain reasons, the firm has to revise its prices it needs to ensure that the prices so revised would allow it to maintain either:

1. A fixed percentage mark-up over cost;
2. Profit as a fixed percentage of total sales; or
3. A fixed return on existing investments.

Rate of return price is determined in the following manner:

Step 1. The firm specifies an expected rate of return on investment (expressed as earnings divided by capital invested).
Step II. To determine a 'normal rate' of output by the firm and then to estimate the 'full cost' on the basis of this normal rate of production.
Step III. To estimate 'capital turnover' ratio (expressed as invested capital divided by full cost).
Step IV. To multiply capital turnover ratio with the expected rate of return on investment (as found in
Step I). This will give us the mark-up percentage.
Step V. To compute Rate of Return (ROR) price, we add up the full cost and the mark-up, i.e., P = Full Cost + Mark-up

Competition Oriented Pricing

Going Rate Pricing

- Another method of pricing adopted by small firms – which are price followers – is known as going rate pricing.
- Under this system, a firm sets its price according to the general pricing structure in the industry or according to the price set by the price leader.
- In a sense, each firm has "monopoly" power over its produce and it can, if it chooses, fix a monopoly price and face all the consequences of monopoly.
- In practice, however, it prefers the easier and more practical method of choosing price going in the market. It will change its price only when other firms do the same. Such a price policy is useful and safe to a firm under certain circumstances.
- For instance, the firm may not have an accurate idea of its costs or it may like to play safe and not provoke the larger firm to go for cutthroat competition. Besides, it is difficult for each firm to calculate the full implication of change in costs and prices and it is much better to follow the same pattern of pricing adopted by others.
- Even a large firm may be satisfied with going rate pricing lest a change in price by it unnecessarily disturbs the whole market. No firm would like to "spoil" the common market by reducing the price.

Customary Pricing

- There are certain goods whose prices tend to be fixed more or less in the minds of consumers-these are known as the "Charm" prices.
- Change in costs of production – if the change is moderate – will not affect the price, as the firms will not and cannot change the price.
- Accordingly, a rise in cost of production may probably lead to reduction in quality of the product but not to a rise in price.
- Likewise, a fall in cost of production may not be accompanied by a decline in price. Pricing in this case may be known as customary pricing.

Price leadership

- If often happens that in an industry there is one or many big firms whose cost of production is low and they dominate the industry. In such a situation, the small firms will not like to enter into price war with these big firms. The former may, therefore, follow the price fixed by the leader.
- ***For example***, Cadbury may be accepted as a leader in the chocolate industry, Hindustan Lever in the soap industry, and so on. Small firms may change the price only when there is a general change in the cost of production and the price leader has recognized and adjusted his price on that basis. In fact, the price leadership pattern is adopted as a strategy of co-existence – each firm catering to its market.

Sealed – bid pricing

This method is more popular in tenders and contracts. Each contracting firm quotes its price in a sealed cover called 'tender'. All the tenders are opened on a scheduled date and the person, who quotes the lowest price, other things remaining the same, is awarded the contract.

Demand Oriented Pricing

Differential pricing or price discrimination

There are many bases on which the open price discrimination is practiced. These are discussed below:

a) **Time Price Differentials:** It is a general practice to use the expression "the demand for a product or service", but it is important to note that demand also has a time dimension. The demand may shift in fairly short-time intervals. For example, demand for telephone facilities is more in the day time rather than at night.

b) **Use Price differentials:** Different buyers have different uses of a product or a service. For example railways can be used for long-haul or short-haul freight traffic. Railways can also be used for transporting different types of commodities. Electricity can similarly, be used for industrial or residential purposes.

c) **Quality price Differentials:** If the product caters to that group of consumers who are concerned about its quality, then the quality becomes a significant determinant of demand elasticity. The seller has, therefore, to create differences in quality to sell his product. It must be emphasized here that the differences in quality basically depend upon the buyers' understanding of the quality. Sellers use many devices to create quality differences.

d) **Quantity Differentials:** When the seller discriminates on the basis of the quantity of purchase, it is known as quantity differentials. Quantity discounts are price concessions based on the size of the lot purchased at one time and delivered at one location. These discounts are thus related to size of a single purchase. The size of the lot purchased is measured in terms of either physical units or monetary units. Sometimes, discounts are according to the trade status, i.e., wholesaler, retailer, jobber, etc

Perceived Value Pricing

Perceived value pricing refers to fixing the price on the basis of a buyer's perception of the value of the product.

Pricing Based on Other Economic Considerations

Administered Prices

Administered prices are the prices which are fixed and enforced by the Government. The term administered prices was introduced by Keynes.

1. They are fixed by Government
2. They are statutory i.e., legally enforced by the Government
3. They are regulatory in nature
4. They are meant as corrective measure
5. They are the outcome of the price policy of the Government.

Dual Pricing

- Dual pricing is a system in which there are two prices for the same commodity at the same time – one is a controlled price fixed by the Government and the other is a free market price based on conditions of demand and supply.
- The controlled price is fixed price while the free market price is a fluctuating price.
- Generally, the Government fixed the prices of a commodity – say, sugar – at a level which will cover the cost of production and permit a reasonable margin of profit. But this controlled price is obviously lower than the free market price because of the existence of excess of demand over supply.
- The controlled price is mainly for the benefit of lower income groups and it many often be fixed so low that the producers may incur a small margin of loss.
- The producers are compelled to sell part of their output at the controlled rate to the weaker sections of the community but are permitted to sell the surplus stocks in the market at the free market price which is much higher. This enables the producers to make up their loss in the controlled market or increase their volume of profit. Besides, the general consumers are given a chance to satisfy their demand fully from the market.

Shadow Pricing

- The producer has to decide two questions – 1) how much of each product should be produced to maximize profits? 2) What price is worth paying for additional quantities of a scarce resource?
- To decide the second question "What price is worth paying for additional quantity of a scarce resource", very often "shadow prices" are used. Shadow prices are not prices obtained by observing the real world. Shadow prices are "imputed values".
- The shadow price shows the marginal contribution of the factors of production employed. It is calculated by using the "simplex method". These imputed values show the increase in profit which would result if an additional unit of that scarce factor is used. The imputed value is the reduction in contribution if that scarce factor is removed.

Pricing Policies Based on Market Conditions

Perfect Competition:

A firm can only sell its product at the market price and nothing above it. In the long run, for an efficient firm, the sales price is just equal to the average cost. Normal profit is made. There is no excess profit.

Monopoly Pricing

Monopoly is a market conditions with the following features –

- One seller of a particular good or service.
- Absence of competition.
- Absence of close substitutes.
- Power to influence price.

Price determination under monopoly

- Substitute Firms who sell similar products enter the market and because of differentiation of products by sellers, monopolistic competition arises.
- Since there is a limit to the growth of competitors, the excess profits earned by monopolistic situation attracts new competition. This will have a long-run effect on the excess profits, which will tend to diminish because of the price competition with close substitutes.

Hence, the price determination will be as under-

- ☞ **Short Run Optimal Price**: In the short run, the individual Firm will go on producing as long as additional units add more to revenue than to cost. It will stop at the point beyond which additional output adds more to cost than to revenue. Hence, the Optimal Price is determined at the level of output at which Marginal Revenue equals to Marginal Cost.
- ☞ **Long Run Optimal Price:** In the long run, Average Revenue curve will be more elastic, since large number of substitutes will be available. Therefore, equilibrium is established when Firms are earning normal profits.

Skimming Price Policy:

- When the product is new but with a high degree of consumer acceptability, the firm may decide to charge a high mark up and, therefore, charge a high price.
- The system of charging high prices for new products is known as price skimming for the object is to "skim the cream" from the market.

There are many reasons for adopting a high mark-up and, therefore, high initial price:

a) **Inelastic Demand:-**The demand for the new product is relatively inelastic. The high prices will not stop the new consumers from demanding the product. The new product, novelty, commands a better price. Above all, in the initial stage, cross elasticity of demand is low.

b) If life of the product promises to be a short one, the management may fix a high price so that it can get as much profit as possible and, in as short a period as possible.

c) Such an initially high price is also suitable if the firm can divide the market into different segments based on different elasticities. The firm can introduce a cheaper model in the market with lower elasticity.

d) High initial price may also be needed in those cases where there is heavy investment of capital and when the costs of introducing a new product are high. The initial price of a transistor radio was ` 500 or more (now ` 50 or even less).

Duopoly

- This is the case where there are only two firms in an industry. Each duopolist can choose his production in such a way as to maximize his income for a given value of output.
- Each duopolist has no interest in modifying his behaviour as long as the other does not modify this. If both duopolists attempt to take one another's reactions into account, the problem is no longer predetermined.

- Duopoly is often characterized by instability. Duopolists eliminate their competitors through price wars or through agreements. Duopolists can assure themselves by cooperating, a total income greater than the sum of the revenues that each can insure for himself by no cooperative behaviour.

Oligopoly

- In oligopolistic situations, entrepreneurs attempt to avoid price wars which are ruinous for the industry.
- Being aware of the fact that their rivals can do the same, they refrain from seeking to increase their share of the market through price cuts.
- As a result, oligopoly can attain a certain stability characterized by: a) the 'price leadership' of a firm, b) the reduction of hidden prices, and c) competition in fields other than that of price (like promotion, packaging, etc.).
- Now, about the lowering of hidden prices. It can assume various forms. It is contingent upon the customer, upon the size of the order, upon the geographical area and the existence of inferior brands. This policy has the advantage that it precedes adjustments of official prices and in this way contributes to the stability of oligopolists.
- Finally, non-price competition is a substitute for price competition. It is much less dangerous because its effects are felt in the long run. So the possibilities of reactions from competition are more limited.

Pricing of a New Product

Introduction Stage

There are two alternative price strategies which a firm introducing a new product can adopt, viz., skimming price policy and penetration pricing policy.

a) Skimming Price Policy:

- It is a strategy of pricing in which a marketers, at first, sets a relatively high price for a product or service, then lowers the price over time. As the demand of the first customers is satisfied, the firm lowers the price to attack another, more price – sensitive segment.

b) Penetration Price Policy

- The aim of **penetration pricing is usually to increase market share of a product,** providing the opportunity to increase price once this objective has been achieved.
- Penetration pricing is the pricing technique of **setting a relatively low initial entry price**, usually lower than the intended established price, to attract new customers. The strategy **aims to encourage customers to switch to the new product** because of the lower price.

Penetration pricing pursues the objective of quantity maximization by means of a low price. It is most appropriate when:

- Demand is expected to be highly elastic; that is, customers are price sensitive and the quantity demanded will increase significantly as price declines.
- Large decreases in cost are expected as cumulative volume increases.
- The product is of the nature of something that can gain mass appeal fairly quickly.
- There is a threat of impending competition.

Penetration price policy is preferred to skimming price under three conditions:

1. **In the first place**, skimming price offering a high margin will attract many rivals to enter the market. With the entry of powerful rivals into the market, competition will be intensified, price will fall and profits will be competed away in the long run. A firm will prefer a low penetration price if it fears the entry of powerful rivals with plenty of capital and new technology. A low penetration price, based on extremely low mark-up will be least profitable and potential competitors will not be induced to enter the market.
2. **Secondly,** a firm will prefer low penetration price strategy if product differentiation is low and if rival firms can easily imitate the product. In such a case, the objective of the firm to fix low price is to establish a strong market base and build goodwill among consumers and strong consumer loyalty.
3. **Finally,** a firm may anticipate that its main product may generate continuing demand for the complementary items. In such a case, the firm will follow penetration pricing for its new product, so that the product as well as its complements will get a wider market.

Role of Costs in Pricing Decisions

Other Pricing Strategies

1. Premium Pricing

- Use a high price where there is a unique brand.
- This approach is used where a substantial competitive advantage exists and the marketer is safe in the knowledge that they can charge a relatively higher price.
- Such high prices are charged for luxuries such as Cunard Cruises, Savoy Hotel rooms, and first class air travel.

2. Economy Pricing

- This is a no frills low price. The costs of marketing and promoting a product are kept to a minimum.
- Supermarkets often have economy brands for soups, spaghetti, etc. Budget airlines are famous for keeping their overheads as low as possible and then giving the consumer a relatively lower price to fill an aircraft.
- The first few seats are sold at a very cheap price (almost a promotional price) and the middle majority are economy seats, with the highest price being paid for the last few seats on a flight (which would be a premium pricing strategy).

3. Product Line Pricing

- Where there is a range of products or services the pricing reflects the benefits of parts of the range.
- For example car washes; a basic wash could be `2, a wash and wax `4 and the whole package for `6. Product line pricing seldom reflects the cost of making the product since it delivers a range of prices that a consumer perceives as being fair incrementally – over the range.

4. Optional Product Pricing

- Companies will attempt to increase the amount customers spend once they start to buy. Optional 'extras' increase the overall price of the product or service.
- For example airlines will charge for optional extras such as guaranteeing a window seat or reserving a row of seats next to each other. Again budget airlines are prime users of this approach when they charge you extra for additional luggage or extra legroom.

5. Captive Product Pricing

- Where products have complements, companies will charge a premium price since the consumer has no choice.
- For example a razor manufacturer will charge a low price for the first plastic razor and recoup its margin (and more) from the sale of the blades that fit the razor.

6. Product Bundle Pricing

- Sellers combine several products in the same package.
- This also serves to move old stock. Blu-ray and video games are often sold using the bundle approach once they reach the end of their product life cycle.
- You might also see product bundle pricing with the sale of items at auction, where an attractive item may be included in a lot with a box of less interesting things so that you must bid for the entire lot.
- It's a good way of moving slow selling products, and in a way is another form of promotional pricing.

7. Promotional Pricing

- Pricing to promote a product is a very common application.
- There are many examples of promotional pricing including approaches such as BOGOF (Buy One Get One Free), money off vouchers and discounts. Sales are extravaganzas of promotional pricing

8. Geographical Pricing

- Geographical pricing sees variations in price in different parts of the world.
- For example rarity value, or where shipping costs increase price. In some countries there is more tax on certain types of product which makes them more or less expensive, or legislation which limits how many products might be imported again raising price.

9. Value Pricing

- This approach is used where external factors such as recession or increased competition force companies to provide value products and services to retain sales e.g. value meals at McDonalds and other fast-food restaurants.
- Value price means that you get great value for money i.e. the price that you pay makes you feel that you are getting a lot of product.

OPERATING COSTING

Operating Costing is a method of costing applied in ascertaining the cost of rendering services. It is not applicable for entities manufacturing tangible goods. The main objective of operating costing is to compute the cost of the services offered by the organization.

Entities/companies usually use this method of costing are as follows:

a. Utility Services: canteen, hospital

b. Distribution Services: Electricity

c. Transportation Services: Railways, Bus etc.

d. Other Services: such as Management Consultants, courier services etc.

TRANSFER PRICING

- A **transfer price** is the price of one segment (sub unit, department, division etc.) of an organization charges
- For a product or service supplied to another segment of the same organization.
- Transfer prices are used when individual entities of a larger multi-entity firm are treated and measured as separately run entities.
- **Transfer pricing** is needed to monitor the flow of goods and services among the divisions of a company and to facilitate divisional performance measurement.
- The main use of transfer pricing is to measure the notional sales of one division to another division. Thus the transfer prices used in the organization will have a significant effect on the performance evaluation of the various divisions.
- Transfer price creates revenues for the Transferring Division and Costs for the Recipient Division, affecting each sub-unit's Operating Income. This requires that the system of transfer pricing should be objective and equitable.

Objectives of Transfer Pricing

1. Goal congruence

- The prices should be set so that the divisional management desire to maximize divisional earnings is consistent with the objectives of the company as a whole.
- The transfer prices should not encourage sub-optimal decision-making. The system should be so designed that decisions that improve business unit profits will also improve company profits.

2. Performance appraisal

The prices should enable reliable assessments to be made of divisional performance. The prices form part of information, which should:

- Guide decision making.
- Appraise managerial performance.
- Evaluate the contribution made by the division to overall company profits.
- Assess the worth of the division as an economic unit.

The transfer prices should be designed such that they help in measuring the economic performance

3. Divisional autonomy

- The prices should seek to maintain the maximum divisional autonomy so that the benefits of decentralization (motivation, better decision-making, initiatives, etc.) are maintained.
- The profits of one division should not be dependent on the actions of other divisions.

4. **Simple and easy:** The system should be simple to understand and easy to administer.
5. The transfer price should provide each segment with the relevant information required to determine the optimum trade-off between company costs and revenues.
6. To optimize the profit of the company over a given short period of time. Here the stress is on maximum utilisation of plant capacity.
7. To optimize the allocation of companies' financial resources. This is a long-term objective.

Transfer Pricing Methods

There are three general methods for establishing transfer prices.

a) **Market-Based Transfer Price:**

b) **Cost-Based Transfer price**

c) **Negotiated Transfer Price**

A. Market-Based Transfer Price

- In the presence of competitive and stable external markets for the transferred product, many firms use the external market price as the transfer price. When there is a perfectly competitive market for the goods and services that are bought and sold between divisions of an organization, the transfer price should be the market price.

  Advantages:

  - Forces selling division to be competitive with market conditions.
  - Does not penalize buying division by charging a price greater than it would have to pay on the market.

  Disadvantages:

  - May lead selling division to ignore negotiation attempts from buying division and sell directly to outside customers.
  - Could cause an internal shortage of materials.
  - Forces buying division to purchase materials from the outside.
  - Overall company profits may fall even though selling division makes a profit.

B. Cost-Based Transfer price

- In the absence of an established market price, many companies base the transfer price on the production cost of the supplying division.
- **The most common methods are:**
    - **Full Cost**
    - **Cost-plus**
    - **Variable Cost plus Lump Sum charge**
    - **Variable Cost plus Opportunity cost**
    - **Dual Transfer Prices**

a) Full Cost

- A popular transfer price because of its clarity and convenience and because it is often viewed as a satisfactory approximation of outside market prices.
- Full actual costs can include inefficiencies; thus its usage for transfer pricing often fails to provide an incentive to control such inefficiencies.
- Use of full standard costs may minimize the inefficiencies mentioned above.

b) Cost-Plus

- When transfers are made at full cost, the buying division takes all the gains from trade while the supplying division receives none.
- To overcome this problem the supplying division is frequently allowed to add a mark-up in order to make a "reasonable" profit. The transfer price may then be viewed as an approximate market price.

c) Variable Cost plus a Lump Sum Charge

- In order to motivate the buying division to make appropriate purchasing decisions, the transfer price could be set equal to (standard) variable cost plus a lump-sum periodical charge covering the supplying division's related fixed costs

d) Variable Cost plus Opportunity Cost

- Also known as the Minimum Transfer Price:
- Minimum Transfer Price = Incremental Cost + Opportunity Cost.
- For internal decision making purposes, a transfer price should be at least as large as the sum of:
- Cash outflows that are directly associated with the production of the transferred goods; and,
- The contribution margin foregone by the firm as a whole if the goods are transferred internally.

e) Dual Transfer Prices

- To avoid some of the problems associated with the above schemes, some companies adopt a dual transfer pricing system. For example:
    - Charge the buyer for the variable cost. The objective is to motivate the manager of the buying division to make optimal (short-term) decisions.
    - Credit the seller at a price that allows for a normal profit margin. This facilitates a "fair" evaluation of the selling division's performance

Benefits of transfer pricing policy

An ideal transfer pricing policy will benefit the organisation in the following ways:

- Divisional performance evaluation is made easier.
- It will develop healthy inter-divisional competitive spirit.
- Management by exception is possible.
- It helps in co-ordination of divisional objectives in achieving organisational goals.
- It provides useful information to the top management in making policy decisions like expansion, sub-contracting, closing down of a division, make or buy decisions, etc.
- Transfer price will act as a check on supplier's prices.
- It fosters economic entity and free enterprise system.
- It helps in self-advancement, generates high productivity and encouragement to meet the competitive economy.
- It optimizes the allocation of company's financial resources based on the relative performance of various profit centres, which in turn are influenced by transfer pricing policies.

Dual-Rate Transfer Pricing

Uses two separate Transfer Prices to price each inter-divisional transaction, as under -

(i) Debit Cost in Recipient Division (Cost = Relevant Costs, i.e. Variable Cost + Opportunity Cost, if any)

(ii) Credit Income in Transferring Division [Income = Market Price, or Full Cost plus mark-up (whether or not Intermediate Product is marketable)]

Here, Company Profits = Total of Divisional Profits Less Inter-Divisional Mark-up, (i.e. difference between two Transfer Pricing Rates used above X Quantity Transferred)

Advantages

- **Incentive to Transferring Division:** The Transferring Division Manager is motivated to transfer the Intermediate Product internally, since each unit transferred generates a profit (due to mark-up).
- **No Unjust Enrichment:** If the Transfer Price is set at the Transferring Division's Marginal Cost for the Intermediate Product, that division will not have any contribution from internal transfers. All the total contribution from inter-divisional trading will be assigned to the Recipient Division. Such unjust enrichment is avoided through the use of mark-up.
- **Optimal Decisions:** Since Relevant Cost is used as the second. Transfer Price, (for debiting Cost in Recipient Division) the Transfer Pricing system automatically promotes goal congruence by leading to optimal decisions.

Disadvantages

- **Confusing:** Use of different Transfer Prices causes confusion, particularly when more than two divisions are involved.
- **Artificial:** Dual Transfer Prices are considered to be artificial.
- **No incentive:** Fixed Price with mark-up protects Transferring Divisions from competition. It gives them little incentive to improve their productivity.
- **Misleading:** Dual Transfer Prices can result in misleading information and create a false impression of divisional profits. There is a possibility of double-counting of profits. At the extreme, all divisions may report profits, when the Company as a whole is losing money.

Negotiated Transfer Prices Method

- Negotiated Transfer Pricing Refers to the determination of transfer prices based on active participation involvement co-ordination and agreement of the managers of the transferring and recipient divisions.
- In this method each decentralization unit is considered as an independent unit. Such unit decided the transfer price by negotiations or bargaining.

Advantages:

1. **Proper Decision Making:** Negotiated prices lead to business like attitude amongst division of the company. The buying division may purchase from outside sources if the outsides prices are lower than the internal division price.
2. **Autonomy and Motivation Value: Each** sub-unit is considered as an independent unit. Buyers and sellers are completely free to deal outside the company. This promotes sub-units autonomy and motivations managers

BUDGETARY CONTROL

Budget

- Budget is a financial and /or quantitative statement, prepared and approved prior to a defined Period of time of the policy to be pursued during that period for the purpose of attaining a given objective. It may include income, expenditure and employment of capital.

Features

1. Financial and/or Quantitative Statement.
2. **Futuristic** - prepared and approved prior to a defined period of time.
3. **Goal Oriented** - for the purpose of attaining a given objective.
4. **Components** - Income, Expenditure and Employment of Capital.

Objectives of budgeting

The objectives of Budgeting are-

1. To encourage self-study in all aspects of a Company's operations.
2. To get all members of management to "put their heads" to the basic question of how the business should be run, to make them of a coordinated team operating in unison towards clearly defined objectives.
3. To promote the planning process and provide a sense of direction to every member of the organization.
4. To force a definition and crystallization of Company policies and aims.
5. To increase the effectiveness with which people and capital are employed.
6. To disclose areas of potential improvement in the Company's operations.
7. To stimulate study of relationship of the Company to its external economic environment for improving the effectiveness of its direction.
8. To direct and co-ordinate business activities and units to achieve stated targets of performance.
9. To facilitate the control process, by comparing actual results with plan, and provide feedback to the employees about their performance.

Budgetary Control

- Budgetary Control is defined as "the establishment of budgets, relating the responsibilities of executives to the requirements of a policy, and the continuous comparison of actual with budgeted results either to secure by individual action the objective of that policy or to provide a base for its revision.

Salient features

1. **Objectives**: Determining the objectives to be achieved, over the budget period, and the policy (ies) that might be adopted for the achievement of these ends.

2. **Activities**: Determining the variety of activities that should be undertaken for achievement of the objectives.

3. **Plans:** Drawing up a plan or a scheme of operation in respect of each class of activity, in physical as well as monetary terms for the full budget period and its parts.

4. **Performance Evaluation:** Laying out a system of comparison of actual performance by each person section or department with the relevant budget and determination of causes for the discrepancies, if any.

5. **Control Action**: Ensuring that when the plans are not achieved, corrective action are taken; and when corrective actions are not possible, ensuring that the plans are revised and objective achieved

Objectives

The objectives of a Budgetary Control System are –

1. **Definition of Goals:** Portraying with precision, the overall aims of the business and determining targets of performance for each section or department of the business.

2. **Defining Responsibilities:** Laying down the responsibilities of each individual so that everyone knows what is expected of him and how he will be judged.

3. **Basis for Performance Evaluation:** Providing basis for the comparison of actual performance with the predetermined targets and investigation of deviation, if any, of actual performance and expenses from the budgeted figures. It helps to take timely corrective measures.

4. **Optimum use of Resources**: Ensuring the best use of all available resources to maximize profit or production, subject to the limiting factors.

5. **Co-ordination**: Coordinating the various activities of the business and centralizing control, but also making a facility for the Management to decentralize responsibility and delegate authority.

6. **Planned action**: Engendering a spirit of careful forethought, assessment of what is possible and an attempt at it. It leads to dynamism without recklessness. It also helps to draw up long range plans with a fair measure of accuracy.

Advantages

1. **Conduct business in efficient manner**

- The use of budgetary control system enables the management of a business concern to conduct its business activities in the efficient manner.

2. **Control of their expenditure**

- It is a powerful instrument used by business houses for the control of their expenditure. It infact provides a yardstick for measuring and evaluating the performance of individuals and their departments.

3. **Reveals the deviations**

- It reveals the deviations to management, from the budgeted figures after making a comparison with actual figures.

4. **Effective utilization of resources**

- Effective utilization of various resources like-men, material, machinery and money is made possible, as the production is planned after taking them into account.

5. **Review current trends**

- It helps in the review of current trends and framing of future policies.

6. **Implementation of standard costing**

- It creates suitable conditions for the implementation of standard costing system in a business organization.

7. It inculcates the feeling of cost consciousness among workers.

Disadvantages

1. **Estimates:** Budgets may or may not be true, as they are based on estimates. The assumptions about future events may or may not actually happen.

2. **Rigidity:** Budgets are considered as rigid document. Too much emphasis on budgets may affect day-today operations and ignores the dynamic state of organizational functioning.

3. **False Sense of Security:** Mere budgeting cannot lead to profitability. Budgets cannot be executed automatically. It may create a false sense of security that everything has been taken care of in the budgets.

4. **Lack of co-ordination:** Staff co-operation is usually not available during Budgetary Control exercise.

5. **Time and Cost**: The introduction and implementation of the system may be expensive.

Essential Steps for Installation of Budgetary Control System

1. **Budget Manual:**
   - This is a written document specifying the objectives and procedures of budgetary control. It spells out the duties and responsibilities of executives.
   - The budget manual defines the sanctioning powers of the various authorities.

2. **Budget Centres:**
   - A budget center is that part of organisation for which the budget is prepared. Budget center can be a department, section of a department or any other part of department.
   - Budget centres are necessary for the purpose of ascertaining cost, performance and its control.
3. **Budget Committee:**
   - In a large concern, all the functional heads are the members of the budget committee. They discuss their respective budgets and finalize the budget, after collective decisions.
   - The committee is responsible for its execution and achievement of the goals set.

4. **Budget Officer:**
   - The chief executive appoints some person as the budget officer. He is conversant with the functioning of the various departments.
   - All budgets are presented to the budget officer who places before the budget committee, after making the necessary changes, for its approval.
   - The actual performance of each department is communicated to the budget officer. He determines the variances, analyses the reasons and reports to the top management to take the necessary steps to remove the deviations.

5. **Functional Budgets:**
   - Separate functional budgets have to be prepared. Examples are Production Budget, Sales Budget, HR Budget, Cash Budget, Capital expenditure Budget and R & D Budget.

6. **Budget Period:**
   - A budget period is the length of the period for which budget is prepared. Normally, budgets like purchases and sales budgets are prepared for one year. However, a capital expenditure budget is prepared for a longer period i.e. 3 to 5 years.

7. **Determination of Key Factor:**
   - Budgets are prepared for all the functional areas such as production, sales, purchases, finance, human resources and research and development.
   - These activities are inter-connected and inter-dependent and so the budgets are. For example, raw material supply may be limited. So, production and sales budgets are prepared, based on the purchase budget. To some of the firms, finance may be a constraint.
   - Then, all other budgets are prepared based on the availability of finance. A factor, which influences all other budgets, is known as key factor or principal factor.

Steps involved in the preparation of budgets

1. **Definition of Objectives**
    - Objectives should be defined precisely. They should be written out; areas of control de-marketed and items of revenue and expenditure to be covered by the budget stated.
    - This will give a clear understanding of the plan and its scope to all those who must cooperate to make it a success.
2. **Identification of key (or budget) factor**
    - A key factor represents source whose availability is less than its requirement. Such resource constraints put a limit on the organization objective of maximum profitability.
    - Some examples are lack of sales demand, rationing of raw material, labour shortage, plant capacity etc. For proper budgeting, the key factor must be located and estimated properly.
3. **Budget Committee and Controller**
    - Formulation of a budget usually requires whole time services of a senior executive; he must be assisted in this work by a Budget Committee, consisting of all the heads of department along with the Managing Director as the Chairman.
    - The Controller is responsible for coordination and development of budget programmes and preparing the Budget Manual
4. **Budget Manual**
    - The Budget manual is a schedule, document or booklet, which shows in a written form, the budgeting organization and procedure.
    - The manual should be well written and indexed so that a copy thereof may be given to each department head for guidance.
5. **Budget period**
    - The period covered by a budget is known as budget period. Normally a calendar year or a period coterminous with the financial year is adopted as the Budget Period.
    - It is then sub-divided into shorter periods – it may be months or quarters or such period as coincide with period of trading activity.
6. **Standard of activity or output**
    - The standards of activity levels for future period should be laid down. These are generally based on past statistics, known market changes and current conditions and forecast of future situations.

Comparison of Standard Costing with Budgetary Control

SL.No	Base	Budgetary Control	Standard Costing
1	Coverage	It covers all the functions of a business such as purchases, production, sales, finance, capital expenditure and research and development etc. in other words, it has a macro approach.	Standard costs are, basically, developed for the manufacturing function i.e., production. In other words, it has a micro-approach.
2	Objective	Objective is to delegate responsibility and ensure performance, without sacrificing control.	Objective is to enable the management to fix standards, control variances and value closing stock.
3	Application	It can be implemented in all industries	It is not possible to implement in all types of industries. It cannot be applied in jobbing activity, in all operations.
4	Implementation	It can be implemented, even in parts. To certain areas or departments, it can be implemented, while leaving rest of the areas. For example, it can be implemented in the sales department, alone	It cannot be operated in parts. It has to cover all items of expenses, without leaving any item.
5	Projection	It is based on the past actual records and suitably adjusted to future trends and expectations. It is a projection of financial accounts.	It is based on the technical assessments. It is a projection of cost accounts.
6	Variance	Budgetary control deals with total variances. The variances are calculated for the different departments or the organization, as a whole.	Variances are calculated for different elements of costs i.e., material, labour and overheads. Further, they are analysed, in detail, for their causes.
7	Orientation	It is more management oriented.	It is more engineering oriented.
8	Relationship	Budgetary control can be applied, even without the help of standard costing.	To establish standard costing, some form of budgeting is needed to forecast the level of output and prescribed set of working conditions in which standard costs would be used.

Types of Budgets

BASED ON TIME PERIOD

Long Term Budget	Short Term Budget
(a) Budgets which are prepared for periods longer than a year are called Long-Term Budgets. (b) Such Budgets are helpful in business forecasting and forward planning. (c) Examples: Capital Expenditure Budget and R&D Budget.	(a) Budgets which are prepared for periods less than a year are known as Short-Term Budgets. (b) Such Budgets are prepared in cases where a specific action has to be immediately taken to bring any variation under control. (c) Example: Cash Budget.

BASED ON CONDITION

Basic Budget	Current Budget
A Budget, which remains unaltered over a long period of time, is called Basic Budget.	A Budget, which is established for use over a short period of time and is related to the current conditions, is called Current Budget.

BASED ON CAPACITY

Particulars	Fixed Budget	Flexible Budget
Definition	It is a Budget designed to remain unchanged irrespective of the level of activity actually attained	It is a Budget, which by recognizing the difference between fixed, semi variable and variable costs is designed to change in relation to level of activity attained.
Rigidity	It does not change with actual volume of activity achieved. Thus it is known as a Rigid or Inflexible budget.	It can be re-casted on the basis of activity level to be achieved. Thus it is not rigid.
Level of Activity	It operates on one level of activity and under one set of conditions. It assumes that there will be no change in the prevailing conditions, which is unrealistic.	It consists of various budgets for different levels of activity
Effect of variance analysis	Variance Analysis does not give useful information as all Costs fixed, variable and semi-variable) are related to only one level of activity.	Variance Analysis provides useful information as each cost is analysed according to its behaviour.

Use for Decision making	If the budgeted and actual activity levels differ significantly, then aspects like cost ascertainment and price fixation do not give a correct picture.	If facilitates the ascertainment of cost, fixation of selling price and submission of quotations.
Performance Evaluation	Comparison of actual performance with budgeted targets will be meaningless, especially when there is a difference between two activity levels.	It provides a meaningful basis of comparison of the actual performance with the budgeted targets.

Summary of Budgetary Control

Salient features	Objectives	Advantages	Disadvantages	Installation of Budgetary
Objectives	Definition of Goals	Conduct business in efficient manner	Estimates	Budget Manual
Activities	Defining Responsibilities	Control of their expenditure	Rigidity	Budget Centres
Plans	Basis for Performance Evaluation	Reveals the deviations	False Sense of Security	Budget Committee
Performance Evaluation	Optimum use of Resources:	Effective utilization of resources	Lack of co-ordination	Budget Officer
Control Action	Co-ordination	Review current trends	Time and Cost	Functional Budgets
	Planned action:	Implementation of standard costing		Budget Period
				Determination of Key Factor

ZERO-BASED BUDGETING (ZBB)

- Zero based budgeting in management accounting involves preparing the budget from the scratch with a zero-base.
- It involves re-evaluating every line item of cash flow statement and justifying all the expenditure that is to be incurred by the department.
- Zero based budgeting definition goes as a method of budgeting whereby all the expenses for the new period are calculated on basis of actual expenses that are to be incurred and not on the incremental basis which involves just increasing the expenses incurred in the previous year by some fixed rate

Main Features of ZBB

The main features of ZBB are the following:

a) As the basis of budgeting, Zero (or scratch) is taken & not the previous budgets' targets.

b) The fund demanded has to be justified by the management of each decision unit.

c) Grouping of all proposed activities has to be done into various decision packages.

d) According to priority, the adequate evaluation & arrangement of all decision packages are done.

e) After proper evaluation, consideration has to be given to the alternative decision packages.

f) On the merits of evaluation of all decision packages including the alternative decision packages, resources are finally allocated.

Demerits of ZBB

The following are the demerits of ZBB:

1. **Time Consuming**

   Time, energy and money is required in collecting and analyzing data of alternative future projects as well as existing activities.

2. **Lack of Coordination**

   If full co-operation amongst management staff is not forthcoming, then ZBB technique implementation becomes difficult.

3. **Non-availability of standard of evaluation**

   As ideal standard of evaluation is not available, evaluation often becomes very difficult. Technical knowledge may be required in a desired manager's evaluation which may not be available.

4. **Lack of Trained Staff**

   Managers are required to undergo continuous training. Implementation of ZBB cannot be expected in a right way if basis idea and objective of ZBB are not crystal clear to managers.

5. Involvement of good number of individuals may be required by ZBB. Thus, complications may be created in communication system which results in difficulty in managing of the huge volume of data and voluminous paper work may be involved etc.

Merits of ZBB

1. **Accuracy**

   Against the regular methods of budgeting that involve just making some arbitrary changes to the previous year's budget, zero based budgeting makes every department relook each and every item of the cash flow and compute their operation costs. This to some extent helps in cost reduction as it gives clear picture of costs against the desired performance.

2. **Efficiency**

   This helps in efficient allocation of resources (department-wise) as it does not look at the historical numbers but looks at the actual numbers

3. **Reduction in redundant activities**

   It leads to identification of opportunities and more cost-effective ways of doing things by removing all the unproductive or redundant activities.

4. **Budget inflation**

   Since every line item is to be justified, zero based budget overcomes the weakness of incremental budgeting of budget inflation.

5. **Co-ordination and Communication**

   It also improves co-ordination and communication within the department and motivates employees by involving them in decision-making.

Step of Zero- base Budgeting. Answer ZBB involves the following steps –

- **Objectives**: determine a set of objectives.
- **Coverage**: Decide about the extent to which the technique of ZBB is to be applied, whether in all areas of firm's activities or only in a few selected areas on trial basis.
- **Decision areas**: identification areas where decision are required to be taken.
- **Ranking:** develop decision package and rank them in order or preference.
- **Budgeting:** Prepare the budget i.e. translating decision packages into practicable units/items and allocating financial resources.

Distinguish between ZBB and Traditional Budgeting.

The distinctions between the traditional budgeting & zero-base budgeting are the following:

1. In traditional budgeting, emphasis is given on previous level of expenditure, whereas, in ZBB, every time a budget is prepared, new economic appraisal is made.
2. Traditional budgeting is a function which is accounting oriented, whereas, ZBB is a function which is project or decision oriented.
3. For the preparation of a traditional project, rejustification of the existing programme is not needed, whereas, for the preparation of a zero-base budgeting, the justification of existing & new projects is needed to be done in the light of benefits & costs.
4. In the case of traditional budget, the justification regarding why, for a particular decision unit, a particular amount of expenditure is decided upon, is justified by the top management, whereas, in case of ZBB, the amount of expenditure is justified by the manager of the decision unit & not the top management.
5. In the case of traditional budgeting, the amount to added with or deleted from the figures of the previous budget figures is only taken into account, whereas, in case of ZBB, existing level of expenditure is appraised & the justification of future proposal for expenditure is done from different angles.
6. Preparation of a traditional budget is a simple job which is done year after year monotonously, whereas, preparation of a zero-base budgeting requires logical approach & many complex steps are involved for the establishment of logic behind a proposal.

LEAN ACCOUNTING

- Lean Accounting is the general term used for the changes required to a company's accounting, control, measurement, and management processes to support lean manufacturing and lean thinking.

- Most companies embarking on lean manufacturing soon find that their accounting processes and management methods are at odds with the lean changes they are making

What is Lean Accounting? Is an oft-asked question. Everybody working seriously to implement lean thinking in their company eventually bumps up against their accounting systems. It soon becomes clear that traditional accounting systems are actively anti-lean.

- They are large, complex, wasteful processes requiring a great deal of non-value work.
- They provide measurements and reports like labor efficiency and overhead absorption that motivate large batch production and high inventory levels.
- They have no good way to identify the financial impact of the lean improvements taking place throughout the company. On the contrary, the financial reports will often show that bad things are happening when very good lean change is being made.
- Very few people in the company understand the reports that emanate from the accounting systems, and yet they are used to make important and far-reaching decisions.
- They use standard product (or service) costs which can be misleading when making decisions related to quoting, profitability, make/buy, sourcing, product rationalization, and so forth. Almost all companies implementing lean accounting are making poor decisions, turning down highly profitable work, out-sourcing products or components that should be made in house, manufacturing overseas products that can be competitively manufactured here at home etc

RESPONSIBILITY ACCOUNTING

- **Responsibility accounting is the**
  - Collection
  - Summarization, and reporting of financial information

  About various decision centers throughout an organization; can also be called profitability accounting or activity accounting.
- It **tracks costs, revenues, or profits to the individual managers** who are responsible for making the decisions about costs, revenues, or profits and taking action about them.
- Responsibility accounting is appropriate where top management has delegated authority to make decisions.
- The idea behind responsibility accounting is that each manager's performance should be judged by how well he or she manages those items under his or her control.

Characteristics of Responsibility Accounting

- **An accounting system** that collects, summarizes, and reports accounting data relating to the responsibilities of individual managers.
- **An accounting system** which tracks and reports costs, expenses, revenues, and operational statistics by area of responsibility or organizational unit.
- **The system** which provides information to **evaluate each manager on revenue and expense** items over which that manager has primary control (authority to influence).
- Reports contain only those items that are controllable by the responsibility manager.
- Reports contain both controllable and uncontrollable items;
- In this case, controllable and uncontrollable items should be clearly separated.
- The identification of controllable items is a fundamental task in responsibility accounting and reporting.

Some Basic Requirements of Responsibility Accounting

- To implement a responsibility accounting system, the business must be organized so that responsibility is assignable to individual managers.
- The various managers and their lines of responsibility should be fully defined.
- The organization chart is usually used as a basis for responsibility reporting.
- If clear lines of responsibility cannot be determined, it is very doubtful that responsibility accounting can be implemented effectively.

- While decision-making power may be delegated for many items, some decisions (related to particular revenues, expenses, costs or actions) may remain exclusively under the control of top management.
- Several items will be directly traceable to a particular manager's area of responsibility but not actually be controllable by that manager. (Items such as property taxes.)

Pre-requisites of effective responsibility accounting

The pre-requisites of the effective responsibility accounting are the following:

a) Under the supervision of a manager should be each responsibility center & for the purpose of operating, it must be separable & identifiable.

b) The independent measurement of performance of each center must be capable of being done.

c) Each responsibility center should have clearly set targets.

d) Each responsibility center's budget should set targets which should be neither too high nor too low i.e., the budget should be one which can be realised.

e) The top management should fully support the system.

f) All managers of responsibility centers should participate in the formulation of plans & policies relating to responsibility centers for the purpose of providing motivation.

g) For sincere performance of each responsibility center the organizational environments must be conducive.

Objectives of Responsibility Accounting

The objectives of responsibility accounting are the following:

a) Overall organizational goals are broken down into small goals, each of the small goals is meant for better achievement of a responsibility center.

b) With the attached responsibility each responsibility center is tied up & there is adequate authority so that responsibility can be discharged.

c) At the end of a period, evaluation is done of the performance of each responsibility center & comparison of the performance is done with the predetermined targets.

d) Thorough study is made of the achievements which are above or below the targets & remedial measures are adopted.

e) Assessment is made of the contribution made by each responsibility center & examination is done of how far it's possible for the contribution to fulfilling its share in the ultimate organizational growth.

f) Emphasize is given on the control of cost through planning.

Advantages of Responsibility Accounting

The following advantages can be expected from responsibility accounting system:

a) Allocation is made of all the activities of the organization, all the items of income and expenditure including capital expenditure to the well-defined responsibility centers. Profit of each responsibility center is also identified. It should be understood by the manager of the center what has to be performed by him with what resources and in what time period. He gets the things done by making his own way without any interference. Thus much importance is given to human resources.

b) The managers of responsibility centers worked independently which helps in achieving the ultimate goal.

c) There is a relationship between efforts and achievement, thereby, loopholes, if any, in the operations gets easily detected.

d) The overall goals of the organization and individual goals of responsibility centers are communicated to all so that by keeping a view on that, guidance can be given to the managers in their respective centers of the operations.

e) Among the managers and their subordinates, cost-consciousness gets generated which results in automatically reducing cost.

f) It becomes easy to detect the weak areas in the organization. So for the purpose making the weak areas strong, corrective measures are taken.

g) By recording the negative variances between the actual performance and target, introduction of management by exception can be done.

h) For the purpose of exercising best managerial control over the affairs of the organization and achieving the desired goal, responsibility accounting system and budgetary control system can work together.

Disadvantages of Responsibility Accounting

The following are the apprehended disadvantages of responsibility accounting:

a) Solely upon the sincere efforts put in by the managers of the responsibility centers, the success of the responsibility accounting depends. Whether the system will succeed or not shall be decided by the personal factors of the managers.

b) The place of good management cannot be ever taken by the responsibility accounting because the latter is only a tool in the hands of the former.

c) Although theoretically, the manager of each organization is given free hand, in actual practice, neglect of employees' reaction, interference etc. is often noticed. Thus, in the way of proper discharging of responsibility, this stands.

d) In modern organizations, among the departments, inter-relations & inter-departments are mostly observed. So it becomes almost impossible to demarcate responsibility centers by clear-cut outlines.

e) Manager of the responsibility center prepares & communicates performance reports. The desired result will not be achieved by the responsibility accounting system, if there is any shortcoming in the report.

PROCESS CONTROL

- **Process control** is a statistics and engineering discipline that deals with architectures, mechanisms and algorithms for maintaining the output of a specific process within a desired range.
- Process control is extensively used in industry and enables mass production of continuous processes such as oil refining, paper manufacturing, chemicals, power plants and many other industries.
- Process control enables automation, with which a small staff of operating personnel can operate a complex process from a central control room.

A process control system consists of four essential elements: *process, measurement, evaluation,* and *control*.

1. **Process**

   A process consists of an assembly of equipment and material that is related to some manufacturing operation or sequence.

2. **Measurement**

   Measurement refers to the conversion of the process variable into an analog or digital signal that can be used by the control system.

3. **Evaluation**

   In the evaluation step of the process control sequence, the measurement value is examined, compared with the desired value or set point, and the amount of corrective action needed to maintain proper control is determined.

4. **Control**

   The control element in a control loop is the device that exerts a direct influence on the process or manufacturing sequence. This final control element accepts an input from the controller and transforms it into some proportional operation that is performed on the process.

Types of control systems

In practice, process control systems can be characterized as one or more of the following forms:

1. Discrete

- Found in many manufacturing, motion and packaging applications.
- Robotic assembly, such as that found in automotive production, can be characterized as discrete process control.
- Most discrete manufacturing involves the production of discrete pieces of product, such as metal stamping.

2. Batch

- Some applications require that specific quantities of raw materials be combined in specific ways for particular durations to produce an intermediate or end result.
- **One example** is the production of adhesives and glues, which normally require the mixing of raw materials in a heated vessel for a period of time to form a quantity of end product.
- **Other important examples** are the production of food, beverages and medicine. Batch processes are generally used to produce a relatively low to intermediate quantity of product per year (a few pounds to millions of pounds).

3. Continuous

- A physical system is represented through variables that are smooth and uninterrupted in time.
- The control of the water temperature in a heating jacket, for example, is an example of continuous process control.
- Some important continuous processes are the production of fuels, chemicals and plastics. Continuous processes in manufacturing are used to produce very large quantities of product per year (millions to billions of pounds).

Process control (basic and advanced) normally implies the process industries, which includes chemicals, petrochemicals, oil and mineral refining, food processing, pharmaceuticals, power generation, etc.

These industries are characterized by continuous processes and fluid processing, as opposed to discrete parts manufacturing, such as automobile and electronics manufacturing. The term process automation is essentially synonymous with process control.

Advanced Process Control

- Advanced Process Control (APC) refers **to a broad range of techniques and technologies implemented within industrial process control systems.**
- Advanced process controls are usually deployed optionally and in addition to *basic* process controls. Basic process controls are designed and built with the process itself, to facilitate basic operation, control and automation requirements.
- Advanced process controls are typically added subsequently, often over the course of many years, to address particular performance or economic improvement opportunities in the process.

Types of Advanced Process Control

Following is a list of the best known types of advanced process control:

1. Advanced regulatory control (ARC)

- It refers to several proven advanced control techniques, such as feed forward, override or adaptive gain.
- ARC is also a catch-all term used to refer to any customized or non-simple technique that does not fall into any other category.
- ARCs are typically implemented using function blocks or custom programming capabilities at the DCS level. In some cases, ARCs reside at the supervisory control computer level.

2. Multivariable Model predictive control (MPC)

- It is a popular technology, usually deployed on a supervisory control computer that identifies important independent and dependent process variables and the dynamic relationships (models) between them, and uses matrix-math based control and optimization algorithms, to control multiple variables simultaneously.
- MPC has been a prominent part of APC ever since supervisory computers first brought the necessary computational capabilities to control systems in the 1980s.

3. Inferential control:

- The concept behind inferential is to calculate a stream property from readily available process measurements, such as temperature and pressure, that otherwise would require either an expensive and complicated online analyzer or periodic laboratory analysis.
- Inferential can be utilized in place of actual online analyzers, whether for operator information, cascaded to base-layer process controllers, or multivariable controller CVs.

4. Sequential control

- It refers to dis-continuous time and event based automation sequences that occur within continuous processes.
- These may be implemented as a collection of time and logic function blocks, a custom algorithm, or using a formalized Sequential function chart methodology.

5. Compressor control

- Typically includes compressor anti-surge and performance control.

PROCESS MODELING & SIMULATION

Process simulation

- Process simulation is used for the ***design, development, analysis, and optimization of technical processes*** and is mainly applied to chemical plants and chemical processes, but also to power stations, and similar technical facilities.

- Process simulation is a model-based representation of chemical, physical, biological, and other technical processes and unit operations in software.

- Basic prerequisites are a thorough knowledge of chemical and physical properties of pure components and mixtures, of reactions, and of mathematical models which, in combination, allow the calculation of a process in computers.

Modeling

- Modeling is the process of producing a model; a model is a representation of the construction and working of some system of interest.

- A model is similar to but simpler than the system it represents. One purpose of a model is to enable the analyst to predict the effect of changes to the system.

- On the one hand, a model should be a close approximation to the real system and incorporate most of its salient features. On the other hand, it should not be so complex that it is impossible to understand and experiment with it.

- A good model is a judicious tradeoff between realism and simplicity. Simulation practitioners recommend increasing the complexity of a model iteratively. An important issue in modeling is model validity. Model validation techniques include simulating the model under known input conditions and comparing model output with system output.

Simulation

- A simulation of a system is the operation of a model of the system. The model can be reconfigured and experimented with; usually, this is impossible, too expensive or impractical to do in the system it represents.

- The operation of the model can be studied, and hence, properties concerning the behavior of the actual system or its subsystem can be inferred. In its broadest sense, simulation is a tool to evaluate the performance of a system, existing or proposed, under different configurations of interest and over long periods of real time.

SIMULATION METHODOLOGY

Typical steps in developing a simulation model are listed below.

Step 1: Problem Definition

- The first step to simulation is to define the objective by identifying critical problem areas in a process. Once the problem areas are identified it facilitates data collection and analysis for mapping the process steps in detail.

Step 2: Design the study

- Once the objective of simulation is clear, the next step is to design the study. This includes data collection, finalizing the model and the duration of the simulation exercise.

Step 3: Design the conceptual model

- During this stage, the first level of process mapping is done to understand the dependencies that exist in the process and to validate the data collected.

Step 4: Formulate inputs, assumptions and process definition

- In this phase, the simulation team feeds the data collected into the model to generate the simulation. A critical step here is to consider the assumptions made while simulating the process. This step determines the predictability and accuracy of the simulation model.

Step 5: Build, Verify and validate the simulation model

- The output of the simulation model is used to validate the model accuracy. The simulation model should be able to replicate the real world scenario of the process as closely as possible. The final acceptance of modeling accuracy depends on the assumptions made and the objective of the simulation.

Step 6: Conduct the Design of Experiments (DOE)

- Once the model is finalized it can then be leveraged by conducting various "What-If" analyses. This needs to be done in a structured DoE (Design of Experiment) way to ensure that all "To-Be" scenarios are simulated and the most appropriate model is selected. It is important to note that the final "To-Be" model may not replicate the most optimized scenario. This is due to the fact that some process constraints cannot be excluded in real time.

Step 7: Document and present the model

- Documentation is another critical step which ensures that the team is able to leverage the learning from the model in the long run.

Step 8: Define the model life cycle

- Every model is true only within the process boundaries defined in the first 3 steps. It is important to clearly define the boundaries of the process and when the boundaries change, the model should be re-developed.

Benefits of Simulation Modeling and Analysis

- Obtain a better understanding of the system by developing a mathematical model of a system of interest, and observing the system's operation in detail over long periods of time.
- Test hypotheses about the system for feasibility.
- Compress time to observe certain phenomena over long periods or expand time to observe a complex phenomenon in detail.
- Study the effects of certain informational, organizational, environmental and policy changes on the operation of a system by altering the system's model; this can be done without disrupting the real system and significantly reduces the risk of experimenting with the real system.
- Experiment with new or unknown situations about which only weak information is available.
- Identify the "driving" variables - ones that performance measures are most sensitive to - and the inter-relationships among them.
- Identify bottlenecks in the flow of entities (material, people, etc.) or information.
- Use multiple performance metrics for analyzing system configurations.
- Employ a systems approach to problem solving.
- Develop well designed and robust systems and reduce system development time.

Pitfalls of Simulation

Simulation can be a time consuming and complex exercise, from modeling through output analysis that necessitates the involvement of resident experts and decision makers in the entire process.

Following is a checklist of pitfalls to guard against.

- Unclear objective.
- Using simulation when an analytic solution is appropriate.
- Invalid model.
- Simulation model too complex or too simple.
- Erroneous assumptions.
- Using the wrong input probability distribution.
- Replacing a distribution (stochastic) by its mean (deterministic).

- Using the wrong performance measure.
- Bugs in the simulation program.
- Using standard statistical formulas that assume independence in simulation output analysis.
- Initial bias in output data.
- Making one simulation run for a configuration.
- Poor schedule and budget planning.
- Poor communication among the personnel involved in the simulation study.

ACTIVITY BASED COST MANAGEMENT

- ABC systems calculate the costs of individual activities and assign costs to cost objects such as products and services on the basis of the activities undertaken to produce each product or services.
- It accurately identifies sources of profit and loss.

Important Terms in Activity Based Costing

The operation of the ABC system involves the use of the following terms:

1. **Activity**
    - An activity means an aggregate of closely related tasks having some specific functions which are used for completion of goal or objectives.
    - For example, customer order processing is an activity. It includes receiving order from customers, interacting with production department regarding capacity to produce and giving commitment to the customer regarding delivery time. Other activities may be assembling, packaging, advertising etc.
2. **Resource**
    - Resources are elements that are used for performing the activities or factors helping in the activities. For example, order receiver, telephone, computers etc. are resources in customer order processing activity.
    - It may include material, labour, equipment, office supplies etc.
3. **Cost**
    - Cost is amount paid for resource consumed by the activity.
    - For example, salaries, printing stationary, telephone bill etc. are cost of customer order processing activity. It is also known as activity cost pool.
4. **Cost object**
    - It refers to an item for which cost measurement is required. E.g. a product, a service, or a customer.
5. **Cost pool**
    - A cost pool is a term used to indicate grouping of costs incurred on a particular activity which drives them.
6. **Cost driver**
    - Any element that would cause a change in the cost of activity is cost driver. Actually cost drivers are basis of charging cost of activity to cost object. Cost drivers are used to trace cost to product by using a measure of resources consumed by each activity. For example, frequency of order, number of order etc. may be cost driver of customer order processing activity.

Cost driver may be involved two parts:

1. **Resource cost driver**
2. **Activity cost driver**

- ***A resource cost driver is a measure of the quantity of resources consumed by an activity.***
- ***An activity cost driver is a measure of the frequency and intensity of demand, placed on activities by cost objects.***

Stages of Activity Based Costing

The different steps or stages in ABC system can be given as follows:

1. **Identify the chosen cost objects**

   The cost objects of any organization are the products or services and the goal is to first calculate the total cost of manufacturing and distributing these products and their unit cost.

2. **Identify the different activities within the organization**

   After the identification of cost objects, the main activities, which are being performed in the organization, have to be identified. Usually the number of activities over cost centers in ABC will be much more as compared to traditional overhead system. The exact number will depend on how the management subdivides the organizations activities.

3. **Identifying the direct cost of products**

   The direct cost of products or objects may comprise direct material cost, direct labor cost and direct expenses. Classification of as many of the total costs as direct costs as is economically feasible should be made. It reduces the amount of costs classified as indirect.

4. **Relating the overhead to the activities**

   After identifying the organizations activities, the various items of overhead are related to activities both support and primary, that caused them. As a result of relating the items of overhead to various activities, cost pool or cost buckets are created.

5. **Spreading the support activities across the primary activities**

   The spreading of support activities (i.e., activities which support or assist manufacturing) across the primary activities (correlated to the number of units produced) is done on some suitable base which reflects the use of support activity. The base is the cost driver and is measured of how the support activities are used.

6. **Determining the activity cost drivers**

   The determination of the activity cost drivers is done in order to relate the overhead collected in cost pools to the cost objects of products. It is done on the basis of the factor that drives the consumption of the activities.

7. **Calculating the activity cost driver rates**

   The activity cost rates for each activity are calculated in the way in which overhead absorption rates would be calculated under the traditional system. It can be presented as follows:

Activity cost driver rate = Total cost of activity/Activity driver

These activity cost driver rates are to be used for ascertaining the amount of overhead chargeable to various cost objects or products.

8. **Computing the total cost of products or cost objects**

The total costs of the products shall be computed by adding all direct and indirect costs assigned to them. The amount of overhead chargeable to a product or cost object shall be calculated by multiplying the activity cost drivers rates by different amounts of each activity that each product or other cost object consumes

Advantages of Activity Based Costing

1. It provides more accurate product costing information by reducing arbitrary cost allocations.
2. It improves the quality of information available for decision making by answering the questions such as what activities and events are driving cost and where efforts should be made to control cost
3. It is easiest way to allocate overhead in the product.
4. It helps to identify the activities that can be eliminated.
5. It links up cause and effect relationship.
6. ABC helps to identify the value added activities (that increase the customer's satisfaction) and non- value added activities (that creates the problems in customer's satisfaction)
7. ABC translates cost in to a language that people can understand and that can be linked up to business activities.

Limitations of Activity Based Costing

- More time consuming to collect data
- Cost of buying, implementing and maintaining activity based system
- In some cases, the establishment of cause and effect relationship between cost driver and costs not be a simple affair.
- ABC does not conform to generally accepted accounting principles in some areas.

ACTIVITY BASED BUDGETING

- Activity Based Budgeting is the ***process of planning and controlling the expected activities of the organistaion*** to derive a cost-effective budget that meets forecast workload and agreed strategic goals.
- Activity-based budgeting is a ***quantitative expression of the expected activities of the organization*** reflecting management forecast of workload and financial and non-financial requirements to meet agreed strategic goals and planned changes to improve performance.

The three key elements of 'Activity-based budgeting' are as follows

a. Type of work to be done

b. Quantity of work to be done, and

c. Cost of work to be done.

Advantages

The advantages of ABB are similar to those provided by activity-based costing (ABC).

- It draws attention to the costs of 'overhead activities' which can be a large proportion of total operating costs.
- It recognises that it is activities which drive costs. If we can control the causes (drivers) of costs, then costs should be better managed and understood.
- ABB can provide useful information in a total quality management (TQM) environment, by relating the cost of an activity to the level of service provided.

Disadvantages

- A considerable amount of time and effort might be needed to establish the key activities and their cost drivers.
- It may be difficult to identify clear individual responsibilities for activities.
- It could be argued that in the short-term many overhead costs are not controllable and do not vary directly with changes in the volume of activity for the cost driver. The only cost variances to report would be fixed overhead expenditure variances for each activity.

According to the specialists' opinion, the stages of the activity-based budgeting are the following:

1. Estimation of key-factors of the budget (estimations regarding the total value of the quantities of products obtained and the sales to customers);
2. Establishment of the organizational activities (elaboration and execution of the activity-based budget);
3. Determination of the necessary resources (quantity and type) in order to perform the organizational activities;
4. Identification of the total of necessary resources in order to satisfy the demands;
5. Determination of the capacities at the level of activities and at the level of resources.

Activity-Based Budgeting vs. Traditional Budgeting

ACTIVITY BASED MANAGEMENT (ABM)

- Activity-Based Management (ABM) manages activities to improve the value of products or services to customers and increase the firm's competitiveness and profitability.
- ABM draws on ABC as its major source of information and focuses on the efficiency and effectiveness of key business processes and activities.
- Using ABM, management can pinpoint avenues for improving operations, reducing costs, or increasing values to customers. By identifying resources spent on customers, products, and activities,
- ABM improves management's focus on the firm's critical success factors and enhances its competitive advantage.
- ABM manages activities rather than resources. It determines what drives the activities of the Firm and how these activities can be improved to increase the profitability.

ABM applications can be classified into two categories

Operational ABM

- Operational ABM and strategic ABM. Operational ABM enhances operation efficiency and asset utilization and lowers costs;
- Its focuses are on doing things right and performing activities more efficiently.
- Operational ABM applications use management techniques such as activity management, business process reengineering, total quality management, and performance measurement.

Strategic ABM

- Strategic ABM attempts to alter the demand for activities and increase profitability through improved activity efficiency.
- Strategic ABM focuses on choosing appropriate activities for the operation, eliminating nonessential activities and selecting the most profitable customers.
- Strategic ABM applications use management techniques such as process design, customer profitability analysis, and value chain analysis.

Stages in Activity Based Cost Management

1. **Identification of the activities that have taken place in the Firm**
2. **Assigning costs to cost pool for each activity.**
3. **Spreading of Support Activities costs across the Primary Activities**
4. **Determining Cost Driver for each activity.**
5. **Managing the costs of activities.**

Activity Based Management Model

(a) Cost Driver Analysis, (b) Activity Analysis, and (c) Performance Analysis

1. **Cost Driver Analysis**:
    - This identifies the factors that cause activities to be performed, in order to manage activity costs. An activity may be performed inefficiently due to a particular reason.
    - Managers have to address this cost driver to correct the root cause of the problem.
2. **Activity Analysis:**
    - It involves identification of the activities of the Firm and the activity centres (or activity cost pools) that should be used in an ABC system.
    - Activity analysis also identifies Value Added (VA) and Non-Value Added (NVA) activities. The number of activity centres is likely to change over time, as organizational needs for activity information evolve.
3. **Performance Analysis:**
    - This involves the identification of appropriate measures to report the performance of activity centres or other organizational units, consistent with each unit's goals and objectives.
    - This aims to identify the best ways to measure the performance of factors that are important to organizations, in order to stimulate continuous improvement.

Benefits derived from ABM's

- ✓ Identification of redundant costs;
- ✓ Analysis of value-added and non-value-added cost
- ✓ Quantification of the costs of quality by element
- ✓ Identification of customer-focused activities
- ✓ Analysis of the cost of complexity
- ✓ Identification of process costs and support of process analysis
- ✓ Measurement of the impact of reengineering efforts
- ✓ Better understanding of cost drivers
- ✓ Evaluation of manufacturing flexibility investments; and
- ✓ Activity-based budgeting.

Specific uses of ABM in organizations

1. **Attribute analysis**
2. **Strategic decision making**
3. **Benchmarking**
4. **Operations analysis**
5. **Profitability/pricing analysis, and**
6. **Process improvement**

1. Attribute analysis

- Classifies and combines cost and performance data into manageable, controllable clusters.
- ABC/ABM systems can use many different attribute or "data tags" for a specific cost. Data attributes allow a company to perform analysis on many different dimensions of a management problem using the same basic warehouse of data.

Some common forms of attribute analysis are:

- ✓ Value analysis, which utilizes information collected about business processes and examines various attributes of the process (e.g., diversity, capacity, and complexity) to identify candidates for improvement efforts;
- ✓ Time variability analysis, which seeks to under-stand variances in the time needed to complete an activity or provide a service and to develop ways to reduce these variances; and
- ✓ Cost of quality, which is a management reporting technique that identifies and measures quality costs within an organization using four basic categories: prevention, detection, internal failure, and external failure.

2. Strategic Analysis

- Explores various ways a company can create and sustain a competitive advantage in the marketplace. Emphasizing long term objectives and challenges, strategic analysis seeks to impact future costs and improve future profitability by clarifying the cost of various cost objects such as products, customers, and channels.
- Strategic analysis emphasizes future opportunities and challenges, using a combination of both physical and financial measures to explore the impact of alternative strategic positions.

Ways in which ABM supports strategic analysis include:

- ✓ Strategic planning;
- ✓ Consolidation of operations analysis;
- ✓ Acquisition analysis; and
- ✓ Analysis of revenue and profitability growth potential.

3. Benchmarking

- It is a methodology that identifies an activity as the standard, or benchmark, by which a similar activity will be judged. It is used to assist managers in identifying a process or technique to increase the effectiveness or efficiency of an activity.

ABM supports different types of benchmarking, including:

- ✓ Internal benchmarking;
- ✓ Industry/competitive benchmarking; and
- ✓ Best-in-class benchmarking.

4. Operations analysis

- It seeks to identify, measure, and improve current performance of key processes and operations within a firm.

Areas where ABM is useful include:

- ✓ "What-if" analysis;
- ✓ Project management;
- ✓ Creation and use of activity-based performance measures;
- ✓ Capacity management;
- ✓ Constraint analysis; and
- ✓ Process-based costing.

5. Profitability/pricing analysis

- It is a key area for any company. ABM assists a company in analyzing the costs and benefits of products and processes in both the "as is" and post-improvement "to be" scenarios. ABM also supports prelaunch analysis and improvement of product profitability.

Areas in which ABM has proven useful in adopting organizations include:

- ✓ Product/Service profitability analysis;
- ✓ Business process reengineering;
- ✓ Distribution channel profitability analysis;
- ✓ Market segment profitability analysis; and
- ✓ Target and life-cycle costing.

6. Process Improvement

- It lies at the heart of modern management techniques. Focused on identifying the causes of variation, waste, and inefficiency, process improvement includes both incremental and quantum change efforts that seek to increase the value created per resources consumed by an organization.

Uses being made of ABM for process improvement include:

- ✓ Business process modeling;
- ✓ Total quality initiatives;
- ✓ Business process reengineering; and
- ✓ Analysis of outsourcing and shared service opportunities.

The Role of the Management Accountant

The role of Management Accountants in ABM efforts comprises the following activities:

- Creation of the ABC database
- Maintenance of the ABM data warehouse
- Assurance and monitoring of data integrity within the warehouse
- Analysis of the costs and benefits of improvement projects
- Ongoing audit and analysis of project performance against goals
- Creation and support of management reporting structures
- Provision of cost estimates and reports to meet management's decision-making needs
- Participation on cross-functional teams at all levels of the organization
- Education of line managers on the economics of business within process settings
- Participation in the development of desktop decision support tools for line managers
- Creation and revision of cost estimates as process changes are made
- Target and life-cycle cost and profit analysis
- Strategic and operational budget and planning support; and
- Tracking the results/benefits of the ABC/ABM initiative.

Business Applications of ABM

1. **Cost Reduction**
    - ABM helps the Firm to identify opportunities in order to streamline or reduce the costs or eliminate the entire activity, especially NVA activities.
    - It is useful in identifying and quantifying process waste, leading to continuous process improvement through continuous cost reduction.
2. **Activity Based Budgeting**
    - Activity based budgeting analyses the resource input or cost for each activity. It provides a framework for estimating the amount of resources required in accordance with the budgeted level of activity.
    - Actual results can be compared with budgeted results to highlight (both in financial and non-financial terms) those activities with major discrepancies for potential reduction in supply of resources.
    - It is a planning and control system, which supports continuous improvement.
3. **Business Process Re-Engineering (BPR)**
    - BPR is the analysis and redesign of workflows and processes in a Firm, to achieve dramatic improvement in performance, and operational excellence.
    - A business process consists of linked set of activities, e.g. purchase of materials is a business process consisting of activities like Purchase Requisition, Identifying Suppliers, preparing Purchase Orders, mailing Purchase Orders and follow up.
    - The process can be reengineered by sending the production schedule direct to the suppliers and entering into contractual agreement to deliver materials according to the production schedule.
4. **Benchmarking**
    - It involves comparing the Firm's products, services or activities with other best performing organizations, either internal or external to the Firm.
    - The objective is to find out how the product, service or activity can be improved and ensure that the improvements are implemented.
5. **Performance measurement**
    - Activity performance measures consist of measures relating to costs, time quality and innovation.
    - For achieving product quality, some illustrative performance measures are

Distinguish between ABC and ABM.

Activity Based Management (ABM) and Enterprise Performance Management (EPM)

ENTERPRISE RESOURCE PLANNING (ERP)

Meaning of ERP

- Enterprise resource planning software or ERP attempts to integrate all departments and functions across a company into a single computer system that can serve all those different departments' particular needs.
- In fact ERP combines all computerised departments together with the help of a single integrate software program that runs off as single database so that various department can more easily share information and commission with each other.

The need for ERP

- Most organisation across the world have realised that in a rapidly changing environment, it is impossible to creates and maintain customer designed software package which will cater to all their requirements and be up-to-date.
- Realising the requirement of user organisations, some of the leading software companies have designed Enterprise Resource Planning software, which offers an integrated software solution to all the function of an organisation.

Components of ERP

- To enable the easy handling of the system, ERP has been divided the following core subsystems, sales and marketing, master scheduling, materials requirements planning, capacity requirement planning, bill of materials, purchasing, shop floor control, accounts payable/receivable , logistic, assets management and financial accounting.

Features of Enterprise Resource Planning

Some of the major features of ERP and What ERP can do for the business system are

- **ERP facilities company**—wide Integrated Information System covering all functional areas like manufacturing, selling and distribution, payables, receivables, inventory, accounts, human resources, purchases etc.
- **ERP perform core activities** and increases customer's service, thereby augmenting the corporate image.
- **ERP bridge the information** gap across organisations.
- **ERP provides complete integration** of system not only across departments but also across companies under the same management.
- **ERP is the solution** for better project management.
- **ERP allows automatic introduction** of the latest technologies like Electronic Fund Transfer (EFT). Electronic Data Interchange (EDI), Internet, Intranet, Video conferencing, E—commerce etc.
- **ERP eliminates most business problems** like materials shortages, productivity enhancements, customer service, cash management, inventory problems, quality problems, prompt delivery etc.

Benefits of Enterprise Resource Planning

The benefits accruing to any business enterprise by implementing an ERP package are unlimited.

1. **Product Costing**
    - Determination of cost of products correctly, is quite critical for every industry.
    - ERP supports advance costing methods, including standard costing, actual costing and activity–based costing. Additionally, all costing methods and information can be fully integrated with finance. This provides the company with essential financial information for monitoring controlling costs.
2. **Inventory Management**
    - ERP can be used in multi-national, multi – company, and multi—site manufacturing and distribution environments. This system simplifies complicated logistics by allowing one to plan and manage companies in different countries as a single unit and its advanced functionality allows one to process product and financial information flows in several different ways.
    - Inventory reporting supports all reporting of specific and general types of stock transaction such as various types of stock transfers, re-classification, ID changes and physical inventory results.
3. **Distribution & Delivery**
    - Delivery and distribution in ERP lets one to define logistics processes, flexibly and efficiently to deliver the right product from the right warehouse to the right customer at the right time –every time. To the customer, the most important element of quality is one-time delivery.
    - It doesn't matter how well a product is made if arrives late. Processing distribution or acquisition orders involves several closely related activities.
4. **E – Commerce**
    - Internet enables ERP offers Internet, Intranet and extranet solutions for business, business to consumer, employee self-service and more.
5. **Automatic Control** It ensure automatic quality control procedure.
6. **After Sales Service** it ensures better after sales service.
7. **Improvement in Production Planning** It improved production planning.
8. **Quick response** it enables quick response to change in business operations & market conditions.
9. **Cumulative Edge's** it helps to achieve competitive advantages by improving business process.

Reasons for the Implementation of ERP by Companies

1. Improve a company's business performance

- ERP automates the tasks involved in performing a business process – such as order fulfillment which involves taking an order from a customer, shipping it and billing for it. With ERP, when a customer service representative takes an order from a customer, he or she has all the information necessary to complete the order (the customer's credit rating and order history, the company's inventory levels and the shipping dock's trucking schedule).

2. Standardize manufacturing processes

- Manufacturing companies --- especially those with an appetite for mergers and acquisitions --- often find that multiple business units across the company make the same widget using different methods and computer systems, Standardizing those processes and using a single, integrated computer system can save time, increase productivity & reduce headcount.

3. Integrate financial data

- As the CEO tries to understand the company's overall performance, he or she may find many different versions of the truth. Finance has its own set of revenue numbers, sales has another version, and the different business units may each have their own versions of how much they contributed to revenues. ERP creates a single version of the truth that cannot be questioned because everyone is using the same system.

4. To standardise HR information

- Especially in companies with multiple business units, HR may not have a unified, simple method for tracking employee time and communicating with them about benefits and services. ERP can fix that.

5. Reduction in cycle time

- Cycle time is the time between receipt of the order and delivery of the product. ERP systems are helpful in both make-to -order and make-to-stock situations. In both cases, cycle time can be reduced by the ERP systems, but the reduction will be more in the case of make-to-order systems.
- ERP packages go a long way in reducing the cycle times due to automation achieved in material procurement, production planning and the efficiency achieved through the plant maintenance and production systems of the ERP packages.

6. Improved Resource Utilization

- As manufacturing processes become more sophisticated and as the philosophies of elimination of waste and constraint management achieve broader acceptance, manufacturer place increased emphasis upon planning and controlling capacity.
- The capacity planning feature of ERP systems offer both rough-cut and detailed capacity planning. The system loads each resource with production requirements from Master Production Scheduling, Materials Requirements Planning and Shop-floor Control.

- The ERP systems have simulation capabilities that help the capacity and resource planners to simulate the various capacity and resource utilization scenarios and choose the best option. The ERP systems help the organisation in drastically improving the capacity and resource utilization.

7. Better Customer Satisfaction

- Customer satisfaction means meeting or exceeding customer's requirements for a product or service. The customer could get technical support by either accessing the company's technical support knowledge base (help desk) or by calling the technical support.
- Since all the details of the product and the customer are available to the person at the technical support department, the company will be able to better support the customer. All this is possible because of use of latest developments in information technology by the ERP systems.

8. Improved Supplier Performance

- The quality of the raw materials or components and the capability of the vendor to deliver them on time are of critical importance for the success of any organisation.
- For this reason, an organisation chooses its suppliers or vendors very carefully and monitor their activities very closely. To realise these benefits, corporations rely heavily on supplier management and control systems to help, plan, manage and control the complex processes associated with global supplier partnerships.

COST OF QUALITY

Concept of Quality

- **Quality as perception:** You will not be wrong when you state that the term quality is a perception which is personal to an individual.
- In plain terms, quality is "features" or "worth" or "value". You will realise how this is true when you read the following phrases picked from literature on quality.
  1. ***"Quality is not an act. It is a habit"-*** Aristotle. This is true and applicable to any act of a human being.
  2. ***"Quality is conformance to requirements":*** This in line with the concept that quality is decided by the customer.
  3. ***"Quality is zero defects":*** No customer wants defects in the products or services him or she pays for. This is a totally different idea on quality and is true when you make quality a habit.
  4. ***"Quality is free"*** **-** Phil Crosby. This is the utopian situation. When there are no defects then there is no wastage and thus quality becomes free.
  5. ***"Quality is the degree to which a set of inherent characteristics fulfils requirements"-*** ISO 9000. This is an attempt to give universality to the term quality.

What is cost of quality? How it can be reduced?

The cost of quality is the sum of cost of conformance, cost of non-conformance and cost of lost opportunity. The quality costs amount to somewhere between 5-25% of turnover depending on industry. The quality cost will be much more if we include the potential loss of business from the affected customers. With cost of quality accounting for such a large proportion of turnover any reduction in quality cost will improve profitability and provide competitive edge to the company.

The quality cost reduction can be achieved in the following two stages

1. When prevention costs are increased to pay for the right kind of systems engineering work in quality control, a reduction will occur in rejection, defect and rework of output. This defect reduction means a substantial reduction in both types of failure costs.
2. A reduction in defective output will have a positive effect on appraisal costs because defect reduction means a reduced need for routine inspection and test activities. It follows that as prevention is increased the need for appraisal decreases. The end result is a substantial reduction in the cost of quality and an increase in the level of quality

What components of cost are reported in a cost quality report?

1	**Prevention costs**	Ensuring the failures do not happen Example: • Quality training • Quality circles • Statistical process control activities • System Development for prevention • Quality improvement
2	**Appraisal costs**	Checking for failures Example: • Testing and inspecting materials • Final product testing and inspecting • WIP testing and inspecting • Package inspection • Depreciation of testing equipment
3	**Internal failure costs**	Keeping defective products from falling into the hands of customers Example: • Cost of Scrap (net of realization) • Cost of Spoilage • Cost of Rework • Down time due to defect in quality • Retesting
4	**External failure cost**	Costs of defects discovered by the customers Example: • Cost of field servicing • Cost of handling complaints • Warranty repairs • Lost sales • Warranty replacements

Quality Cost but poor Quality cost more.

"Quality Cost but poor quality costs more" –

- Quality costs matter because they are normally large but they are not normally measured by traditional methods and the result is that they are not known and therefore uncontrolled with a proper and complete evaluation of the quality cost from the stage of design and development to production and services.
- The Cost and Management Accountant would help in creating a better awareness throughout the organization of the profound impact of poor quality and its repercussion on profitability.

Quality Cost can be analyzed under two major categories:

1. **Cost of Quality Assurance, incurred by the manufacturer (internal quality cost): Internal quality cost consists of**

- Preventive Cost: Quality Engineering, Quality Planning.
- Appraisal Cost: Cost of appraising product for conformance to requirements.
- Failure Cost: Cost incurred by failure - Scrap, excess material, testing and assembling.

2. **Cost of Quality Assurance, at the user's end, which are called as "User Quality Cost". User Quality Cost: consists of:**

- Cost of repair, Cost of maintaining extra capacity, Cost of effective loss, Cost of damage caused by a failed item.

TOTAL QUALITY MANAGEMENT (TQM)

- Total Quality Management is a philosophy of ***continuously improving the quality of all the products and processes*** in response to continuous feedback for meeting the customers' requirements.
- TQM is a ***vision based, customer focused, prevention oriented, continuously improvement strategy*** based on scientific approach adopted by cost conscious people committed to satisfy the customers first time every time.
- It aims at Managing an organization so that it excels in areas important to the customer

The underlying principles of TQM

The philosophy of TQM rest on the following principles which are enlisted below:

1. Clear exposition of the benefits of a project.
2. Total Employee involvement (TEI).
3. Process measurement.
4. Involvement of all customers and contributors.
5. Elimination of irrelevant data.
6. Understanding the needs of the whole process.
7. Use of graphical and pictorial techniques to achieve understanding.
8. Establishment of performance specifications and targets.
9. Use of errors to prompt continuous improvement.
10. Use of statistics to tell people how well they are doing

Steps in Total Quality Management

Step 1: Identification of customers/customer groups

- Through a team approach (a technique called Multi-Voting), the Firm should identify major customer groups.
- This helps in generating priorities in the identification of customers and critical issues in the provision of decision-support information.

Step 2: Identifying customer expectations

- Once the major customer groups are identified, their expectations are listed. The question to be answered is - What does the customer expect from the Firm?

Step 3: Identifying customer decision-making requirements and product utilities:

- By identifying the need to stay close to the customers and follow their suggestions, a decision-support system can be developed, incorporating both financial and nonfinancial and non-financial information, which seeks to satisfy user requirements.
- Hence, the Firm finds out the answer to - What are the customer's decision-making requirements and product utilities? The answer is sought by listing out managerial perceptions and not by actual interaction with the customers.

Step 4: Identifying perceived problems in decision-making process and product utilities:

- Using participative processes such as brainstorming and multi-voting, the Firm seeks to list out its perception of problem areas and shortcomings in meeting customer requirements.
- This will list out areas of weakness where the greatest impact could be achieved through the implementation of improvements.
- The Firm identifies the answer to the question - What problem areas do we perceive in the decision-making process?

Step 5: Comparison with other Firms and benchmarking:

- Detailed and systematic internal deliberations allow the Firm to develop a clear idea of their own strengths and weaknesses and of the areas of most significant deficiency.
- Benchmarking exercise allows the Firm to see how other Companies are coping with similar problems and opportunities.

Step 6: Customer Feedback:

- Steps 1 to 5 provide an information base developed without reference to the customer.
- This is rectified at Steps 6 with a survey of representative customers, which embraces their views on perceived problem areas.
- Interaction with the customers and obtaining their views helps the Firm in correcting its own perceptions and refining its processes.

Steps 7 & 8: Identification of improvement opportunities and implementation of Quality Improvement Process:

- The outcomes of the customer survey, benchmarking and internal analysis, provides the inputs for Steps 7 and 8, i.e. the identification of improvement opportunities and the implementation of a formal improvement process. This is done through a six-step process called **PRAISE**, for short.

List out ten steps of quality improvement which has been conceptualized by Philip Crosby

The following are the ten steps of Quality Improvement, as per Philip Crosby:

- Management is committed to quality and this is clear to all.
- Create quality improvement teams, with representatives from all departments.
- Measure processes to determine current & potential quality issues.
- Calculate the cost of poor quality.
- Raise quality awareness of all employees.
- Take action to correct quality issues.
- Monitor progress of quality improvement-Establish a zero-defect committee.
- Train supervisors in Quality improvement.
- Encourage employees to create their own quality improvement goals.
- Recognize participants' efforts.

The components of cost to be reported in a Cost of Quality Report

1. **Prevention costs** are all costs incurred in the process of preventing poor quality from occurring. They include quality planning costs, such as the costs of developing and implementing a quality plan. Also included are the costs of product and process design, from collecting customer information to designing processes that achieve conformance to specifications. Employee training in quality measurement is included as part of this cost, as well as the costs of maintaining records of information and data related to quality.

2. **Appraisal costs** are incurred in the process of uncovering defects. They include the cost of quality inspections, product testing, and performing audits to make sure that quality standards are being met. Also included in this category are the costs of worker time spent measuring quality and the cost of equipment used for quality appraisal.

3. **Internal failure costs** are associated with discovering poor product quality before the product reaches the customer site. One type of internal failure cost is *rework*, which is the cost of correcting the defective item. Sometimes the item is so defective that it cannot be corrected and must be thrown away. This is called *scrap,* and its costs include all the material, labor, and machine cost spent in producing the defective product.

4. **External failure costs** are associated with quality problems that occur at the customer site. These costs can be particularly damaging because customer faith and loyalty can be difficult to regain. They include everything from customer complaints, product returns, and repairs, to warranty claims, recalls, and even litigation costs resulting from product liability issues. A final component of this cost is lost sales and lost customers. For example, manufacturers of lunch meats and hot dogs whose products have been recalled due to bacterial contamination have had to struggle to regain consumer confidence. Other examples include auto manufacturers whose products have been recalled due to major malfunctions such as problematic braking systems and airlines that have experienced a crash with many fatalities. External failure can sometimes put a company out of business almost overnight.

PRAISE ANALYSIS

Identification of improvement opportunities and implementation of quality improvement process, of the TQM Process is through a six-step activity sequence, identified by the acronym 'PRAISE'.

Step	Activity	Elements
1	**Problem Identification**	• Areas of customer dissatisfaction. • Absence of competitive advantage
2	**Ranking**	Prioritise problems and opportunities by – 1. Perceived importance, and 2. Ease of measurement and solution.
3	**Analysis**	• Ask "Why?" to identify possible causes. Keep asking 'Why?' beyond to the move symptoms and to avoid jumping to premature conclusion • Ask 'What?' to consider potential implications. • Ask 'How much?' to quantify cause and effect
4	**Innovation**	• Use creative thinking to generate potential solutions. • Operationalise these solutions by identifying – 1 .Barriers to implementation, 2. Available enablers, and 3. People whose co-operation must be sought
5	**Solution**	• Implement the preferred solution. • Take appropriate action to bring about the required changes. • Reinforce with training and documentation back-up.
6	**Evaluation**	• Monitor the effectiveness of actions. • Establish and interpret performance indicators to track progress towards objectives • Identify the potential for further improvements and return to Step 1

Implementation of PRAISE Process

A three-point action plan for implementation of the process is -

1. **Small to Big Issues:** Big improvement opportunities are generally complex and require extensive interdepartmental co-operation. The choice of a relatively small problem in the first instance provides a greater chance of success. Therefore, the TQM team has to proceed from small to big issues gradually.

2. **Solvable problem:** The problem selected should not be trivial, but it should be one with a potential impact and a clear improvement opportunity. Measurable progress towards implementation should be accomplished within a reasonable time in order to maintain the motivation of participants and advertise the success of the improvement itself.

3. **Recognition of participants:** The successful projects and team members should receive appropriate recognition. Prominent individuals should be rewarded for their efforts through monetary / nonmonetary prices as a measure of personal recognition and as encouragement to others.

Difficulties in PRAISE Analysis

Step	Activity	Difficulties	Remedies
1	**Problem Identification**	• Effects of a problem are apparent, but the problems themselves are difficult to identify. • Problem may be identifiable, but it is difficult to identify a measurable improvement opportunity. • Some problems are too vague to define e.g. morale, communication, productivity etc.	• Participative approaches like brainstorming, multi-voting, panel discussion. • Quantification and precise definition of problems.
2	**Ranking**	• Difference in perception of individuals in ranking • Difference in preferences based on functions, e.g. production, finance, marketing etc. • Lack of consensus between individuals.	• Participative Approach. • Subordination of individual to group interest.
3	**Analysis**	• Adoption of adhoc approaches and quick-fix solutions.	• Lateral Thinking. • Brainstorming.
3	**Innovation**	• Lack of creativity or expertise. • Inability to operationalise ideas, i.e. convert thoughts into action points.	• Systematic evaluation of all aspects of each strategy.
4	**Solution**	• Resistance from middle managers.	• Effective internal communication. • Training of personnel and managers. • Participative approach.
5	**Evaluation**	• Problems in implementation. • Lack of measurable data for comparison of expectations with actuals.	• Effective Control System to track actuals. • Feedback system.

CONTINUOUS PROCESS IMPROVEMENT

CPI Procedure

CPI has been described using a number of models. Here we will discuss the system approach or ADDIE (Analysis, Design, Development, Implement, and Evaluate) model.

Analysis Phase

- The first step in the ADDIE process is "Analyze." The one that would be most appropriate for this step is "Seek First to Understand, Then to be understood."
- This is the stage when asking questions of stakeholders is the primary task so that we can completely understand the current situation (reality), the desired situation (goals), and then to determine what the gaps are in employee knowledge, skills and attitude.

The outcome of this stage is a report that summarizes these issues known as a training needs analysis.

Below are a few key questions that can be asked during this phase of the process:

- ✓ What are the organizational goals?
- ✓ What are the training program objectives?
- ✓ Who are the stakeholders?
- ✓ Who is the audience and what are their characteristics?
- ✓ What does the audience need to learn?
- ✓ What is the extent of participant knowledge/skills prior to training?
- ✓ What resources are available for the planning and implementation of the project?
- ✓ What are the constraints?
- ✓ What are the delivery options?
- ✓ What approach will be used for transferring learned skills to the workplace?
- ✓ What will participants do to determine their competency?
- ✓ When should the project be completed?
- ✓ What are the project risks?
- ✓ What will be the project costs?
- ✓ What are the anticipated benefits of the project?

Design Phase

- The second step of the ADDIE process is "Design." The primary tasks in this stage are to take the information gathered during the Analysis stage and do some further questioning of stakeholders in order to establish a framework for the training program in question.
- The end product of this stage is a program design outline. This document would contain all the strategies for the training program, but not the content of the topic(s).

Below are a few significant factors to take into consideration when designing a program design outline:

- ✓ How do the organizational and program objectives translate into specific learning objectives?
- ✓ Based on the learning objectives, what content must be developed?
- ✓ What will be the program structure?
- ✓ What will be the program sequence?
- ✓ What will be the program duration?
- ✓ What will be the pace of the program?
- ✓ What will be the mode(s) of delivery?
- ✓ What type(s) of skill assessment process and instruments will be utilized?
- ✓ How will the training program itself be evaluated?
- ✓ What are the specific expectations for transfer of learning?
- ✓ What support will be in place in the workplace to reinforce transfer of learning?

Development Phase

- The third step of the ADDIE process is "Develop." During this stage, the training topics identified during the first two steps are researched and the training program content is determined.
- This content is then translated into a variety of products.
- It is important to remember that it is not only important to come up with the content that addresses the true learning needs, but it is also important to put thoughtful consideration into how the information will be presented.

Below are the products that should come out of this step:

- ✓ Communication packets for program stakeholders
- ✓ Training lesson plans
- ✓ Trainer guides
- ✓ Participant workbooks & handouts
- ✓ Trainer and participant resources
- ✓ Training and job aids
- ✓ Coaching/mentoring guides and resources
- ✓ Technology infrastructure and software (if needed)
- ✓ Participant Knowledge/Skills/Attitude assessment tools
- ✓ Program evaluation instruments

Implementation Phase

- The fourth step of the ADDIE process is "Implement."
- It is during this stage that all the work up to this point is put into action. If the planning in the first three steps has been done well, then the implementation stage should also go well.
- The actual hard-copy products of this stage are the completed knowledge/ skills/attitude assessments, attendance records, and completed participant feedback forms.

Below are the tasks to be completed in this phase of the process:

- ✓ Rollout program communications to stakeholders.
- ✓ Produce program materials and aids.
- ✓ Prepare coaches/mentors/trainers.
- ✓ Install technology infrastructure and services (if needed).
- ✓ Set up administrative databases and systems.
- ✓ Install job aids.
- ✓ Set up venue(s) for the program.
- ✓ Schedule participants.

Evaluation Phase

- The fifth and final step of the ADDIE process is "Evaluate."
- Many people misunderstand this stage. They think that if you evaluate the learning experiences by collecting participant feedback forms, then you are done.
- This is far from accurate. Remember that this is a proactive process. People who do this stage will collect participant feedback and take the information to learn how to improve the program – and then they make the changes necessary for that improvement.
- They also continually assess the impact that the training is having on the employees, the department, and the organization as a whole.
- They do this to ensure that the training is achieving the desired results. If it stops doing this, the training must be changed or replaced with something more appropriate.
- The products of this stage are completed evaluations and reports that summarize the implications of the evaluations.

Below are the primary tasks found in this ADDIE step.

- Collect training program evaluation data.
- Collect project evaluation data.
- Review training program performance.
  - ✓ number of employees trained
  - ✓ percent participants passed (if applicable)
  - ✓ participant satisfaction
- Review project performance.
  - ✓ cost
  - ✓ schedule
  - ✓ scope
  - ✓ stakeholder satisfaction
  - ✓ project team satisfaction
- Report program and project performance results

THEORY OF CONSTRAINTS

The theory of constraints (TOC) focuses attention on constraints and bottlenecks within the organization which stands in the way for speedy production. The theory was developed by Goldartt and Cox to help managers to improve overall profitability of the concern. The main concept is to maximize the rate of manufacturing outputs. The theory was turned into an accounting system known as Throughput Accounting. TOC views that the peace of production is guided by the bottleneck within the organization; hence the same should be either removed or their influence to hinder production be minimized. In the new approach to production management called OPT (optimized production technology), TOC advocates a throughput orientation whereby throughput must be given first priority, inventories second and operational expenses last. The TOC adopts a short-run time horizon and treats all operating expenses (including direct labour but excluding direct materials) as fixed, thus implying that variable costing should be used for decision-making, profit measurement and inventory valuation. In substance, TOC appears to be merely a restatement of contribution per limiting factor; and in reality, TOC deals with a LP problem of maximizing throughput contribution subject to constraint of bottleneck resources.

MARGINAL COSTING

Theory of Marginal Costing

- At any given level of output, additional output can normally be obtained at less than proportionate cost per unit. This is because the aggregate of certain items of cost will tend to remain fixed and only the aggregate of the remainder (variable Cost) will tend to rise proportionately with increase in output. Conversely, a decrease in the volume of output will normally be accompanied by a less than proportionate fall in the aggregate cost.
- Therefore, costs should be analysed into variable and fixed components, for meaningful decision-taking. This theory, which recognises the difference between variable and fixed costs is called Marginal Costing.
- Marginal costing is also known as 'variable costing' or 'out of pocket costing'

Marginal Cost

- Marginal Cost represents the increase or decrease in total cost, which occurs with a small change in output say, a unit of output. In cost accounting, variable costs represent marginal cost.
- Distinguish between Differential Cost and Marginal Cost:
- The main point which distinguishes marginal cost and differential cost is that of change in fixed cost when volume of production increases or decreases by a unit of production. In the case of differential cost, variable as well as fixed cost i.e. both costs change due to change in the level of activity, whereas under marginal costing only variable cost changes due to change in the level of activity.

Important factors to be considered in marginal costing decisions

In all recommendations of marginal Costing decisions, the following factors are to be considered:

(a) Contribution: Whether the product or production line in question makes a contribution.

(b) Specific fixed cost, if any: Where a choice is to be made between two courses of action, the additional fixed overhead, if any, should be taken into account.

(c) CVP relationship: The effect of increase in volume on profits, and the rate of earning, additional profits, should be analysed.

(d) Incremental contribution: Where additional quantities can be sold only at reduced prices, incremental contribution will be more effective in decision making, as it takes into account the additional sale quantity and additional contribution per unit.

(e) Capacity: Whether acceptance of the incremental order, or additional product line is within the firm's capacity or whether key factor comes into play, should be analysed.

(f) Non-cost factors: Non cost factors should also be considered, wherever applicable.

Advantages of Marginal Costing:

1. **Pricing decisions:** Since marginal cost per unit is constant from period to period within a short span of time, firm decisions on pricing policy can be taken. If fixed cost is included, the unit cost will change from day to day depending upon the volume of output. This will make decision task difficult.
2. **Overhead variances:** Overheads are recovered in costing on the basis of pre-determined rates. This creates the problem of treatment of under or over-recovery of overheads, if fixed overheads were included. Marginal costing avoids such under or over recovery of overheads.
3. **True Profit**: It is argued that under the marginal costing technique, the stock of finished goods and work in progress are carried on marginal cost basis and the fixed expenses are written off to profit and loss account as period cost. This shows the true profit of the period.
4. **Break-even analysis:** Marginal costing helps in the preparation of break-even analysis, which shows the effect of increasing or decreasing production activity on the profitability of the company.
5. **Control over expenditure:** Segregation of expenses as fixed and variable helps the management to exercise control over expenditure. The management can compare the actual variable expenses with the budgeted variable expenses and take corrective action through variance analysis.
6. **Business decision-making:** Marginal costing helps the management in taking a number of business decisions like make or buy, discontinuance of a particular product, replacement of machines, etc.

Limitations of Marginal Costing

1. **Difficult to classify:** It is difficult to classify exactly the expenses into fixed and variable category. Most of the expenses are neither totally variable nor wholly fixed.
2. **Contribution is not final:** Contribution of a product itself is not a guide for optimum profitability unless it is linked with the key factor.
3. **Wrong pricing decisions:** Sales staff may mistake marginal cost for total cost and sell at a price; which will result in loss or low profits. Hence sales staff should be cautioned while giving marginal cost.
4. **Stock valuation:** Overheads of fixed nature cannot altogether be excluded particularly in large contracts, while valuing the work-in-progress. In order to show the correct position, fixed overheads have to be included in work in progress.
5. **Native assumptions:** Some of the assumptions regarding the behavior of various costs are not necessarily true in realistic situation. For example, additional output can be sold only by reducing sale prices.
6. **Ignores time value:** Marginal costing ignores time factor and investment. For example, the marginal cost of two jobs may be the same but the time taken for their completion and the cost of machines used may differ. The true cost of job, which takes longer time and uses costlier machine, would be higher. This fact is not disclosed by marginal costing.

Marginal and Absorption Costing – Differences

1. COST CLASSIFICATION:

- Under adsorption costing, costs are classified on functional basis i.e. Production,
- Administration, Selling & Distribution, Research, Development etc.
- Under marginal costing, costs are classified as either Fixed or Variable.

2. PRODUCT v/s PERIOD COSTS:

- Under adsorption costing, fixed costs are treated as product costs.
- Under marginal costing, fixed costs are treated as period costs. They are written off in the period in which they are incurred.

3. STOCK VALUATION:

- Under adsorption costing, the fix overheads (fixed production overheads under financial accounting system and fixed production and administration overheads under cost accounting system) are charged to the output. To the extent, the output remains unsold i.e. closing stock; its valuation would include not only the variable production cost but also the fixed overheads.

4. PROFIT MANIPULATION:

- Profit figure can be manipulated by showing higher stocks under absorption costing. No such manipulation is possible under marginal costing.

5. VARIANCE CALCULATION:

- In variance reporting, Fixed Overheads expenditure variance only can be computed under marginal costing. There is no volume variance since fixed overheads are none “absorbed”.
- In variance reporting Fixed Overheads Expenditure and Volume variance, variance can be computed under absorption costing. Volume variance can also be sub-classified into Capacity, Efficiency and Calendar variances.

6. OVER /UNDER ABSORPTION:

- If the spent amount is different from absorbed amount then, there will be over/under absorption under absorption costing.
- Since all fixed costs are written off in the period in which they are incurred there is no possibility of over/under absorption**.**

Contribution

- Contribution is the excess of sales revenue over the variable cost, i.e. Contribution =
- Sales Less Variable cost.
- It is called so, since it initially contributes towards recovery of fixed costs and thereafter towards profit of the business. The contribution forms a fund for fixed expenses and profit.
- The contribution concept is based on the theory that the profit and fixed expenses of a business is a 'joint cost' which cannot be equitably apportioned to different segments of the business. Hence contribution serves as a measure of efficiency of operations of various segments of the business.

Marginal Cost Equation:

- The Marginal Cost Statement, when written in an equation form, constitutes the Marginal Cost Equation.
- Sales - Variable Cost = Contribution
- Fixed Cost Profit

Cost-Volume-Profit Analysis

- Cost-Volume-Profit analysis is analysis of three variables e.g. cost, volume and profit which explores the relationship existing amongst costs, revenue, activity levels and the resulting profit.
- It aims at measuring variations of profits and costs with volume, which is significant for business profit planning.
- CVP analysis makes use of principles of marginal costing. It is an important tool of planning for making short term decisions.

The important assumptions are

1. All other variables remain constant.
2. A single product or constant sales mix.
3. Total cost and total revenue are linear functions of output.
4. Profits are calculated on a variable costing basis.
5. The analysis applies only to the relevant range only.
6. Costs can be accurately divided into their fixed and variable elements.
7. The analysis applies only to a short term time horizon.
8. Complexity related fixed costs do not change.

The following are the basic decision making indicators in Marginal Costing:

a) **Profit Volume Ratio (PV Ratio) / Contribution Margin ratio**

b) **Break Even Point (BEP)**

c) **Margin of Safety (MOS)**

d) **Indifference Point or Cost Break Even Point**

Profit Volume Ratio (PV Ratio)

- The Profit Volume Ratio (PV Ratio) is the relationship between Contribution and Sales Value. It is also termed as Contribution to Sales Ratio.

Significance of PV Ratio

- PV Ratio is considered to be the basic indicator of the profitability of the business.
- The higher the PV Ratio, the better it is for a business. In the case of a firm enjoying steady business conditions over a period of years, the PV Ratio will also remain stable and steady.
- If PV Ratio is improved, it will result in better profits.

Improvement of PV Ratio

- PV Ratio can be improved by the following means:
- By reducing the variable cost,
- By increasing the selling price, or
- By increasing the share of products with higher PV Ratio in the overall sales mix. (Where a firm produces a number of products)

Uses of P/V Ratio

- To compute the variable costs for any volume of sales.
- To measure the efficiency or to choose a most profitable line. The overall profitability of the firm can be improved by increasing the sales/output of a product giving a higher PV ratio.
- To determine break-even point and the level of output required to earn a desired profit.
- To decide more profitable sales-mix.

Break Even Point (BEP)

Meaning

- The Break – Even Point is the point or a business situation at which there is neither a profit nor a loss to the firm. In other words, at this point, the total contribution equals fixed costs.

Assumptions underlying break even analysis

1. Total costs can be easily classified into Fixed and Variable categories.
2. Selling Price per unit remain constant, irrespective of quantity sold.
3. Variable Costs per unit remain constant. However total variable costs increase as output increases.
4. Fixed Costs for the period remains same irrespective of output.
5. Productivity of the factors of production will remain the same.
6. The state of technology process of production and quality of output will remain unchanged.
7. There will be no significant change in the level of opening and closing inventory.
8. The company manufactures a single product. In the case of a multi-product company, the sales-mix remains unchanged.

Break-even chart

The break-even chart is a graphical representation of cost-volume profit relationship. It depicts the following:

1. Profitability of the firm at different levels of output.
2. Break-even point – No profit no loss situation.
3. Angle of Incidence: This is the angle at which the total sales line cuts the total cost line.
4. Relationship between variable cost, fixed expenses and the contribution.
5. Margin of safety representing the difference between the total sales and the sales at breakeven point.

Limitations of break-even chart

1. The variable cost line need not necessarily be a straight line because of the possibility of operation of law of increasing returns or decreasing returns.
2. Similarly the selling price will not be a constant factor. Any increase or decrease in output is likely to have all influence on the selling price.
3. When a number of products are produced separate break-even charts will have to be calculated. This poses a problem of apportionment of fixed expenses to each product.
4. Break-even charts ignore the capital employed in business, which is one of the important guiding factors the determination of profitability.

Margin of Safety

- Margin of Safety (MOS) represents the difference between 'the actual total sales and sales at break-even point.' It can be expressed as a percentage of total sales, or in value, or in terms of quantity.
- Significance
- Upto Break-even point the contribution earned is sufficient only to recover fixed costs. However beyond the Break -even point. The contribution is called profit (since fixed costs are fully recovered by then)
- Profit is nothing but contribution carried out of Margin of Safety Sales.
- The size of the margin of safety shows the strength of the business.
- If the margin of safety is small, it may indicate that the firm has large fixed expenses and is more vulnerable to changes in sales.
- If the margin of safety is large, a slight fall in sales may not affect the business very much but if it is small even a slight fall in sales may adversely affect the business.

Improvement in Margin of Safety

1. Increase in the selling price, provided the demand is inelastic so as to absorb the increased prices.
2. Reduction in fixed expenses.
3. Reduction in variable expenses.
5. Increasing the sales volume provided capacity is available.
6. Substitution or introduction of a product mix such that more profitable lines are introduced.

Operation Research Part-02

Write some typical applications of 'Operation Research

Typical applications of operation research:

1. **Capital Budgeting**
2. **Asset allocation**
3. **Portfolio selection**
4. **Benchmarking**
5. **Supply chain planning**
6. **Inventory planning**
7. **Resource allocation and staff allocation**
8. **Marketing channel optimization**
9. **Fraud prevention, Anti-Money Laundering**
10. **Direct marketing campaigns, predicting customer response, and campaign optimization**

Application and Scope of Operations Research

SL.No	Area	Application
1	**Finance**	Dividend policy making investment and budgeting portfolio analysis, cash flow analysis, credit risks, etc.
2	**Accounting**	Cash flow planning Credit policy analysis Planning of delinquent account strategy
3	**Marketing**	Advertising and media planning Product selection, timing, competitive action Recruitment of salesmen.
4	**Personnel**	Selection of personnel, mixes of age and skills Recruitment policies and assignment of jobs Manpower planning, wage (or salary) administration Scheduling of training programmes.
5	**Construction**	Allocation of resources to projects Determination of proper workforce Deployment of workforce Project scheduling, monitoring and control.
6	**Facilities Planning**	Factory size location decision Location and size of warehouse, distribution centres and retail outlets Transportation, loading and unloading Logistics system design, layout

7	**Manufacturing**	Employment, training, layoffs, quality control Aggregate production planning, assembly line, blending, purchasing Production scheduling, production smoothing Inventory control
8	**Purchasing and procurement**	Bidding policies, Vendor analysis, Replacement policies Optimal buying and reordering Materials transfer.
9	**Maintenance and Project scheduling**	Preventive maintenance and maintenance policies Project scheduling and allocation of resources Maintenance crew size and scheduling Project management & strategic planning
10	**Research and development**	Control of R&D projects Product introduction planning Organizational design and control Decision supports system & MIS
11	**Government**	Economic planning, natural resources Energy, Urban and rural housing problem Military, police and pollution control.

Advantages

1. Optimum use of production factors.
2. Improved quality of Decision.
3. Preparation of future managers.
4. Modification of mathematical Solution.
5. Better decisions.
6. Better co-ordination
7. Better control.

Limitations

1. Magnitude of computation.
2. Distance between managers and Operations research.
3. Reliability of the proposed solution.
4. Presence of multiple objects.
5. Non-availability of appropriate data.
6. Deals only with quantified data.

LINEAR PROGRAMMING

Linear programming (LP, or linear optimization)

- It is a mathematical method for determining a way to achieve the best outcome (such as maximum profit or lowest cost) in a given mathematical model for some list of requirements represented as linear relationships.

- Linear programming is a specific case of mathematical programming (mathematical optimization).

Linear Programming is a mathematical way of planning, which involves three steps

1. Identify the objective function as a linear function of its variables and state all the limitations on resources as linear equations and/or in equations (constraints).
2. Use mathematical techniques to find all possible sets of values of the variables (unknowns), satisfying the constraints.
3. Select the particular set of values of the variables obtained in (2) that lead to our objective– maximum profit, least cost, etc.

LP Assumptions

Linear programming is based on four mathematical assumptions. An assumption is a simplifying condition taken to hold true in the system being analyzed in order to render the model mathematically tractable (solvable).

The four mathematical assumptions are the following:

- **Proportionality** – the effect of a decision variable in any one equation is proportional to a constant quantity.
- **Additivity** – the combined effect of the decision variables in any one equation is the algebraic sum of their individual weighted effects. (The weighting, of course, is due to the proportionality constants.)
- **Divisibility** – the decision variables can take on fractional (non-integer) values.
- **Certainty** – all model parameters are known constants.

Advantages

- Linear Programming helps in attaining the optimum use of productive factors. It also indicates how a decision maker can employ his productive factors effectively by selecting and distributing these elements.

- Linear programming techniques improve the quality of decisions. Users of this technique become more objective and less subjective.

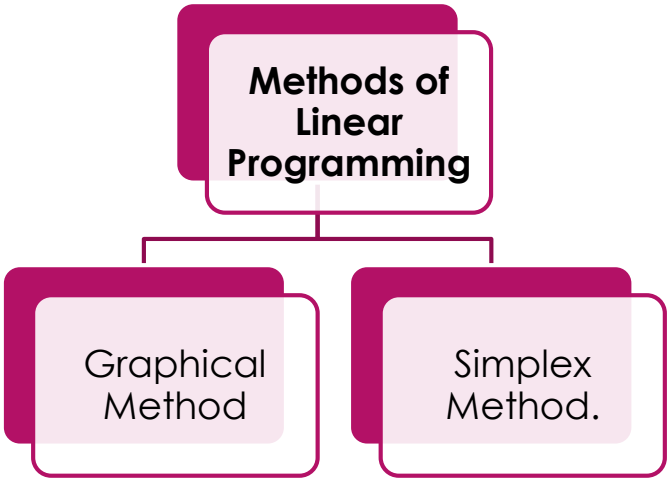
- Highlighting of bottlenecks in the production processes is one of the most significant advantages of this technique.

- Linear programming provides possible and practical solutions since there might be other constraints operating outside of the problem which must be taken into account.

Limitations

- In reality, objectives, functions and constraints cannot be expressed in linear form.
- In Linear Programming problem, fractional values are permitted for the decision variables.
- However, many decision problems require that the decision variables should be obtained in non-fractional values.
- The co-efficient of basic variables cannot be determined with certainty; however, they can be stated only with probability.
- Where a problem consists of inflicting multiple objectives, this technique cannot provide a solution.
- The linear programming does not take into consideration the effect of time and uncertainty.
- Parameters appearing in the LP model are assumed to be constant but in real life situations they are frequently neither known nor constant.
- In case of large, complex and constrained problems, computational problems are enormous

Methods of Linear Programming



Simplex method

- The Simplex method is a computational procedure-an algorithm-for solving Linear Programming Problems. It is an iterative optimizing technique.

- In the Simplex process, we must first find an initial basic solution (extreme point). We then proceed to an adjacent extreme point. We continue moving from point to point until we reach an optimal solution.

Advantage of Simplex Method over the Graphical solution

- Algebraic method and Graphical method can only be used when there are only less than 2 variables in an LPP. Further Algebra will fail, if there are inequalities. In case the no. of variables exceeds 2, it will not be possible to solve the problem by Algebra/Graphically. In that case, we have to resort to the Simplex method only.

- Simplex method is highly efficient and versatile as also amenable to further mathematical treatment and offers interesting economic interpretations. Thus it is possible to solve conveniently linear programming problem graphically, as long as the number of variables is not more than two. Further, the Simplex method is popular, due to its ability to easily program the algorithm on a computer.

- Simplex methods use the concept of slack variables and two theorems-The Extreme Point Theorem and the Basis Theorem. In Simplex, we move from the initial basic solution to a better solution and proceed for a further better solution and so on, till we reach the optimum solution. As the Simplex method is quite tedious and highly computational, one has to keep his head cool while solving a LPP by Simplex method.

LEARNING CURVE

- Learning Curve Theory is concerned with the idea that when a new job, process or activity commences for the first time it is likely that the workforce involved will not achieve maximum efficiency immediately.
- Learning is the process by which an individual acquires skill, knowledge and ability. When a new product or process is started, the performance of a worker is not at its best and learning phenomenon takes place.
- As the experience is gained, the performance of a worker improves, time taken per unit of activity reduces and his productivity goes up.

Areas of consequence

- A Standard Costing system would need to set standard labour times after the learning curve had reached a plateau.
- A budget will need to incorporate a learning cost factor until the plateau is reached.
- A budgetary control system incorporating labour variances will have to make allowances for the anticipated time changes.
- Identification of the learning curve will permit the company to better plan its marketing, work scheduling, recruitment and material acquisition activities.
- The decline in labour costs will have to be considered when estimating the overhead apportionment rate.
- As the employees gain experience they are more likely to reduce material wastage.

Uses of Learning curve

Learning curve is now being widely issued in business. Some of the uses are as follows:

1. Where applicable the learning curve suggest great opportunities for cost reduction to be achieved by improving learning.
2. **The learning curve concept suggests a basis for correct staffing in continuously expanding production**.

   The curve shows that the work force need not be increased at the same rate as the prospective output. This also helps in proper production planning through proper scheduling of work; providing manpower at the right moment permitting more accurate forecast of delivery dates.

3. **Learning curve concept provides a means of evaluating the effectiveness of training programs**.

   What level of cumulative cost reduction do they accomplish? How does the learning curve for this group or shop compare with others? Whether any of the employees who lack the aptitude to meet normal learning curve should be eliminated.

4. **The use of learning curve, where applicable, is important in the working capital required**.

   If the requirement is based on average cumulative unit cost, the revenues from the first few units may not cover the actual expenditures. For instance, if the price was based on the average cumulative unit cost of 328 hours the first unit when produced and sold will cause a deficit of 4.72 hours (8.00 – 3.28). Provision should therefore, be made to cover the deficit of working capital in the initial stages of production.

5. **A knowledge of the learning curve assists in planning the inventories of materials. Work-in-progress, and finished goods.**

   As employees become more efficient, the rate of production increases and so more materials are needed, the work-in-progress inventory turns over faster, and finished goods inventory grows at an accelerated rate.

6. **Learning curve techniques are useful in exercising control**

   Variable norms can be established for each situation, and a comparison between these norms and actual expenses can be made. Specific or average incremental unit cost should be used for this purpose.

7. **The learning curve may be used for make-or- buy decisions**

   Especially if the outside manufacturer has reached the maximum on the learning curve. Help to calculate the sensitive rates in wage bargaining.

Limitations to the usefulness of the learning curve

1. The learning curve is useful only for new operations where machines do not constitute a major part of the production process. It is not applicable to all productions. E.g. new and experienced workmen.

2. The learning curve assumes that the production will continue without any major interruptions. If for any reason the work in interrupted, the curve may be deflected or assume a new slopes

3. Charges other than learning may affect the learning curve. For example, improvement in facilities, arrangements, and equipment as well as personnel morale and performance may be factors influencing the curve. On the other hand, negative developments in employee attitudes may also affect the curve and reverse or retard the progress of improvement.

4. The characteristic 80 percent learning curve as originally obtaining in the air force industry in U.S.A. has been usually accepted as the percentage applicable to all industries. Studies show that there cannot be a unique percentage which can be universally applied.

Factors affecting Learning Curve

1. While pricing for bids, general tendency is to set up a very high initial labour cost so as to show a high learning curve. This should the learning curve useless and sometimes misleading.

2. The method of production, i.e. whether it is labour oriented or machine oriented influences the slop of the learning.

3. When labour turnover rate is high management has to train new workers frequently. In such situations the company may never reach its maximum efficiency potential. One of the important requisites of the learning curve concept is that there should be uninterrupted flow of work. The fewer the interruptions, the grater will be the improvement in efficiency.

4. Changes in a product or in the methods of production, designs, machinery, or the tools/used affect the slope of the learning curve. All these have the effect of starting learning a fresh because of new conditions If the changes are frequent, there may be no learning at all.

5. Also other factors influencing the learning curve are labour strikes, lock outs and shut downs due to other cause also/affect the learning curve. In each such case there is interruption in the progress of learning.

What are the impacts of 'learning curve model' on labour variances?

The learning curve model will affect labour variance since:

- The initial standard time taken to produce the item will become rapidly out of date.
- Variances calculated using out of date standards will quickly become meaningless for planning and control.
- In many respects the easiest way of incorporating learning effects is to build them into the standards used.

SIMULATION TECHNIQUE

- Simulation is a modeling and analysis tool widely used for the purpose of designing, planning, and control of manufacturing systems.

- Simulation is generally referred to as computer simulation, which simulates the operation of a manufacturing system. A computer simulation or a computer model is a computer program which attempts to simulate an abstract model of a particular system

- Simulation in general is to pretend that one deals with a real thing while really working with an imitation. In operations research, the imitation is a computer model of the simulated reality. The task of executing simulations provides insight and a deep understanding of physical processes that are being modeled

Application of Simulation

1. Scheduling aircraft,
2. Job-ship scheduling and personnel scheduling,
3. Manpower-hiring decisions,
4. Traffic light-timing,
5. Transport-scheduling,
6. Evaluating alternative investment opportunities, and
7. Design of parking lots, harbor, and communication systems etc.

Advantages of Simulation

- Enables to experiment and study complex interactions of a system (e.g. company operations, economic policies).
- Possible to study the effects of organizational environment informational changes in the operations of a system (e.g. number of stocking points, industrial policies).
- Better insight and understanding of a complex system to indication for improvement.
- Assists in teaching and training (management games).
- New situations policies can be protested.
- Probabilistic features can be easily incorporated.
- A process can be studies in extended or compressed time.
- Risks involved in experimenting with real problems can be eliminated.

Limitations of Simulations

- Simulated results are not precise. Unlike mathematical models, it does not give optimum solutions.
- At times one may not be able to assess the extent of error in a simulated result.
- Some situations are not amenable to simulation.
- Simulation may be expensive needing advanced computer supports
- Simulation by itself does not generate solutions, but only indicates a way of evaluating solutions.
- It is often a long, complicated process to develop a model.

Steps involved in constructing and using a Simulation Model

All simulation projects follow the following steps

- Define the problem
- Data collection
- Problem analysis
- Simulation model specification
- Model programming
- Model validation
- Simulation experimentation
- Evaluation and interpretation of simulation results
- Report generation and plans for implementation of the results

Design of Simulation Model

One should consider the characteristic of the system in question and the nature of the problems to be tackled while choosing a modeling approach. In general the simulation model used in the area of

Manufacturing Systems Engineering (MSE) can be classified as

1. Static and Dynamic Simulation Models
2. Continuous and Discrete Simulation Model
3. Stochastic and Deterministic Simulation Model
4. Social Simulation
5. Web based Simulation
6. Parallel and Distributed Simulation

Types of Simulation

Simulators are usually divided into the following categories or simulation modes.

1. Behavioral simulation
2. Functional simulation
3. Static timing analysis
4. Gate-level simulation
5. Switch-level simulation
6. Transistor-level or circuit-level simulation

NETWORK ANALYSIS

- Network analysis is the general name given to certain specific techniques which can be used for planning, management and control of project.

- It often acts as a network management tool for breaking down projects into components or individual activities and recording the result on a flow chart or network diagram.

- These results generally reveal information that is used to determine duration, resource limitations and cost estimates associated with the project.

Applications

- Construction of a Residential complex,
- Commercial complex,
- Petro-chemical complex
- Ship building
- Satellite mission development
- Installation of a pipe line project etc

The procedure of drawing a network

1. **Specify the Individual Activities:** From the work breakdown structure, a listing can be made of all the activities in the project. This listing can be used as the basis for adding sequence and duration information in later steps.

2. **Determine the Sequence of the Activities:** Some activities are dependent on the completion of others. A listing of the immediate predecessors of each activity is useful for constructing the CPM network diagram.

3. **Draw the Network Diagram:** Once the activities and their sequencing have been defined, the CPM diagram can be drawn. CPM originally was developed as an activity on node (AON) network, but some project planners prefer to specify the activities on the arcs.

4. **Estimate Activity Completion Time:** The time required to complete each activity can be estimated using past experience or the estimates of knowledgeable persons. CPM is a deterministic model that does not take into account variation in the completion time, so only one number is used for an activity's time estimate.

5. **Identify the Critical Path:** The critical path is the longest-duration path through the network. The significance of the critical path is that the activities that lie on it cannot be delayed without delaying the project. Because of its impact on the entire project, critical path analysis is an important aspect of project planning.

Differences between PERT & CPM

PERT	CPM
1. It is a technique for planning scheduling & controlling of projects whose activities are subject to uncertainty in the performance time. Hence it is a probabilistic model.	1. It is a technique for planning scheduling & controlling of projects whose activities not subjected to any uncertainty and the performance times are fixed. Hence it is a deterministic model.
2. It is an Event oriented system	2. It is an Activity oriented system
3. Basically does not differentiate critical and non-critical activities	3. Differentiates clearly the critical activities from the other activities
4. Used in projects where resources (men, materials, money) are always available when required.	4. Used in projects where overall costs is of primarily important. Therefore better utilized resources
5. Suitable for Research and Development projects where times cannot be predicted.	5. Suitable for civil constructions.

List any three common errors committed in drawing network diagrams

1. **Looping:** Generally, the arrow points from left to right, since time flows in that direction. If this convention is not followed, the result is illogical looping.

2. **Dangling:** This represents a situation when an event is not continued further, i.e. it hangs abruptly in the middle of the network without being connected to completion stage. Such activities undertaken with no results should be avoided.

   This can be overcome by following these rules —
   - All events, except the first and the last, must have at least one activity entering and one activity leaving them.
   - All activities must start and finish with an event.

3. **Duplication:** Activities that have the same head event and the same tail event are called duplicate activities. Duplication can be corrected by the introduction of a dummy activity.

TIME SERIES ANALYSIS

- Time series analysis refers to problems in which observations are collected at regular time intervals and there are correlations among successive observations.

- Applications cover virtually all areas of Statistics but some of the most important include economic and financial time series, and many areas of environmental or ecological data.

Goals of time series analysis

1. **Descriptive:** Identify patterns in correlated data–trends and seasonal variation
2. **Explanation:** understanding and modeling the data
3. **Forecasting:** prediction of short-term trends from previous patterns
4. **Intervention analysis:** how does a single event change the time series?
5. **Quality control:** deviations of a specified size indicate a problem

Characteristics of Time Series Analysis

1. Some movements exhibit (persistent) growth or decline.
2. Few movements are regular and periodic exceeding a year.
3. Again some are regular and periodic exceeding a year.
4. Some are irregular, mild or violent in movements.

COMPONENTS OF TIME SERIES

The four components of time series are:

1. **Secular trend**
2. **Seasonal variation**
3. **Cyclical variation**
4. **Irregular variation**

Secular trend:

A time series data may show upward trend or downward trend for a period of years and this may be due to factors like increase in population, change in technological progress, large scale shift in consumer's demands, etc.

- ***For example***, population increases over a period of time, price increases over a period of years, production of goods on the capital market of the country increases over a period of years. These are the examples of upward trend. The sales of a commodity may decrease over a period of time because of better products coming to the market. This is an example of declining trend or downward trend. The increase or decrease in the movements of a time series is called Secular trend.

Seasonal variation

- Seasonal variation are short-term fluctuation in a time series which occur periodically in a year.
- This continues to repeat year after year. The major factors that are responsible for the repetitive pattern of seasonal variations are weather conditions and customs of people.
- More woolen clothes are sold in winter than in the season of summer Regardless of the trend we can observe that in each year more ice creams are sold in summer and very little in winter season.
- The sales in the departmental stores are more during festive seasons that in the normal days.

Cyclical variations

- Cyclical variations are recurrent upward or downward movements in a time series but the period of cycle is greater than a year. Also these variations are not regular as seasonal variation.
- There are different types of cycles of varying in length and size. The ups and downs in business activities are the effects of cyclical variation.
- A business cycle showing these oscillatory movements has to pass through four phases-prosperity, recession, depression and recovery. In a business, these four phases are completed by passing one to another in this order.

Irregular variation

- Irregular variations are fluctuations in time series that are short in duration, erratic in nature and follow no regularity in the occurrence pattern.
- These variations are also referred to as residual variations since by definition they represent what is left out in a time series after trend, cyclical and seasonal variations. Irregular fluctuations results due to the occurrence of unforeseen events like floods, earthquakes, wars, famines, etc.

Entrepreneurial approach to cost management with reference to core competencies

Part-03

Business Process Outsourcing (BPO)

BPO stands for Business Process Outsourcing. Outsourcing is a system whereby an organisation can sub-contract certain areas of work or processes to a specialist third party organisation.

Types of Outsourcing

The main types of outsourcing that are currently practiced by organisations are as follows:

1. **Contracting out the activities:** This can take place when an organisation is delegating to another organisation the element of the demand chain in question. Typically, contracting out is used for Entrepreneurial Approach to Cost Management with reference to Core Competencies fairly low level ancillary services such as cleaning and managing washroom hygiene. This is a short term, tactical solution to urgently find means of dealing with a problem.

2. **Outsourcing the services:** It involves carefully selecting and then engaging specialised external service providers who will allow the organisation to redefine, refocus and energies in order to tap into the expertise that the service provider has accumulated. If properly managed, this enables the organisation to benefit from the service provider's contribution as a deep and strategic level. This may ultimately enable it to focus more and more on what it does best and on where it has a real edge over other companies.

3. **In-sourcing.** This is an alternative approach of securing productivity gains by improving the operation of an area so that work from other businesses can be undertaken. In this way skills can be retained and assets exploited, resulting in low unit cost for the in-sourcing business.

4. **Co-sourcing**. This is a relationship where the interaction between the supplier and the host organisation is even more intimate than in normal outsourcing. This usually means that the host organisation supplies staff or managers to the outsourcing deal, not as transferred staff but because of their specialist knowledge, which the host organisation cannot afford to lose permanently.

5. **Benefit-based relationships**: This is a long term relationship based on both parties making an upfront investment in the relationship and sharing the benefits as they accrue according to some preagreed formula.

Benefits of Business Process Outsourcing

Organisations can gain a number of benefits by outsourcing or using a business process outsourcing company.

1. **Saving money.** Most companies that provide BPO services are able to carry out the work for considerably less. This is generally achieved through having lower operational costs themselves because labour is less expensive, social costs are lower and they don't have to provide benefits to their workers. Typically, BPO should save companies in the region of 40-50%.

2. **Quality of service.** It is also possible in some instances to improve the quality of service through being able to have more resources and better qualified personnel**.**

3. **Productivity improvements.** It allows executives and management to focus on critical functions of the business. For example, it will allow expensive and skilled personnel to focus on sales and marketing strategy rather than operational issues such as preparing a VAT return or payroll. You normally find that executives spend 80% of their time in management of day-to-day issues and only 20% on strategy. Outsourcing certain processes can in many instances reverse this statistic. Giving management time to carry out other functions can enable an organisation to become more profitable and find other ways of generating income.

4. **Access to a wider array of skills.** BPO enables an organisation to access different skills sets and expertise that their company would not normally have access to. Many BPO companies have skills and intellectual assets that take many, many years to generate.

5. **Allocation of resources.** Organisations that use BPO can effectively reallocate personnel into areas that will have a positive impact upon other projects, such as expansion or opening offices in new territories.

6. **Operational expertise.** BPO companies are able to provide the relevant expertise that most companies don't have access to or would be difficult and expensive to develop in-house.

7. **Flexibility.** BPO can help organisations become more flexible, for example by speeding up key business processes such as purchasing, and thereby ensuring that not too much or indeed too little stock is held at any one time.

8. **By allowing organisations to retain flexibility and agility.** BPO also ensures that companies do not become too bureaucratic. This is a feature of smaller and younger companies but as they grow, more processes and procedures are put in place which while allowing for control, can stifle a company and the people working for it

What type of companies would benefit from Business Process Outsourcing?

Most companies can benefit from some form of outsourcing but many are not inclined to do so because they feel uncomfortable with contracting key functions to a third party.

The key to understanding business process outsourcing is to ask these questions:

- What business processes are critical to the business?
- What are the areas or processes that do not work very well in-house?
- Would using a business process outsourcing company improve or resolve any of these issues?
- How?
- What are the risks?

Pitfalls of Business Process Outsourcing

Although the benefits can be extensive, there are many risks associated with business process outsourcing.

1. **Risk is seen as the biggest potential issue with BPO.** Risk can be reflected in security issues in relation to sensitive data and privacy, risk of losing independence and potentially losing control.

2. **Loss of flexibility in reacting to changes in business conditions**. It is important that communications continue throughout the life cycle of any BPO agreement. This means informing the BPO provider of any change of strategy or conditions that might impact their ability to function properly.

3. **Potential threat to security or access to confidential information**. There are many examples where confidential data has gone 'astray' or been sold. Processes and procedures must be put in place to ensure that only certain personnel can access specific information, especially with payroll systems, HR and client records.

4. **Staff turnover.** It is expected that within call centres, for example there may be a fairly high turnover of staff, typically some 30%, but typically within BPO companies this can be up to 50%. This can be critical because losing key people can have a serious impact operationally, e.g. having to retrain people on a particular system or product within a call centre if people are leaving. Also, if absenteeism is high within a call centre environment, this will naturally badly impact customer service and call waiting times.

5. **Cultural differences**. If a BPO company's staff is based abroad, for example in India, there can be potential problems. This can be anything from communications difficulties to not totally understanding what perhaps a British customer expects. Many BPO off-shoring companies train their staff in order to resolve this.

6. **Job losses.** People often believe that BPO only leads to staff losing their jobs. This could be true to a certain extent, but while there might be a perceived threat to staff's finances, generally the roles that are outsourced are those which typically a company can have difficulty fulfilling anyhow.