CMA - INTERMEDIATE

MA CHART BOOK- INDEX

MANAGEMENT ACCOUNTING

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1. INTRODUCTION TO MANAGEMENT ACCOUNTING

What is Management Accounting?

Management accounting is accounting (i.e. producing useful information) for management (people with the task of running the business)

MANAGEMENT ACCOUNTING

- **Management** — Running an organisation in consonance with the strategic goal
- **Accounting** — Encompass any of the activities that attempt to gauge the performance of an organisation

Fundamental activities of management accounting would include:

1. Calculating the profitability of products, services and operations,
2. Allocating costs to products,
3. Setting inter-divisional transfer prices.

EVOLUTION

Stage 4	Creation of Value through effective use of resources
Stage 3	Reduction of waste of resources in Business processes
Stage 2	Information for management planning and control
Stage 1	Cost determination and financial control

SCOPE OF MANAGEMENT ACCOUNTING

1. Budgeting, planning and forecasting
2. Measuring organisational, divisional and departmental performance
3. Comparing results and performance within and between organisations
4. Assisting in the process of increasing effectiveness and efficiency
5. Assessing the performance of past and future capital investments
6. Advising on decisions about product mix, markets to be served and selling prices

FINANCAL ACCOUNTING & MANAGEMENT ACCOUNTING

BASIS FOR COMPARISON	FINANCIAL ACCOUNTING	MANAGEMENT ACCOUNTING
Purpose	Financial Accounting classifies, analyses, records, and summarizes the financial transactions of a particular period of the company.	Management accounting helps management make effective decisions about the business
Application	Financial accounting is prepared to reflect true and fair picture of financial affairs.	Management accounting helps management to take meaningful steps and strategize.
Scope	The scope is pervasive, but not as much as the management accounting.	The scope is much broader.
Information type	Quantitative.	Quantitative and qualitative.
Inter dependence	It is not dependent on management accounting.	Management accounting is basically decision making accounting and depends on information created by Financial Accounting as well as Cost Accounting.
Statutory requirement	It is legally mandatory to prepare financial accounts of all companies.	Management accounting has no statutory requirement
Format	Financial accounting has specific formats for presenting and recording information.	There's no set format for presenting information in management accounting.
Users	Mainly for potential investors as well as all stakeholders.	Only for management.
Verifiable	The information presented is verifiable	The information presented is predictive and not immediately verifiable.

COST ACCOUNTING & MANAGEMENT ACCOUNTING

Basis for Comparison	Cost Accounting	Management Accounting
Meaning	Cost accounting revolves around cost computation, cost control, and cost reduction	Management accounting helps management make effective decisions about operations of the business
Application	Cost accounting prevents a business from incurring costs beyond budget.	Management accounting offers a big picture of how management should strategize.
Scope	The scope is much narrower	The scope is much broader
Measuring grid	Quantitative.	Quantitative and qualitative.
Sub-set	Cost accounting is one of the many sub-sets of management accounting.	Management accounting is the universal set
Basis of decision making	The task of decision making very less. Even if there is some, it is based on historic information	Historic and predictive information is the basis of decision-making
Statutory requirement	Statutory audit of cost accounting is a requirement in some specified industries	The audit of management accounting has no statutory requirement.
Dependence	Cost accounting isn't dependent on management accounting to be successfully implemented.	Management accounting is dependent on both cost & financial accounting for successful implementation.
Used for	Management, shareholders, and vendors.	Only for management

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FUNCTIONS OF A MANAGEMENT ACCUNTANT

Planning and Accounting	• Management accountants prepare an accounting system covering costs, sales forecasts, profit planning, production planning, and allocation of resources
Controlling	• Management accountants assist in the control of an organisation's performance through the use of standard costing, budget control, accounting ratios, funds flow statements, cost-cutting initiatives, and assessing capital expenditure proposals and returns on investment.
Reporting	• Management accountants assist the top management in finding out the root cause of an unfavorable operation or event by identifying the real reasons for the adverse events as well as the responsible parties and comprehensively reporting them
Coordinating	• Management accountants improve an organisation's efficiency and profits by providing various coordination tools such as budgeting, financial reporting, financial analysis and interpretation, and so on.
Communication	• Management accountants create a wide range of reports to communicate results to the superiors
Financial evaluation and Interpretation	• Management accountants analyze the data and present it to the management in a non-technical approach, together with their comments and ideas, so that the shareholders and senior management can understand it and make informed decisions.
Tax Administration	• Management accountants are in charge of tax policies and processes. They make the reports that are required by various authorities.
Evaluation of external effects	• There may be changes in government policy and existing laws. These amendments and policy changes can affect business goals.
Economic appraisal	• When the government makes regular announcements about the country's economic situation, management accountants is entrusted with making the economic study and determine the influence of current economic conditions on the company's operations.
Asset Protection	• Management accountants separate fixed asset registers for each type and provide internal checks and controls to protect the company's assets

EFFECT OF NEW BUSINESS ENVIRONMENT

Global competition

- Globalisation ushered in changes where there have been reductions in tariffs and duties on imports and exports as well as dramatic improvements in transportation and communication systems

Changing product life cycles

- the management accountant plays a crucial role as in order to compete successfully, companies must be able to manage their costs effectively at the design stage, have the capability to adapt to new environment, different and changing customer requirements and reduce the time to market of new and modified products.

Advances in manufacturing technology

- Flexibility to cope with short product life cycles, demands for greater variety of product, more discriminating customers and increasing international competition has created enormous pressure on the operational activities of the business

The impact of information technology

- Along with electronic business communication technologies known as e-business, e-commerce or internet commerce have also developed significantly.

Environmental and sustainability issues

- ethical issues have also come to the forefront as the business has to deal with customers who are more aware of this issues then they were a decade back
- Sustainable development, where it is acknowledged that environmental resources are limited and should be preserved for future generations, is the order of the day

Focus on value creation

- The scope of management accounting is enormous. Managers who are in charge of the operations of the organisations depends on the management accountants in realisation of the strategic goal of the organisations

ROLES OF MANAGEMENT ACCOUNTANTS

a) To consult with the segments of management responsible for policies and procedures and look into the effectiveness of those policies and procedures.

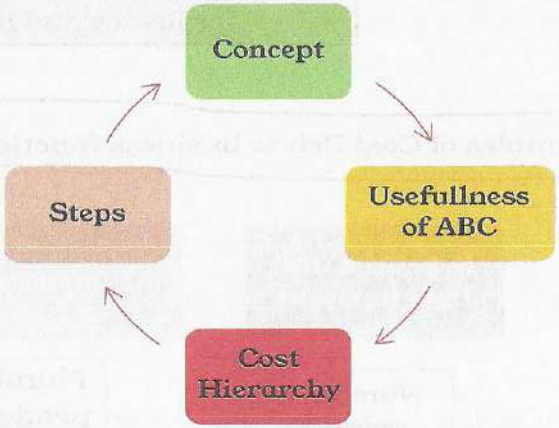
b) To make comparisons to the operational plan and standards, as well as to report and evaluate operational outcomes to all levels of management and the business owners.

c) Establish, coordinate, and execute an adequate plan of operation and control as an inherent aspect of management. Such a plan would include spending budgets, profit planning, sales forecasts, and capital investment and financing program, as well as the procedures necessary to carry out the plan.

d) To ensure the financial security of the company's assets through effective internal controls and adequate insurance coverages.

2. ACTIVITY BASED COSTING

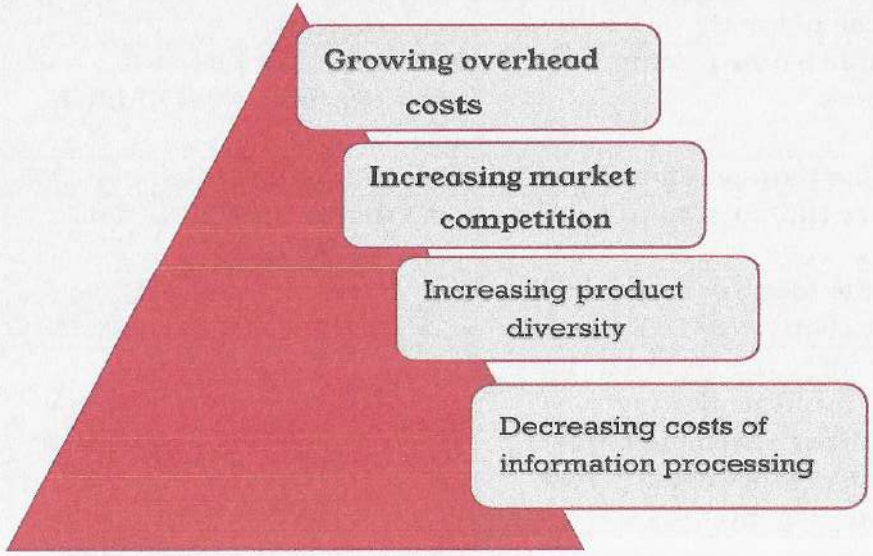
POINTS OF DISCUSSION



MEANING OF ACTIVITY BASED COSTING

ACTIVITY BASED COSTING (ABC)	Accounting methodology that assigns costs to Activities rather than products or services.
	Cost are assigned based on their use of resources.
	Creates a LINK BETWEEN THE ACTIVITY (resource consumption) and the COST OBJECT.
	Useful to the ORGANIZATION WITH MULTIPLE PRODUCTS.

FACTORS PROMPTING DEVELOPMENT OF ABC



USEFULNESS/SUITABILITY OF ABC

ABC is particularly needed in the following situations:			
High amount of overhead	Wide range of products	Presence of non-volume related activities	Stiff competition

ADVANTAGES AND DISADVANTAGES OF ABC

ADVANTAGES	DISADVANTAGES
More accurate costing	Expensive
Overhead allocation is done on logical basis	Not helpful to the small organizations.
Enable better pricing policies.	May not be applied to organizations with limited products.
Utilize than just total cost rather than just total cost	Selection of the most suitable cost driver may be difficult or complicated.
Help to identify non-value added activities	
Helpful to the organizations with multiple products.	
Highlight problems areas which require attention of the management.	

TERMS USED

(i) Activity

- Even that incurs cost

(ii) Cost Object

An item for which cost measurement is required

(iii) Cost Driver

- Factor that causes a change in the cost of an activity
- Resource cost driver: Measure of the quantity of resources.
- Activity cost driver: Measure of the frequency and intensity of demand.

Examples of Cost Driver business function wise:

- **Research and Development**
  - Number of research projects
  - Personnel hours on a project
- **Design of products, services and procedures**
  - Number of products in design
  - Number of parts per product
  - Number of engineering hours

Customer Service	Marketing	Distribution
Number of service calls	Number of advertisements	Number of units distributed
Number of products serviced	Number of sales personnel	Number of customers
Hours spent on servicing products	Sales revenue	

(iv) Cost Pool — Group of various individual cost items
Example machine set-up

REQUIREMENTS IN ABC IMPLEMENTATION

COST ALLOCATION

TRADITIONAL ABSORPTION COSTING VS ABC

Activity Based Costing

↓

Related to activities

↓

More realistic

↓

Activity-wise cost drivers

↓

Cost are assigned to cost objects

↓

Aids cost control

Traditional Absorption Costing

↓

Related to cost centers

↓

Not realistic

↓

Time (hours) - only cost driver

↓

Costs are assigned to cost units

↓

Not suitable for cost control.

LEVEL OF ACTIVITIES UNDER ABC METHODOLOGY/ COST HIERARCHY

Unit level activities	
Activities which can be identified with the number of units produced.	- Indirect materials/ consumables - Inspection or testing of every item produced

Batch level activities	
Activities which are performed each time a batch of goods is produced.	- Material ordering - Machine set-up costs

Product level activities	
Activities which are performed to support different products in product line.	- Designing the product - Producing parts specifications

Facilities level activities	
Activities which are common and joint to all products manufactured.	- Maintenance of buildings - Plant security

STAGES IN ACTIVITY BASED COSTING (ABC)

Identify different activities within the organisation
- Break the organisation down into many very small activities.

Relate the overheads to the activities
- This creates 'cost pools' or 'cost buckets'.

Support activities are then spread across the primary activities
- Where base is the cost driver measuring, how the support activities are used.

Determine the activity cost drivers
- To relate the overheads collected in cost pools to the cost objects.

Calculate activity cost driver rates
- Calculate activity cost driver rates for each activity

$$\text{Activity cost driver rate} = \frac{\text{Total cost of activity}}{\text{Activity driver}}$$

EXAMPLES OF COST DRIVERS

	ACTIVITY COST POOL	COST DRIVERS
Overhead Costs	Ordering and Receiving Materials cos	Number of purchase orders
	Setting up machines costs	Number of set-ups
	Machining costs	Machine hours
	Assembling costs	Number of parts
	Inspecting and testing costs	Number of tests
	Painting costs	Number of parts
	Delivery cost	Direct labour hours
	Shelf-stocking cost	Number of deliveries
	Customer Support	Shelf-stocking hours
	Customer Support	Number of items sold

HOW TO CALCULATE COST PER PRODUCT USING ABC?

If it is given that,

Activity	Cost (₹)
Ordering	64,000
Delivery	1,40,000
Shelf stocking	80,000

Particulars	Product 1	Product 2
No. of Purchase Orders	30	50
No. of Deliveries	110	90
Shelf Stocking Hours	220	180

Then, cost per product as per ABC

Activity	Total Cost (₹)	Cost Driver	Cost Driver Level	Cost Driver Rate (₹)	Product 1 (₹)	Product 2 (₹)
(a)	(b)	(c)	(d)	(e) = (b)/(d)	(f)	(g)
Ordering	64,000	No. of Purchase Orders	80 (30+50)	800	24,000 (800 x 30)	40,000 (800 x 50)
Delivery	1,40,000	No. of Deliveries	200 (110 + 90)	700	77,000 (700 x 110)	63,000 (700 x 90)
Shelf stocking	80,000	Shelf Stocking Hours	400 (220 +180)	200	44,000 (200 x 220)	36,000 (200 x 180)

PRACTICAL APPLICATIONS OF ACTIVITY BASED COSTING

As a Decision-Making Tool

Improve performance and protability → Discission w.r.t. introduction of new product or vendor → Decisions related to facility and resource expansion → Decision support for human resources → Helps in determining price based on cost plus markup basis

As a Decision-Making Tool

Activity Based Cost Management (ABM): Using ABC to manage costs at activity level.

- Cost Driver Analysis
- Activity Analysis
  - Value-Added Activities (VA)
  - Non-Value Added Activities (NVA)
- Performance Analysis
  - Cost Reduction
  - Business Process Re-engineering
  - Benchmarking
  - Performance Measurement

Facilitate Activity Based Budgeting (ABB)

It analyses the resource input or cost for each activity. It is the reversing of the ABC process to produce financial plans and budgets.

Key Elements

- Types of work to be done
- Quantity of work to be done
- Cost of work to be done

Benefits

- Enhance accuracy of financial forecasts
- Increasing management understanding
- Rapidly and accurately produce financial plans
- Eliminates much of the needless

3. MARGINAL COSTING

Contribution

Formula 1:- Contribution per unit = Selling price per unit - Variable Cost per unit

Formula 2:- Total Contribution = Total Sales - Total Variable Costs

Formula 3:- Contribution = Fixed Cost + Profit (Derivation covered in class)

Formula 4:- Contribution = Fixed Cost - Loss (Derivation covered in class)

Contribution To Sales Ratio

$$\text{P/V ratio} = \frac{\text{sales - variable cost}}{\text{sales}} \times 100 = \frac{\text{fixed cost + profit}}{\text{sales}} \times 100$$

$$= \frac{\text{fixed cost - loss}}{\text{sales}} \times 100$$

Fixed Cost is ignored in Decision Making

Break Even Point

BEP Sales means "No Loss Sales" OR "Survival Sales"

$$\text{BEP (In units)} = \frac{\text{Fixed Cost}}{\text{contribution per unit}}$$

$$\text{BEP Sales in rupees} = \frac{\text{Fixed Cost}}{\text{p/v ratio}}$$

P/V Ratio When Break-Even Sales

$$\text{P/v ratio} = \frac{\text{fixed cost + profit}}{\text{sales}} \times 100$$

At BEP, Profit = Zero & Sales means BEP Sales P/V Ratio =

$$\frac{\text{fixed cost}}{\text{break even sales}} \times 100$$

Calculating P/V Ratio when profit and sales volume of 2 periods are given

$$\text{P/V Ratio} = \frac{\text{difference in profit}}{\text{difference in sales}}$$

Margin of safety sales

Sales generating profit

- MOS sales means excess of actual sales over break-even point sales

$$\text{MOS Sales units} = \frac{\text{profit}}{\text{contribution per unit}}$$

$$\text{MOS Sales in Rs.} = \frac{\text{profit}}{\text{pv ratio}}$$

Variable cost to sales

$$\text{variable cost to sales ratio} = \frac{\text{variable cost}}{\text{sales}} \times 100$$

If variable cost to sales ratio is 60% then it means that if sales is made for Rs. 100 the variable cost of Rs. 60 is incurred

Break Even Sales Ratio and MOS Sales

Break Even Sales ratio + MOS Sales Ratio = 100%

Relation between PV Ratio & Variable Cost to Sales Ratio

Relation between PV Ratio & Variable Cost to Sales Ratio

P/V Ratio + variable cost to sales ratio = 100%

Required sales level to earn desired profit

$$\text{Desired level of Sales (In units)} = \frac{\text{fixed cost + profit}}{\text{contribution per unit}}$$ (Sum of BEP Sales and MOS Sales Formula)

$$\text{Desired level of Sales (In Rs.)} = \frac{\text{fixed cost + profit}}{\text{p/v ratio}}$$

(Sum of BEP Sales and MOS Sales Formula)

Angle of Incidence

This angle is formed by the intersection of sales line and total cost line at the break-even point. is angle shows the rate at which profit is earned once the break-even point is reached. e wider the angle the greater is the rate of earning profits. A large angle of incidence with a high margin of safety indicates extremely favourable position

Merger of 2 departments or companies

If management of 2 or more companies decides to merge companies which are operating at same or different capacity level then Merged company desires to know following things:-

1. P/V Ratio /2. BEP in rupees/ 3. Capacity utilization at BEP /4S. Desired Sales / 5. Desired Profit / 6. Desired capacity utilization of merged plant

Step1 :- Make marginal cost equation of all companies at 100% capacity level

Step2 :- Add all figures to calculate Sales, Variable Costs, Fixed Costs and Contribution of merged company.

Note :- Fixed cost shall include additional fixed cost involved in merger, if any

$$\text{P/V Ratio of merged co} = \frac{\text{Total contribution of all co.at 100\% capacity}}{\text{Total sales of all co.at 100\% capacity}} \times 100$$

$$\text{BEP rupees of merged co} = \frac{\text{Total Fixed cost of all co.+Additiona FC of merger,if any}}{\text{PV Ratio of merged co.}} \times 100$$

$$\text{Capacity utilization at BEP of merged co} = \frac{\text{BEP of merged co}}{\text{Total sales of merged co.at 100\% capacity}} \times 100$$

$$\text{Desired sales to earn given profit} = \frac{\text{Fixed cost of merged co.+desired profit}}{\text{PV Ratio of merged co.}} \times 100$$

$$\text{Capacity utilization at desired sales} = \frac{\text{desired sales}}{\text{Total sales of merged co.at 100\% capacity}} \times 100$$

Cash BEP

Minimum level of sales at which company is able to recover out fixed cost incurred in cash.

$$\text{Cash BEP in units} = \frac{\text{Cash Fixed cost}}{\text{contribution per unt}}$$

$$\text{Cash BEP in rupees} = \frac{\text{cash Fixed cost}}{\text{PV ratio}}$$

Cash fixed cost = Total FC – Non-FC

Non-cash FC are those which do not involve cash outflow e.g. depreciation

Shut down Point

Decision as to whether Produce or discontinue loss making product

FC is divided in 2 category :-

Unavoidable FC :- FC which has to be incurred whether or not item is produced.

Avoidable FC :- FC which can be avoided by stopping production.

$$\text{SDP Sales (units)} = \frac{\text{Avoidable Fixed Cost}}{\text{contribution per unit}}$$

$$\text{SDP Sales (Rs.)} = \frac{\text{Aviodable FC}}{\text{PV Ratio}}$$

Avoidable FC = Total FC – Unavoidable FC11

Income statement under Marginal costing approach

Particulars	Amount (Rs.)
Variable (Direct Material Cost)	XX
Variable (Direct Labour Cost)	XX
Variable (Direct Expenses)	XX
Variable Factory OH	XX
Variable manufacturing cost of Quantity Produced	XX
Add:- Opening FG	(XX)
Less:- Closing FG	XX
Variable manufacturing cost of Quantity Sold	XX
Add:- Variable Office & Admin OH	XX
Add:- Variable Selling & Distribution OH	XX
Variable Cost of Sales (A)	XX
Sales (B)	(XX)
Contribution (B - A)	(XX)
Less:- Fixed Factory OH	(XX)
Fixed Office and Admin OH	
Fixed Selling & Distribution OH	
Profit	XX

Income statement under Absorption costing approach

Particulars	Amount (Rs.)
Variable (Direct Material Cost)	XX
Variable (Direct Labour Cost)	XX
Variable (Direct Expenses)	XX
Variable Factory OH	XX
Fixed Factory OH absorbed units produced x standard rate per unit	XX
Total manufacturing cost of Quantity Produced	XX
Add:- Opening FG	XX
Less:- Closing FG	(XX)
Total manufacturing cost of Quantity Sold	XX
Add:- Variable Office & Admin OH	XX
Fixed Office and Admin OH	XX
Variable Selling & Distribution OH	XX
Fixed Selling & Distribution OH	XX
Add:- Under absorbed OH (Actual OH incurred - OH absorbed)	XX
Less:- Over absorbed OH (OH absorbed - Actual OH incurred)	(XX)
Total Cost of Sales (A)	XX
Sales (B)	XX
Profit (B - A)	XX

Reason for difference in profit

Particulars	Amount (Rs.)
Profit under marginal costing	XXX
Add:- Opening stock Excess in marginal costing	XXX
Closing stock Excess in absorption costing	XXX
Less:- Opening stock Excess in absorption Costing	(XXX)
Closing stock Excess in Marginal costing	(XXX)
Profit under absorption costing	XXX

Cost-Volume-Profit (CVP) Analysis

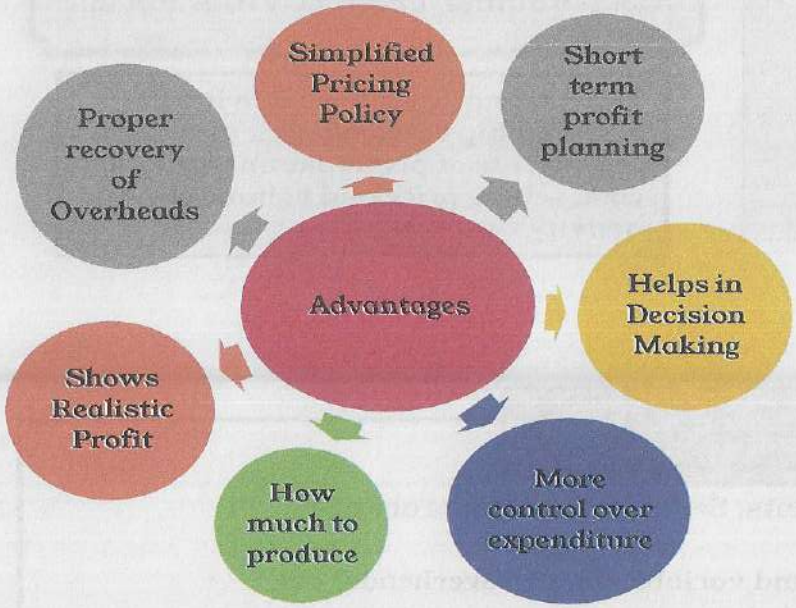
It is a managerial tool showing the relationship between various ingredients of profit planning viz., cost, selling price and volume of activity

Characteristics of Marginal Costing

Characteristics of Marginal Costing

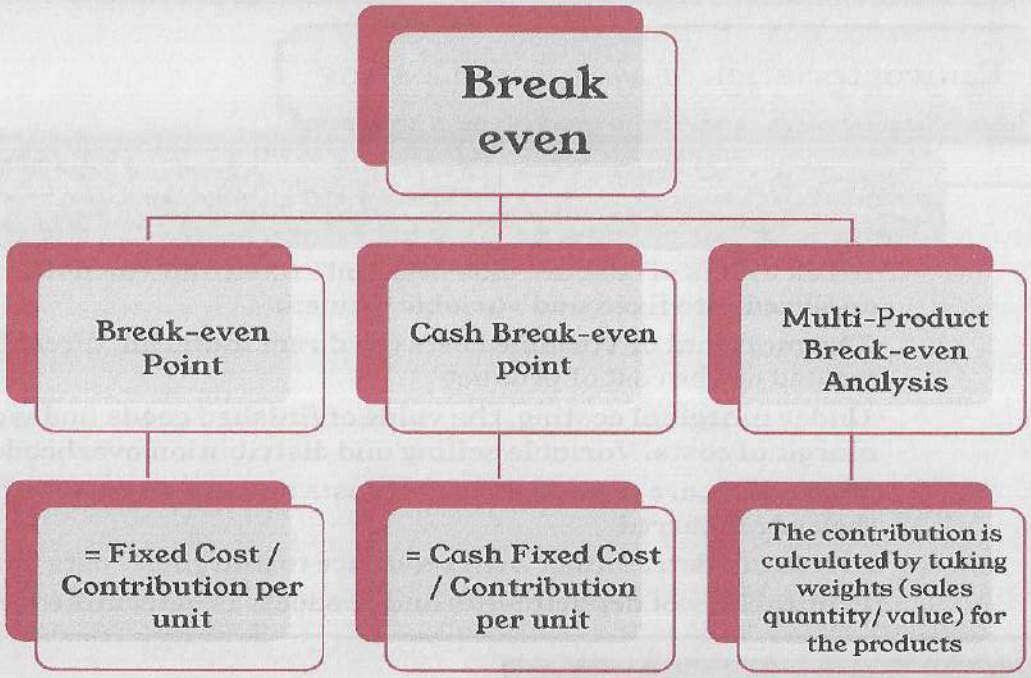
- All elements of cost are classified into fixed and variable components. Semi-variable costs are also analyzed into fixed and variable element
- The marginal or variable costs (as direct material, direct labour and variable factory overheads) are treated as the cost of product
- Under marginal costing, the value of finished goods and work-in-progress is also comprised only of marginal costs. Variable selling and distribution overheads are excluded for valuing these inventories.
- Fixed costs are treated as period costs and are charged to profit and loss account for the period for which they are incurred
- Prices are determined with reference to marginal costs and contribution margin
- Profitability of departments and products is determined with reference to their contribution margin

Advantages of Marginal Costing



Break-Even Analysis

Break-even analysis is a generally used method to study the CVP analysis. is technique can be explained in two ways.
(i) In narrow sense it is concerned with computing the break-even point.
(ii) In broad sense this technique is used to determine the possible profit/loss at any given level of production or sales.



4. APPLICATIONS OF MARGINAL COSTING IN SHORT TERM DECISION MAKING

PRICING DECISION

MEANING: The price to be charged for a product or service.
The price is determined by the market forces, viz. demand, Supply, etc. At the same time, our experience states that these two market forces are influenced even by the price. Further it is well known that the majority of the companies aim at earning reasonable to maximum rate of profit. If at all a company wants to earn profit, its price should be higher than its costs. This implies that the companies should base their prices on costs.

a) Pricing additional or special sales

In the case of the companies operating below their capacity, idle capacity exists. That means, the normal demand from their regular customer is for lower volume than what the companies are capable of producing and selling.

b) Pricing under normal and favourable conditions:

When the conditions prevailed both internally and externally are favourable to the companies, they usually plan to earn some planned profit.

c) Pricing under abnormal conditions:

As already stated, a large number of factors influence the pricing aspect and a number of changes take place in these influencing factor on a continual basis.
Consequently, the conditions which were favourable to the companies start changing.
The companies should have a vigilant eye on the market conditions.

A special order is a one-off revenue earning opportunity
These may arise in the following situations:

a. When a business has a regular source of income but also has some spare capacity allowing it to take on extra work if demanded.

b. When a business has no regular source of income and relies exclusively on its ability to respond to demand.

MAKE OR BUY DECISIONS

This kind of decision typically arises when the product being manufactured has a component part that can either be made within the factory or brought from an outside supplier.

Two factors which must be compared:

a. The supplier's price;

b. The marginal cost of making, plus the loss of contribution from displaced work.

This loss of contribution is usually best found by use of the **CONTRIBUTION PER UNIT OF KEY FACTOR.**

To decide which products should be made and which should be bought, we calculate the saving per unit of scarce resource from making the product rather than buying it in.

ACCEPT AN ORDER OR REJECT

When a business is operating at something lower than its normal value, such a special order can prove attractive depending on the effect of incremental revenues and costs on overall profits of the business. In this case differential cost system provides a useful means for appraising the economic benefits of such an opportunity.

LIMITING FACTOR ANALYSIS - Optimum utilization of Factor of Production

1. Management would make a product mix decision or service mix decision based on the option that would maximize profit and that profit is maximized when contribution is maximized.

2. A key factor is defined as the factor in the activities of an undertaking which, at a particular point of time or over a period, will limit the volume of output. Also known as limiting factor, Principal Budget Factor & scarce factor.

3. In limiting factor decisions, we generally assume that fixed costs are the same, whatever product or service mix is selected, so that the only relevant costs are variable costs.

4. When there is just one limiting factor, the technique for establishing the contribution-maximizing product mix or service mix is to rank the products or services in order of contribution-earning ability per unit of limiting factor.

Profitability = Contribution ÷ Key Factor

SUBCONTRACTING & ANCILLARISATION

Subcontracting refer to off- loading, some of the jobs to outside vendor thus hiring the capacity to meet the requirements of the organisation.

1. A careful analysis as to whether to make or to buy should be done.
2. An economic comparison between cost to make the component or buy the component is to be made to take the decision.

In subcontracting, a decision is taken by the management after consideration of relevant costs of subcontracting. The management should look, how the excess demand can be met by subcontracting some products to the subcontractor, by the application of relevant revenues and costs and after judging the cost and benefit analysis.

SHUTDOWN OR CONTINUE

Shutdown point is a point at which a businessman thinks that there is no benefit in continuing the business operations and decides to shut down the business either temporarily or permanently is called the shutdown point.

Shut down costs are those costs which have to be incurred under all situations in the case of stopping manufacture of a product or closing down a department or division. Shut down costs are always fixed costs.

Shut Down Point =Avoidable Fixed Cost÷ Contribution per Unit

Shut Down point (in ₹) = Avoidable Fixed Cost ÷ P/V Ratio

Decision Making in the context of Shut Down Point:

(i) Level of sales below shut down point, to close down operations, because avoidable fixed costs itself are not fully recovered.

(ii) Equal to shut down point, to continue operation, since avoidable fixed costs are just recovered.

(iii) Above shut down point, to continue operation, since avoidable fixed costs are recovered and further contribution leads to recovery of balance fixed cost.

FURTHER APPLICATIONS OF MARGINAL COSTING

1. CAPACITY DECISIONS

While considering a new plant design or the redesign or expansion of an existing system, a high level decision regarding the production capacity is called for. In order to determine future capacity of the plant adequate consideration should be given to certain factor such as sales forecasts of physical volume, policy decisions on what will be purchased instead of made, engineering estimates of machine productivity and production plans on how equipment will be used.

2. ALTERNATIVE METHODS OF PRODUCTION

The companies use both the manual labour force and the mechanical labour force for this purpose. Both are, to some extent, good substitutes. The alternative which involves the minimum cost is to be selected as the most economical alternative. Alternatively, the amount of contribution from each alternative is to be considered and the alternative which ensures higher amount of contribution is to be preferred.

3. DECISION TO DROP A PRODUCT LINE

Since the objective of any business organisation is to maximize its profits, the firm can consider the economies of dropping the unprofitable products, and adding a more remunerative product(s).

the contribution approach is adopted, taking the following factors into account: a. Contribution from unprofitable product (i.e. Sale Revenue Less Variable Costs) b. Specific fixed costs of the unprofitable product, which can now be avoided or reduced. c. Contribution from the other profitable product, which is proposed to produce with the balance capacity.

4. DECISION REGARDING EQUIPMENT REPLACEMENT

One of the more important decisions involving alternative choices is whether or not to buy new capital equipment. Generally, the economic advantage offered by such an investment is the realization of operating cost savings which are translated into increased net profits.

5. PRODUCT DIVERSIFICATION

Limited product life, availability of idle capacity, possibility of utilizing the wastes, by-products, to produce a new product, etc. encourage or forces the companies to introduce a new product either in addition to the existing products or in place of an existing product.

It is therefore necessary to find out whether it is economical and profitable to introduce a new product or not.

6. SELL OR FURTHER PROCESS DECISION

Often management has to decide whether to sell joint products at the split off point or to sell them after further processing. If further processing adds to the profit of the firm, the decision will be in favour of further processing. Incremental revenue (that is, the difference between sale value after further processing and sale value at the split off point) is compared with differential cost (that is, the additional cost of further processing) to determine whether further processing will result in additional profit.

7. EVALUATION OF CAPITAL EXPENDITURE PROPOSALS

Present value of cash-inflows for different years including the salvage value al the last year under consideration are to be discounted by a discounting factor to arrive at the total present value and from which the original cost of the investment is deducted to arrive at the net present value. A proposal having higher positive net present value is accepted. In this connection, it is important to note that there must be release of working capital in the terminal year, the present value of which is also included in the so called total present value.

8. OPTIMAL LEVEL OF ACTIVITY

It is very well-known that every business organisation usually wishes to earn maximum possible amount of profit. A number of avenues are available to the companies to achieve this objective. Setting the plant at the optimum level is one of the important avenues. This deals with the economies of large-scale production and sales, and also the resultant effect on the selling price, because, whenever there is an increase in the volume of output, some economies accrue in the production costs

9. DECISION REGARDING TEMPORARY SHUT DOWNS: It is found in practice that a business continues its operations even when the demand for its products is low and it is operated far below its normal capacity. Such a situation is forced on the business because it is expensive in many cases to shut down the business for a short time only

10. DECISION REGARDING ADDITIONAL SHIFTS :A very common decision to be taken by management is in connection with the operation of one or more shifts by a business having only one shift. It is evident that, when an additional shift is added, the costs are bound to be higher, though the cost increases may or may not be in proportion to increases in output

11. PRODUCT MIX DECISION: When a company manufactures more than one item, the optimum combination to produce must be determined. The following procedures are followed when making this decision: (i) Produce the maximum of the item with the highest contribution margin per unit under a particular constraint (e.g., machine hour). (ii) If there are any remaining machine hour, produce the maximum that can be sold of the item with the next highest contribution margin per unit, continuing until all machine hours are utilized

5. TRANSFER PRICING

1. CONCEPT OF TRANSFER PRICING.

Meaning

- Concerned with the price one profit centre charges another profit centre within the company for products or services provided.
- Plays a very important in international taxation
- Thus, the profits of both divisions, as well as the evaluation and compensation of their managers, are affected by the transfer price.

Advantages of Transfer Pricing

- Top managers have more time to devote to general planning.
- The decision-making task is distributed among more personnel.
- Better control can be achieved, as the manager can move quickly to make needed corrections.
- Managers are better motivated
- As managers become more proficient in decision making.

Disadvantages of TP

(1) The extent of authority and responsibility to be decentralized is difficult to determine.
(2) Managers needed to head the decentralized units must be selected and trained
(3) The varied activities of decentralized units must be coordinated, a difficult task.

Selection of Transfer Price

- Any transfer-pricing system should aim to:
- Ensure that resources are allocated in an optimal manner;
- Promote goal congruence;
- Motivate divisional managers;
- Facilitate the assessment of management performance;
- Retain divisional autonomy

Why do transfer-pricing systems exist?

- To communicate data
- To evaluate segment performance
- To minimize worldwide taxes, duties, and tariffs.

Objectives of Transfer Pricing

- The transfer prices, thus, can have impact on the evaluation of each division's performance and measures applied for such measurements of performance.
- (i) Transfer prices should help in the accurate measurement of divisional performance (profitability).
- (ii) Transfer prices should motivate the divisional managers into maximizing the profitability of their divisions and making decisions that are in the best interests of the organizations as a whole.
- (iii) Transfer prices should allow goal congruence to take place, which in effect means that the objectives of divisional managers are compatible with the objectives of overall company.

Problems with transfer pricing

- 1. Maintaining the right level of divisional autonomy
- 2. Ensuring divisional performances are measured fairly
- 3. Ensuring corporate profits are maximized

METHODS AND TECHNIQUES OF TRANSFER PRICING.

- Transfer Pricing Methods
  - Cost Based Transfer Pricing
    - Marginal Cost
    - Absorption Cost
    - Standard Cost
    - Two Part Tarif
  - Market Based Transfer Pricing
  - Negotiated Transfer Pricing

1. COST-BASED PRICES.

Commonly used versions of 'cost'

- Marginal cost
- Absorption cost
- Standard cost
- Marginal cost plus a fixed charge.

WHEN TO USE COST BASED TRANSFER PRICES.

- When market prices are unavailable
- When the transferring division is treated as a cost centre

Advantages of Cost Based Transfer Pricing:

- Costs are likely available since they will be computed for other purposes.
- For organisations, units that do not control investment or revenues, cost based transfer prices are consistent with the appropriate performance measure for those units.

Disadvantages of Cost Based Transfer Pricing

- Using actual costs transfers inefficiencies.
- Can lead to sub-optimal decisions.

2. MARKET-BASED PRICES

Where there is a perfectly competitive market for an intermediate product, the current market price is the most suitable basis for setting the transfer price.

Difficulties in Market Based Transfer Prices

A comparable product might not be available in the market.
Different suppliers will quote different initial prices.
Different buyers command different discounts and credit terms.
Current market prices may reflect temporary aberrations in trading conditions.
An internal transfer of goods may involve savings in advertising, packaging and delivery costs, and thus an external market price would not be entirely appropriate.

When to use Market Based Transfer Prices

- When a competitive external market for the product exists.
- When managers have the autonomy to purchase externally or internally.
- When transferring and receiving divisions are treated as a profit or investment centre.

Advantages of Market Based Transfer Pricing

- Managers are motivated to become more efficient
- The market sets the price; therefore, to increase profit, costs must be reduced.
- Easy to use when market prices are readily available

Disadvantages of Market Based Transfer Pricing

- A market price may not exist for the exact product.
- In some industries, market prices can fluctuate widely.

3. NEGOTIATED TRANSFER PRICES

Transfer prices could be set through a process of negotiation between the buying and selling divisions.
Under this method The resulting transfer price should be acceptable to both the buying and selling division since the relevant managers have been directly responsible for the negotiations

Disadvantages to the use of negotiated transfer prices

- The negotiations may be protracted and time-consuming.
- The managers may find it impossible to reach agreement.
- Central managers might act simply as arbitrators in any dispute during negotiations.
- The managers may not be negotiating from an equal basis.

When to use Negotiated Transfer Pricing:

- When an external market does not exist and market prices are not available.
- When divisions are forced to purchase internally.
- Where there is not an excessive number of transfers subject to negotiation.

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Advantages of NTP	Disadvantages of NTP
• Provides managers with the greatest control over divisional profits.	• Negotiations may be time consuming and require a great deal of data, which can be costly to accumulate. • Disputes can result in conflict and hostility between divisions • Focus is on divisional results, not the company as a whole.

CONFLICTS BETWEEN DIVISIONS AND COMPANY AS A WHOLE

Interference of top Management and "dictating a Transfer Price" on the divisions is usually the main basis of conflict between a Division and the Company as a whole.

To resolve transfer pricing conflicts, the following transfer pricing methods can be suggested –

(i) Dual-Rate Transfer Pricing System:	(ii) Two-Part Transfer Pricing System:
• Introduced to overcome the problems caused by using marginal cost. • The supplying division is credited with a price based on total cost plus a mark-up. The receiving division isdebited with marginal cost.	• selling division transfers at marginal cost but raises • a fixed annual fee on the buying division for the privilege of receiving transfers at that price.

5.3 DIVISIONAL PERFORMANCE AND PROBLEM OF GOAL CONGRUENCE

Objectives should be accomplished by Transfer pricing

It should motivate the divisional manager to make sound decisions

it should communicate information

that provides a reliable basis for such decisions It should result in a report of divisional profits that is a reasonable measure of the managerial performance of the division.

It should result in a report of divisional profits that is a reasonable measure of the managerial performance of the division.

It should ensure that divisional autonomy is not undermined.

5.4 DETERMINATION OF INTER-DEPARTMENTAL OR INTER-COMPANY TRANSFER PRICE

Rules for Transfer Pricing:

The limits within which transfer prices should fall are as follows:

The maximum

The lowest market price at which the receiving division could purchase the goods or services externally, less any internal cost savings in packaging and delivery.	The sum of the supplying division's marginal cost and opportunity cost of the item transferred.

The minimum

5.5 INTERNATIONAL TRANSFER PRICING

International Transfer pricing refers to the pricing strategy in play when there is transfer of goods/ services between associated enterprises, in International Transactions.

Factors influencing international transfer pricing decisions:

- tax rates
- income repatriation restriction
- dividend repatriation restrictions
- duties and tariffs
- exposure to foreign exchange rate fluctuations
- political climate
- the need to maintain cash flows in the foreign division
- competitive position of the foreign division
- trade treaties that restrict transfer pricing

TRANSFER PRICES MAY BE SET WITH THE FOLLOWING OBJECTIVES IN MIND

- Minimization of import duties:
- Management of direct taxation:
- Management of indirect taxation:
- Repatriation of profits in kind:
- To win host-country approval:
- To disguise profitability of a subsidiary
- To enable penetration pricing:

6. STANDARD COSTING AND VARIANCE ANALYSIS

What is a Standard or Standard Cost?

Standard cost is defined in the CIMA Official Terminology as "'the planned unit cost of the product, component or service produced in a period. The standard cost may be determined on a number of bases. The main use of standard costs is in performance measurement, control, stock valuation and in the establishment of selling prices."

Types of standards

Ideal Standards: The level of performance attainable when prices for material and labour are most favourable, when the highest output is achieved with the best equipment and layout and when the maximum efficiency in utilisation of resources results in maximum output with minimum cost.

Normal Standards: These are standards that may be achieved under normal operating conditions.

Basic or Bogey Standards: These standards are used only when they are likely to remain constant or unaltered over a long period.

Current Standards: These standards reflect the management's anticipation of what actual costs will be for the current period.

Variance			
AC Cost > Std. Cost -Adverse	AC . Cost < Std. Cost - favorable	AC . Sales > Std. Sales - favorable	AC . Sales < Std. sales -Adverse

- Material Variance
- Labour Variance
- Overhead variance
- Sales Variance
- Profit Variance

Budgeted output in budgeted input = "Budgeted I/P" / "Bud I/P for 1 unit of O/P"

Budgeted O/P in actual I/P = "Total actual I/P" / "Bud I/P for 1 unit of O/P"

Bud. I/P for Actual O/P = =Actual O/P × Budgeted I/P for 1 unit of output

- DM Cost Variance
  - DM Usage Variance
    - DM Usage Variance
      - DM Yield Variance
      - DM Mix Variance
    - DM Price Variance
  - DM Price Variance

Direct Material Variance

Particulars	SP x SQAO	SP x RSQ	SP x AQ	AP X AQ
Material A	XX	XX	XX	XX
Material B	XX	XX	XX	XX
Total	XX	XX	XX	XX
	M1	M2	M3	M4

DMPV = (SP-AP) × Actual Quantity Purchased

DM Cost Variance = M1 - M4

DM Usage Variance = M1-M3

DM Price Variance = M3 - M4

DM Yield Variance = M1 - M2

DM Mix Variance = M2-M3

DMYV = Formula = [Actual O/P - Std. O/P in actual I/P] × Std. Material Cost p.u of "output"

RSQ = We will divide total actual quantity in Std. material Mix Ratio.

SQAO = = Actual O/P × Budgeted I/P for one unit of O/P

Direct Labour Variances are calculated in 2 cases

- Case 1: When workers do not sit Idle
  - i.e without "abnormal" idle time
- Case 2: When workers have to sit idle
  - i.e. with "abnormal" idle time

CASE 1 - Direct Labour Cost Variance

- Direct Labour Efficiency Variance
  - Direct Labour Yeild Variance
  - Direct Labour Mix Variance
- Direct Labour Rate Variance
  - Direct Labour Mix Variance

CASE 2 - Direct Labour Cost Variance

- Direct Labour Efficiency Variance
  - Direct Labour Yeild Variance
  - Direct Labour Mix Variance
- Abnormal Idle time variance
- Direct Labour Rate Variance
  - Direct Labour Mix Variance

CASE 1 - Direct Labour Cost Variance				
Particulars	SR x SHAO	SR x RSH	SR x AH	AR X AH
Skilled	XXX	XXX	XXX	XXX
Semi -skilled	XXX	XXX	XXX	XXX
Unskilled	XXX	XXX	XXX	XXX
Total	XXX	XXX	XXX	XXX
	L1	L2	L3	L4

SHAO = Actual O/P × $\frac{\text{"Total Bud.lab hours"}}{\text{"Total Bud. O/P"}}$

DL Cost Variance = L1 - L 4

DL Efficiency Variance = L1- L 3

DL Rate Variance = L3 - L 4

DL Yield Variance = L1 - L2

DL Mix Variance = L2- L 3

	CASE 2 – Direct Labour Cost Variance				
Particulars	SR x SHAO	SR x RSH	SR x AHW	SR x AH	AR X AH
Skilled	XXX	XXX	XXX	XXX	XXX
Semi -skilled	XXX	XXX	XXX	XXX	XXX
Unskilled	XXX	XXX	XXX	XXX	XXX
Total	XXX	XXX	XXX	XXX	XXX
	L1	L2	L3	L4	L5

Lab. Efficiency Ratio = "Std.hours for actual O/P" / Actual Hours

Std. lab cost = Total std lab hours / Total units produced

Actual lab cost per unit = Total actual lab hours / Total units produced

DL Cost Variance = L1 - L5

DL Efficiency Variance = L1 - L3

DL Ab. Idle time Variance = L3 - L4 (Always Adv)

DL Rate Variance = L4 - L5

DL Yield Variance = L1 - L2

DL Mix Variance = L2 - L3

Particular	Budget	Actual
Working Day	25	26
Hours	30000 hrs	33000 hrs
Output	24000 units	32500 units
Overhead	₹ 45000	₹ 50000

Expected hours in Actual Days = Actual Days x Std. hrs in 1 day

Expected output in Actual Days (Possible Output) = $\frac{\text{Actual hours}}{\text{"Bud.I/Pfor 1 unit of O/P "}}$

Budgeted Days = 25days, Actual Days = 26

Budgeted hours=30000 , Actual hours = 33000

Budgeted O/P =24000 hrs , Actual O/P =32500 hrs

Budgeted OH=45000, Actual OH=50000

Budgeted OH p.u = $\frac{\text{Bud OH}}{\text{Bud O/P}} = \frac{45000}{24000}$ = 1.875 p.unit

Actual OH p.u = $\frac{\text{Actual OH}}{\text{Actual O/P}} = \frac{50000}{32500}$ = 1.538 p.unit

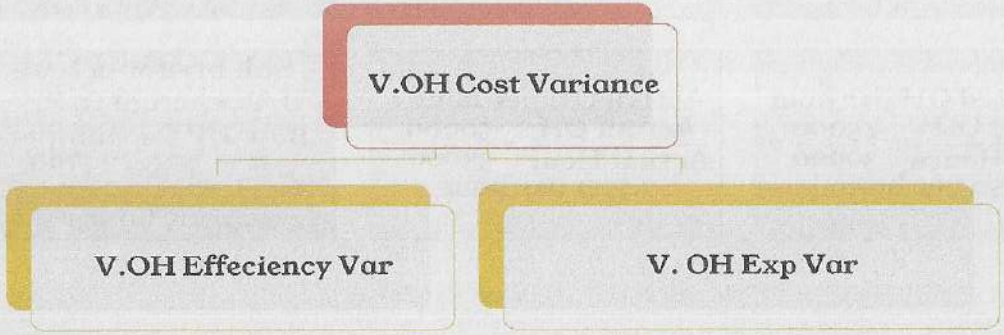
Budgeted OH per hour = $\frac{\text{Bud OH}}{\text{Bud Hours}} = \frac{45000}{30000}$ = 1.50 per hour

Actual OH per hour = $\frac{\text{Actual OH}}{\text{Actual Hour}} = \frac{50000}{33000}$ = 1.5151 per hour

Std. hrs for actual O/P = Actual O/P x Bud. I/P for 1unit of O/P = $32500 * \frac{30000}{24000}$ = 40625 hours

Expected O/P in Actual hrs = $\frac{\text{Actual hours}}{\text{"Bud.I/Pfor 1 unit of O/P "}}$

Particulars	Formula 1	Formula 2
1. Output absorbed OH	Actual O/P x Bud. OH p.u =32000 units x 1.875p.u = ₹60937.5	Std. hrs for actual x Bud. OH p.u = 40625 hr x Rs. 1.5 = ₹ 60937.5
2. Input absorbed OH	Actual hr x Bud. OH per hr = 33000hrs x Rs 1.5 = ₹ 49500	Expected O/P in Actual hrs x Bud OH p.unit = 26400 units x 1.875 = ₹ 49500
3. Possible OH	= Possible OP x Bud OH p. = 24960 x 1.875 = ₹ 46800	= Possible hrs x Bud OH p.hr = 31200 x 1.5 = ₹ 46800
4. Bud OH (Normally given in question)	= Bud o/p x Bud OH p.u. = 24000 units x 1.875 = ₹45000	= Bud hrs x bud OH per hr = 30000 hr x 1.5 = ₹45000
5. Actual OH (Normally given in question)	Actual O/P x Actual OH p.u. = 32500 units x 1.5846 = ₹ 50000	Actual Hrs x Actual OH per hr = 33000 hrs x 1.515151 = ₹ 50000



Particulars	O/P x Absorbed V.OH	I/P x Absorbed V.OH	Actual V.OH
F1 / F2	XX	XX	XX
Total	VO1	VO2	VO3

V.OH Cost Var = VO 1 - VO 3

V.OH Eff. Var = VO 1 - VO 2

V.OH Exp. Var = VO 2 - VO 3

CASE 1 - F.OH Cost Variance

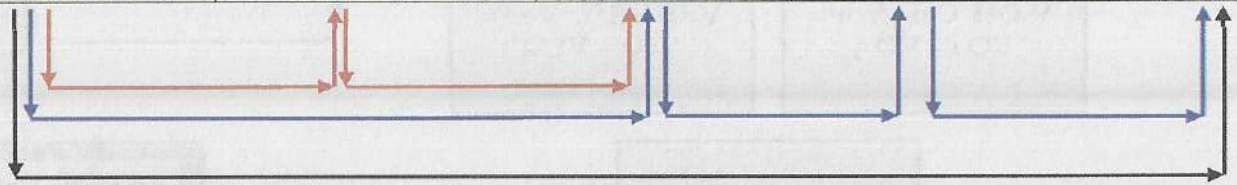
- F.OH Volume Variance
  - F.OH Eff. Var.
  - F.OH Capacity Var.
- F.OH Exp Var. OR Budget Var.

CASE 2- F.OH Cost Variance

- F.OH Volume Variance
  - F.OH Eff. Var.
  - F.OH Capacity Var.
  - F.OH Calendar Var.
- F.OH Exp Var. OR Budget Var.

CASE 1 Calculation of F. OH Variance when budgeted Days & Actual Days are given in Ques.

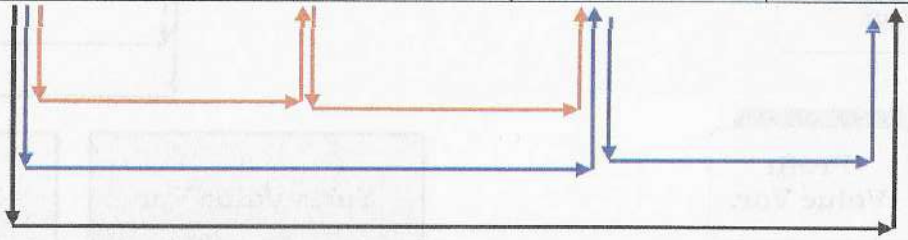
Particulars	O/p Absorbed F.OH	I/p Absorbed F.OH	Possible F.OH	Budgeted F.OH	Actual F.OH
F1	XX	XX	XX	XX	XX
F2	XX	XX	XX	XX	XX
Total	FO1	FO2	FO3	FO4	FO5



F.OH Cost Var. = FO 1 - FO5	F.OH Vol. Var. = FO 1 - FO 4	F.OH Exp. Var. = FO 4 - FO 5
F.OH Eff. Var. = FO 1 - FO 2	F.OH Cap. Var. = FO 2 - FO 3	F.OH calendar Var = FO3 - FO4

CASE 2 Calculation of F.OH Variance when budgeted Days & Actual Days are not given in Ques.

Particulars	O/p Absorbed F.OH	I/p Absorbed F.OH	Budgeted F.OH	Actual F.OH
F1	XX	XX	XX	XX
F2	XX	XX	XX	XX
Total	FO1	FO2	FO3	FO4



F.OH Cost Var
= FO1 - FO4

F.OH Vol. Var
= FO1 - FO3

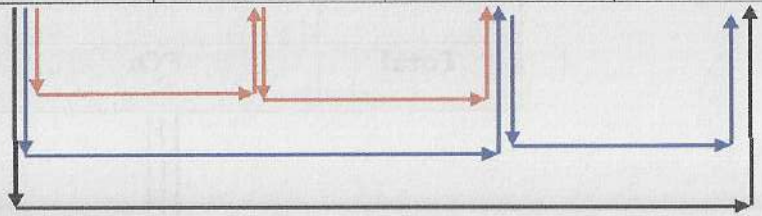
F.OH Exp. Var
= FO3 - FO4

F.OH Eff. Var
= FO1 - FO2

F.OH Cap.Var
= FO2 - FO3

- Sales Value Var.
  - Sales Vol. Var.
    - Sales Qnty. Var.
    - Sales Mix Var.
  - Sales Price Var.

Particular	B.S.P p.u x Bud. Qnty	B.S.P p.u x RSQ	B.S.P p.u x AQ sold	A.S.P p.u X AQ sold
Prod – A	XXX	XXX	XXX	XXX
Prod – B	XXX	XXX	XXX	XXX
Prod – C	XXX	XXX	XXX	XXX
Total	S1	S2	S3	S4



- Profit Value Var.
  - Profit Vol. Var.
    - Profit Qty. Var.
    - Profit Mix Var.
  - Profit Price Var.

Sales Value Var
= S4 – S1

Sales price Var
= S4 – S3

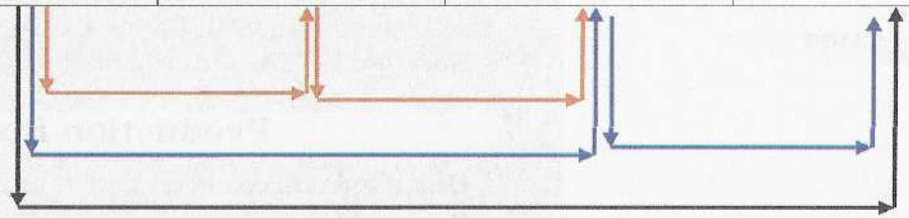
Sales Vol. Var.
= S3 – S1

Sales Mix Var.
= S3 – S2

Sales Qty Var
= S2 – S1

Particulars	B. Profit p.u × Bud. Qnty	B. Profit p.u × RSQ	B. Profit p.u × AQ sold	A. Profit p.u × AQ sold
Prod-A	XXX	XXX	XXX	XXX
Prod-B	XXX	XXX	XXX	XXX
Total	XXX	XXX	XXX	XXX
	P1	P2	P3	P4

Overheads Expenses Variance
Formula = Budgeted OH - Actual OH
Budgeted OH = Budgeted F.OH + Budgeted V.OH



Profit Value Var = P4 - P1	Profit price Var = P4 - P3	Profit Vol. Var. = S3 - S1	Profit Mix Var. = S3 - S2	Profit Qty Var = S2 - S1

Production Volume Var
Formula - Unutilised capacity × Bud. F.OH P.U
Unutilised Cap. = Actual Cap - budgeted Cap (units)

Reconciliation of Std cost & Actual Cost -	
Particular	Amt (₹)
Actual Cost	XX
Cost -Adv. var.	XX
Cost - Fav. Var.	XX
Std Cost	XX

7. FORECASTING, BUDGETING AND BUDGETARY CONTROL

CONTROL RATIO

Activity Ratio

- $\frac{\text{std hours for actual output obtained}}{\text{budgeted hours for budgeted production}} \times 100$

Capacity ratio

- $\frac{\text{actual hours worked}}{\text{budgeted hours for budgeted production}} \times 100$

Efficiency ratio

- $\frac{\text{std.hours for actual output obtained}}{\text{actual hours worked}} \times 100$

DIFFERENT BUDGETS

Sales Budget

- Sales target (In units & In Amount)
- Actual Sales compared with Budgeted
- Analyse SaleÃs Variances

Production Budget

- Units to be produced
- Budgeted production = budgeted Sales + closing stock of finished goods - opening stock of finished goods

Raw Material Budget

- Raw material to be purchased = budgeted production x raw material requirement per unit

Production Cost Budget

- Cost which should have been incurred for the budgeted production level.
- Budgeted production cost is compared with actual production cost.
- Analyse variance.

Flexible Budget

This budget is prepared at different level of production. We divide all types of expenses into 3 categories while making this budget

a. Variable expense = Feature (variable cost remain same at per unit at all levels)

b. Fixed expenses = Feature (Fixed cost in totality remain same at all levels)

c. Semi-variable expenses = Neither Variable Exp. Nor Fixed Exp.

Variable portion in semi-variable cost = $\frac{\text{Difference in total semi-variable cost}}{\text{Difference in units}}$

Fixed portion in semi variable cost = Total semi variable cost – Total variable portion in semi-variable cost

Fixed Budget

According to CIMA official terminology, "a fixed budget, is a budget designed to remain unchanged irrespective of the level of activity actually attained".

CASH BUDGET

- Estimated cash inflows and outflows during the budgeted period.
- Cash account is maintained for past cash inflows and cash outflows.
- Opening cash balances + estimated cash receipts – estimated cash payments = closing cash balance

ZERO BASE BUDGETING (ZBB)

-Make budget Future based (Not Past Based)
-It is defined as 'a method of budgeting which requires each cost element to be specifically justified, although the activities to which the budget relates are being undertaken for the first time, without approval, the budget allowance is zero'.

Stages in Zero-based budgeting

1. Identification and description of Decision packages
2. Evaluation of Decision packages
3. Ranking (Prioritisation) of the Decision packages
4. Allocation of resources

PERFORMANCE BUDGETING

A performance budget is one which presents the purposes and objectives for which funds are required, the costs of the programmes proposed for achieving those objectives, and quantitative data measuring the accomplishments and work performed under each programme.

Steps in Performance Budgeting

- Establishing a meaningful functional programme and activity classification of governemnt operations
- Bring the system of accounting and financial management in accord with this clarification
- Evolving suitable norms, yardsticks, work units of performance and units costs, wherever possible under each programme and activity for thier reporting & evaluation

8. Divisional Performance Measurement

CENTRALIZATION AND DECENTRALIZATION

DEFINITIONS

CENTRALIZATION

- Centralized organization is an organization in which top management makes most decisions and control most activities from the central headquarters.

DECENTRALIZATION

- Decentralization is defined as delegating authority to make decisions.

ADVANTAGES OF DECENTRALIZATION

(a)Size

- the process of decentralization breaks an organization up into more manageable units, this enables decision-making to proceed quickly and effectively and, in theory, a closer control to be maintained on the day to day running of a business's activities.

(b) Motivation

- if managers are made to feel responsible for a particular part of a business then it is generally found that their efforts within that part of the business are improved.

(c) Quality of decisions

- Divisional managers know local conditions and are able to make more informed judgements. Moreover, with the personal incentive to improve the divisions's performance, they ought to take decisions in the division's best interests.

(d) Releasing top management

- it can free top management from detailed involvement in day-to-day operations and allows them to devote more time to strategic planning.

(e) Training

- Divisions provide valuable training grounds for future members of top management by giving them experience of managerial skills in a less complex environment than that faced by top management.

DISADVANTAGES OF DECENTRALIZATION

(a) Lack of goal congruence

- the danger arises that divisional managers will make decisions which, whilst in the best interests of their divisions, are not in the best interest of the company as a whole. This leads to sub-optimal or dysfunctional decisions.

(b) Cost

- It is claimed that the costs of activities that are common to all divisions such as running the accounting department may be greater for a divisionalised structure that for a centralized structure.

(c) Loss of central control

- Top management may not aware what is going on in the division. An effective system of divisional reporting should overcome this problem. The reporting system should produce the key figures to monitor divisional performance and motivate the staff.

DUPONT ANALYSIS

Meaning

It is a multi-step framework of financial equations that provide insight into business's fundamental performance.
The DuPont methodology (also known as the DuPont identification or DuPont model)

According to this analysis, the formula for calculation of the 'Return on Equity; can be presented as under:
Return on Equity = Net Profit Margin × Asset Turnover Ratio × Financial Leverage; or
= (Net Income ÷Sales) × (Sales ÷Total Assets) × (Total Assets ÷Total Equity)

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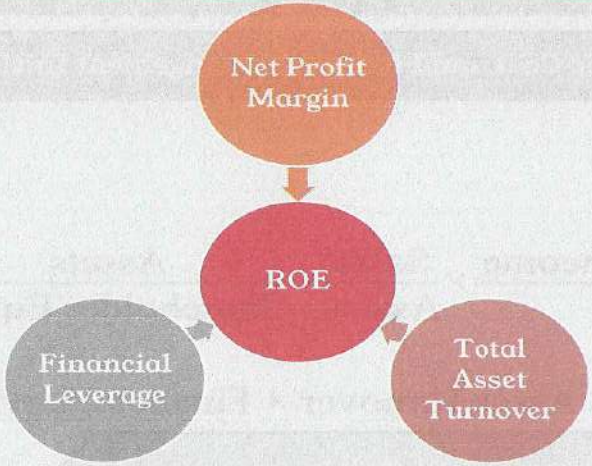
DuPont Chart



Significance of Du Pont Analyses

- Generates a high Net Profit Margin.
- Effectively uses its assets so as to generate more sale
- Has a high Financial Leverage

Disadvantage of DuPont Analysis

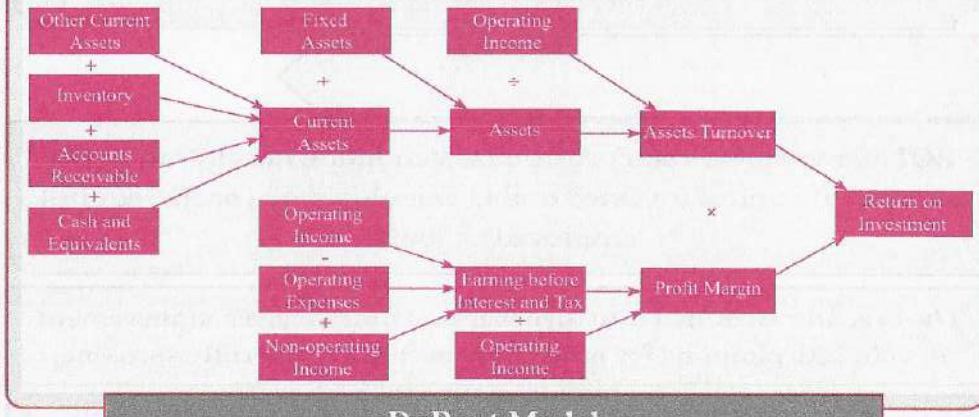
The main disadvantage of the DuPont analysis is that it still relies on accounting equations and data that can be manipulated despite being comprehensive.

Main financial parameters that drive ROE are

(1) Operating performance:

(2) Asset usage performance, and

(3) Financial leverage.



DuPont Model

Five Step DuPoint Model Analysis to Test Impact and Efficacy of Strategic Cost and Financial Management Initiatives

$$ROE = \frac{\text{Net Income}}{\text{Shareholder Equity}}$$

$$= \frac{\text{Net Income}}{\text{Pre-tax Income}} \times \frac{\text{Pre-tax Income}}{\text{Operating Income}} \times \frac{\text{Operating Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Shareholder Equity}}$$

$$= \text{Tax burden} \times \text{Interest burden} \times \text{Operating margin} \times \text{Asset Turnover} \times \text{Financial Leverage}$$

DIVISIONAL PERFORMANCE MEASUREMENT TOOLS - ROI, RESIDUAL INCOME

Return on investment (ROI)/(ROCE)

ROI shows how much profit has been made in relation to the amount of capital invested and is calculated as (profit/capital employed) x 100%.

The breakdown of ROI into turnover and margin gives management insight into planning for profit improvement. Generally speaking, management can:

1. Improve margin
2. Improve turnover
3. Improve both

Use of ROI:

(a) Financial reporting:

- It ties in directly with the accounting process, and is identifiable from the income statement and statement of financial position (balance sheet), the firm's most important communications media with investors.

(b) Aggregation:

- ROI is a very convenient method of measuring the performance for a division or company as an entire unit

Advantages of ROI

- As a relative measure, it enables comparisons to be made with divisions or companies of different size.
- It is used externally and is well understood by users of accounts.
- ROI forces managers to make good use of existing capital resources and focuses attention on them, particularly when funds for further investment are limited.

Disadvantages of ROI

(a) Disincentive to invest

- The most conventional depreciation methods will result in ROI improving with the age of an asset, this might encourage divisions hanging on to old assets and again deter them from investing in new ones.

(b) Subject to manipulation

- The calculation of Return on Investment can be easily modified based on the analysis objective. It depends on what we include in revenues and costs.

(c) Lack of goal congruence

- For example, it is possible that divisional ROI can be increased by actions that will make the company as a whole worse off and conversely, actions that decrease the divisional ROI may make the company as a whole better off.

(d) Not suitable for investment decisions

- It might be affected by the effect they would have on the division's ROI in the short term, and this is inappropriate for making investment decisions.

Residual Income (RI)

MEANING

- RI is a measure of the centre's profits after deducting a notional or imputed interest cost or cost of capital charge.
- (a) The centre's profit is after deducting depreciation on capital equipment.
- (b) The imputed cost of capital might be the organization's cost of borrowing or its weighted average cost of capital (WACC).
- The following two items those are important in regard to the calculation of RI:
- (1) The targeted amount of return is usually some percentage of, or rate of return on, the total employed assets of the division, or the invested capital in the division, and
- (2) The percentage used in the calculation is the required rate of return that management has set.

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RI is calculated as under:

Divisional profit − (Percent capital charge × Divisional investment) = RI

Advantages of RI

(1) It avoids suboptimal decisions as investments are not rejected merely because they lower the divisional manger's ROI.

(2) It maximizes growth of the company and increases shareholders' wealth.

(3) The cost of capital charge on divisional investments ensures that divisional managers are aware of the opportunity cost of funds.

(4) Charging each division with the company's cost of capital ensures that decisions taken by different divisions are compatible with the interests of the organization as a whole.

Disadvantages of RI

(a) Absolute measure - it means that it is difficult to compare the performance of a division with that of other divisions or companies of a different size. To overcome this deficiency, targeted or budgeted levels of RI should be set for each division that are consistent with asset size and the market conditions of the divisions

(b) Residual income is an accounting-based measure, and suffers from the same problem as ROI in defining capital employed and profit.

ECONOMIC VALUE ADDED - DEFINITION, EVA CENTRE, EVA DRIVERS

EVA is an **alternative absolute performance measure**. It is similar to RI and is calculated as follows:

EVA = Net operating profit after tax (NOPAT) less capital charge

Capital charge = WACC x net assets

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The cost of tax should be calculated after tax as follows:
Cost of debt after tax = Cost of tax before tax × (100 – marginal tax rate).

Enhancing EVA:

1. Increasing operating profits without adding further capital in the business.
2. Ensuring that ROI on additional funds invested is more than weighted average cost of capital.
3. Liquidating non-productive capital by releasing capital from those activities that do not cover even the cost of capital.

EVA Centre:

This comprises of the following:
(1) Divisionalization of an organization allows performance measurement through responsibility accounting
(2) Responsibility accounting segregates costs and revenues into areas of responsibility, and a specific manager is made responsible for each area
(3) This assigning of different aspects of the budget to different managers is known as responsibility accounting

Types of responsibility centres:

- Cost centre
- Profit centre
- Investment centre

Decisions with impact on EVA

2. Overview
3. Operative decisions
4. Investment decisions
5. Financing decisions

Behavioral Aspects of EVA

1. Decisions with impact on EVA
2. Overview
3. Operative decisions
4. Investment decisions
5. Financing decisions

INTRODUCTION TO LEARNING CURVE

The term "learning curve" refers to the idea that efficiency increases the more experience a person has with a given task. As a result, the time required for performing the task decreases as increases occur in the number of times the task has been performed.

Learning curve analysis is used in planning, budgeting, and forecasting and also to determine estimated labour costs when bidding on a contract.

The limits for learning curve percentages are as follow.	The learning curve will always be less than 100% if the learning curve is 100% then no learning and no decrease in time required is taking place.
	When the cumulative average-time learning model is being used LC % percentage must be greater than 50%.
	If the LC is less than 50% the total time required to produce the additional units when production doubles plus the time required to produce the initial units would be less than the time required for production of the initial units.
	Neither of the two scenarios above is possible The additional units must require some added amount of time, so the total time for the additional units plus the time for the initial units must be greater than the time required for the initial units.
	This lower limit applies to only the cumulative average-time learning model. Theoretically, at least, the time required for the last unit produced could require less than 50% of the time required for the last unit before production doubled.

Cumulative Average-Time Learning Model.

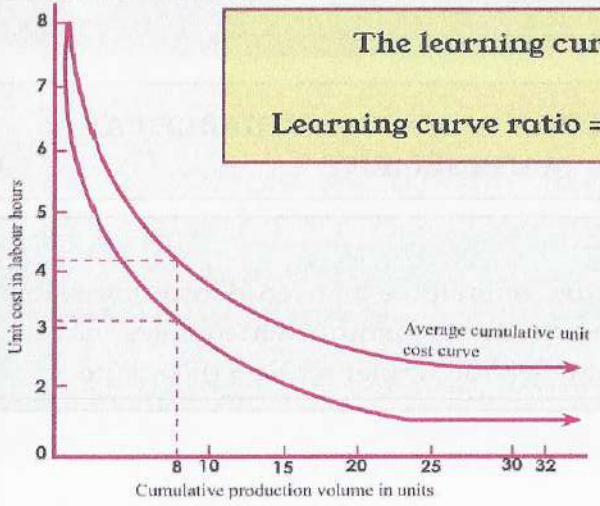
The cumulative average-time learning model assumes a constant rate of decline in the estimated average time per unit each time the quantity of units produced doubles.

This model can be used to calculate three things:

(1) The estimated average time per unit for the entire quantity produced, from the very first unit to the very last unit produced. This is the "cumulative average."

2) The estimated total time required for the entire quantity produced, from the very first unit to the very last unit produced.

3) The estimated total production time required for a certain block of units can be calculated by finding the total time required for all the units produced through the end of that block and subtracting from that the total time required for the units up to that block.



Learning curve graph

The learning curve ratio can be calculated with the help of the following formula:

Learning curve ratio = Average labour cost of first 2 units ÷Average labour cost of first units

Learning curve theory can be used:
To calculate the incremental cost of making extra units of a particular products,
To set standards for labour
To prepare realistic production budgets and to report labour cost variances, and
To quote contact price.

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APPLICATION OF LEARNING CURVE

Application of Learning Curve

- 1. Improvement of Productivity:
- 2. Cost Predictions:
- 3. Work scheduling:
- 4. Standards setting:

CONDITIONS FOR LEARNING CURVE THEORY

(1) There is a significant manual element in the task being considered.

(2) The task must be repetitive

(3) Production must be at an early stage so that there is room for improvement.

(4) There must be consistency in the workforce.

(5) Workforce is motivated.

Limitations and problems associated with learning curve analysis include:

Learning curve analysis is appropriate only for labour-intensive operations

The learning rate is assumed to be constant. In real life, the decline in labour time might not be constant

The reliability of a learning curve calculation can be jeopardized because an observed change in productivity might actually be associated with factors other than learning, such as a change in the labour mix, the product mix, or other factors.

BALANCED SCORE CARD FOR VARIABLE PAY MANAGEMENT

MEANING

The balanced scorecard translates an organization mission and strategy into a set of performance measures that provides the framework for implementing the strategy.

CHARACTERISTICS OF BALANCED SCORE CARD

1. Highlight a company's strategy by focusing on cause-and-effect relationship.

2. Help in communicating the strategy formulated to All members of an organization by translating the strategy into a coherent and linked set of understandable and measurable operational targets.

3. Gives strong emphasis on financial objectives and measures.

4. The scorecard highlights sub-optimal trade-offs that managers may make when they fail to consider operational and financial measures together.

PERSPECTIVES OF THE BALANCED SCORECARD:

1. Financial Perspective:

- Financial measures are lagging performance indicators for the purpose of feedback but not for future-oriented activities and actions.

2. Customers Perspective:

- Customer measures are leading indicators of, and thus affect, financial performance.

3. Internal business process Perspective:

- Internal business process measures are leading indicators of customer-related measures and future financial performance.

4. Learning & Growth Perspectives:

- Learning and growth measures affect internal processes which impact customer service which then determines long term financial results.

DIFFICULTIES WITH BALANCED SCORECARD FOR MEASURING PERFORMANCE

The efficacy of the balanced scorecard in achieving the organization's strategic goals must be monitored closely.

The non-financial indicators may need to be re-evaluated and changed

In order to implement balanced scorecard performance measurement, a firm must have extensive enterprise resource planning

If the balanced scorecard is used as a "command and control" document that is used to control behaviour, employees may "make the numbers" but not be committed to achieving the organization's goals.

Non-financial data is not subject to control or audit and thus its reliability could be questionable.

It is difficult to use scorecards for comparisons across business units because each business unit has its individualized scorecard

Balanced Score Card for Variable Pay Management

Perspectives	Question	Explanation
Financial	How do we create value for our shareholders?	Covers traditional measures such as growth, profitability and shareholder value but set through talking to the shareholder or shareholders direct
Customer	What do existing and new customers value from us?	Gives rise to targets that matter to customers: cost, quality, delivery, inspection, handling and so on
Internal	What processes must we excel at to achieve our financial and customer objectives?	Aims to improve internal processes and decision making
Innovation and learning	Can we continue to improve and create future value?	Considers the business's capacity to maintain its competitive position through the acquisition of new skills and the development of new products

9. RESPONSIBILITY ACCOUNTING

The term 'responsibility accounting' refers to the accounting process that reports how well managers (of responsibility centres) have fulfilled their responsibility. It is a system that measures the plans (by budgets) and actions (by actual results) of each responsibility centre.

Also known as activity or profitability accounting,"a system designed to accumulate and report costs by individual levels of responsibility, each supervisory area is charged only with the cost for which it is responsible and over which it has control"

HELPS TO CONDUCT FIVE BASIC CONTROL FUNCTIONS

1. Preparing a plan (e.g., using budgets and standards) and use it to communicate output expectations and delegate authority.
2. Gathering actual data classified in accordance with the activities and categories specified in the plan.
3. Monitoring the differences between planned and actual data at scheduled intervals
4. Exerting managerial influence in response to significant differences.
5. Continuing comparing data and responding; then, at the appropriate time, the process will begin again.

ASSUMPTIONS OF RESPONSIBILITY ACCOUNTING

1. The areas of responsibility are defined for which managers should be held responsible.
2. Managers are only charged with the items and responsibility over which they can exercise a significant degree of direct control.
3. Managers should actively participate in establishing the goals or budgets against which their performance is measured.
4. Goals defined for each area of responsibility should be attainable with efficient and effective performance.
5. Control (performance) reports should contain significant information related to each area of responsibility.
6. Responsibility centre managers should try to accomplish the budgets and objectives established for their respective areas of responsibility.

ADVANTAGES OF RESPONSIBILITY ACCOUNTING

1. It facilitates delegation of decision making.
2. It helps management promote the concept of management by objective. In management by objective,managers agree on a set of goals. The manager's performance is then evaluated based on his or her attainment of these goals.
3. It provides a guide to the evaluation of performance and helps to establish standards of performance which are then used for comparison purposes.
4. It permits effective use of the concept of management by exception, which means that the manager' attention is concentrated on the important deviations from standards and budgets.

RESPONSIBILITY CENTRE

A responsibility centre may be defined as an area of responsibility which is controlled by an individual. A responsibility centre is an activity such as department over which a manager exercises responsibility. Responsibility areas may be departments (drilling or maintenance department), product lines (chemicals or fertilizers), territories (North or South) or any other type of identifiable unit or combination of units.

COST OR EXPENSE CENTER

The most elementary form of responsibility center is the cost center, which itemizes all of the expenses incurred to run a specified function, but ignores the cost of capital invested in it, as well as any associated revenues.

PROFIT OR EARNINGS CENTER

A profit center is an organizational unit whose manager is responsible for generating revenues and managing expenses related to current activity. Thus, profit centers should be independent organizational units whose managers have the ability to obtain resources at the most economical prices

Sell products at prices that will maximize revenue.

REVENUE CENTER

A revenue center is strictly defined as an organizational unit that is responsible for the generation of revenues and has no control over setting selling prices or budgeting costs.

A revenue center is one where the employees located in a specific functional area are solely responsible for attaining preset revenue levels.

INVESTMENT CENTER

An investment center is an organizational unit whose manager is responsible for managing revenues and current expenses. This center differs from a profit center in that it has control not only over revenues and costs but also over invested funds.

RESPONSIBILITY REPORTING

Responsibility performance reporting implies the reporting phase of responsibility accounting.

Responsibility reporting has two PURPOSES:

(i) To determine the degree of performance in the area of responsibility for which the responsibility manager is directly responsible.

(ii) To formulate measures to improve the performance of the responsibility centre manager.

Usry & Hammer have mentioned the following as CHARACTERISTICS OF RESPONSIBILITY REPORTING:

1. **Reports should fit the organization chart, that is, the report should be addressed to the individual responsible for the items covered by it, who, in turn, will be able to control those costs under his jurisdiction. Managers must be educated to use the results of the reporting system.**
2. Report should be prompt and timely. Prompt issuance of a report requires that cost records be organized so that information is available when it is needed.
3. Reports should be issued with regularity. Promptness and regularity are closely tied up with the mechanical aids used to assemble and issue reports.
4. Reports should be easy to understand. Often they contain accounting terminology that managers with little or no accounting training find difficult to understand, and vital information may be incorrectly communicated. Therefore, accounting terms should be explained or modified to fit the user.
5. Reports should convey sufficient but not excessive details. The amount and nature of the details depend largely on the management level receiving the report. Reports to management should neither be flooded with immaterial facts nor so condensed that management lacks vital information essential to carrying out its responsibilities.

10. DECISION THEORY

DECISION MAKING PROCESS

Step 1: Identify the decision – it is important to identify the nature of decision that the decision maker is faced with. This paves way for making effective decisions.

Step 2: Gather relevant information - Before decision making, it is important to gather all relevant information. The source of information can be two types,

Internal source- information available within the organisation.

External source - information that are available beyond the scope of the organisation.

Step 3: Identify the alternatives – on the basis of the information collected the alternatives are zeroed upon. At this juncture it is important to make a list of all possible alternatives in order to make a correct and effective decision.

Step 4: Consider the evidence - In this step, the decision maker uses his knowledge and emotion to imagine what it would be like if one particular alternative is chosen and carried out. This would have to be thought about for all the possible alternatives

Step 5: Take action - In this step the decision maker is ready to make his call which is decided upon in the previous step.

Step 6: Review of the decision - After the above steps are undertaken and a decision is arrived at, the process of evaluation has to begin where the impact of the decision is considered. If the desired result is not achieved, the whole process has to be revisited

BASIS FOR COMPARISON	RISK- A term applied to a situation where there are several possible outcomes and there is relevant past experience to enable statistical evidence to be produced for predicting the possible outcomes. i.e. probability of winning or losing something worthy	UNCERTAINTY-A term applied to a situation where there are several possible outcomes and but there is little previous statistical evidence to enable probabilities to be attached to possible outcomes. i.e a situation where the future events are not known
Ascertainment	Measurable	Not Measurable
Outcome	Chances of outcomes are known.	The outcome is unknown
Control	Controllable	Uncontrollable
Minimization	Yes	No
Probabilities	Assigned	Not assigned

Decision making under conditions of certainty

- The condition of certainty imply that the future is known and thus the probability of happening/ not happening of an event is one.
- In simple words, the decision-maker is conformed to what will happen when a decision is being made. It is a condition where the future is cent percent definite.
- This situation is conformed because of the availability of all reliable information. Thus the cause and effect are known with certainty

Decision making under condition of uncertainty

- Under condition of uncertainty, the future states of nature are unknown. There is no information available on the happening /not happening of the future state of nature.
- In decision making under uncertainty, the probability distribution associated with the states is either unknown or cannot be determined.
- This lack of information has led to the development of special decision criteria which would be discussed in brief, in later section of this module.

Decision making under condition of risk

- Risk is a situation, where the decision maker is neither certain nor uncertain about the future states of nature. Thus there is imperfect information about the happening/ not happening of the future events.

DECISION MAKING UNDER CONDITION OF RISK

Under risk the decision maker assumes that there exist a number of possible future states of nature as is presented in the previous table. Each has a known (or assumed) probability of occurring, and there may not be one future state that results in the best outcome for all alternatives

PROBABILITIES: Probabilities are mathematical expression which is used to denote the likelihood that an event or state of nature will occur. It is expressed in decimal and varies between 0 and 1.

When the probability of occurrence of an event is 0, it denotes nil likelihood of occurrence whereas a value of 1 signifies absolute certainty – a definite occurrence.

OBJECTIVES PROBABILITIES: are established mathematically or compiled from historical data. Tossing a coin and throwing a dice are examples of objective probabilities.

SUBJECTIVE PROBABILITIES: the probabilities (chances of a particular state of nature of happening/not happening) are often estimated based on managerial judgement.

INDEPENDENT EVENTS: If the occurrence or non-occurrence of one event does not change the probability of the occurrence of the other event, the two events are said to be independent.

MUTUALLY EXCLUSIVE EVENTS: If events are mutually exclusive, it means that if one of them occurs, the other event cannot occur. Either one or the other can occur but not both.

DEPENDENT EVENTS: When there are two events, A and B, and the occurrence of B depends upon the occurrence of A, the probability that both events will occur is the probability that the first event will occur, multiplied by the conditional probability that the second event will occur given that the first event has already occurred

THREE METHODS OF ASSIGNING PROBABLE VALUES

CLASSICAL METHOD

This method assumes that each possible outcome has an equal probability of occurring.

Thus, if there are ten possible outcomes, each outcome is assumed to have a 10% probability of occurring.

RELATIVE FREQUENCY OR OBJECTIVE METHOD

When factual information is available that can be used to determine the probability of something occurring; the use of that information to assign probabilities is called the relative frequency method. The information may come from a sample, analytical data, or any other reliable source.

SUBJECTIVE METHOD

This method is used when neither the classical nor the relative frequency methods can be used because the possible outcomes are not equally likely and relative frequency da-ta is not available.

With the subjective method of assigning probabilities, we use whatever data is available and add to that data our own experience and intuition.

Expected Value/ Return

- expected return, is a weighted average of the possible returns, with the weights being the probabilities of occurrence.
- $EV = \sum P(X_i) x\ X_i$
- $P(X_i)$= Probability of occurrence of event i and X_i is the payoff related to the event i

Variance

- represented by $\sigma 2$ (sigma squared)
- The variance is the sum of the squares of all the differences or deviations from the mean (average), weighted according to their probabilities.
- The variance is actually a weighted average of the squared deviations

Standard deviation

- The standard deviation is the positive square root of the variance. It is represented by σ (sigma).

Coefficient of Variation

- Relative measure of dispersion.
- It measures the standard deviation relative to the mean in percentages
- Coefficient of Variation=Standard Deviation of Return / Expected Return

DECISION MODELS

DECISION MAKING WITH PROBABILITIES: EXPECTED VALUE MODEL

A common approach to decision making under uncertainty is the expected value criterion.

EV (alternative) = (probability of first state of nature) × (outcome of that state of nature) + (probability of second state of nature) × (outcome of the second state of nature) + . . . for all states of nature.

The alternative selected is the one with the highest EV for maximization problems and the lowest EV for minimization problems.

LIMITATIONS OF THE EXPECTED VALUE MODEL

1. Not all future events are foreseeable and, therefore, may be omitted from the model
2. The model assumes future events are independent of each other. There can be overlap between future events.
3. It is difficult to accurately assess the probability of future events.
4. The model ignores qualitative considerations in making a decision.
5. The model ignores the decision maker's attitude towards risk.

EXPECTED VALUE OF PERFECT INFORMATION (EVPI)

Perfect information is knowledge about the future that would enable us to make the best choice today for any possible situation in the future

Companies can sometimes obtain information that reduces or eliminates the uncertainty associated with the different future events/states of nature of a problem. The EVPI refers to the maximum amount a company would pay to obtain this information.

EVPI = EV of best alternative with perfect information - EV of best alternative without perfect information

DECISION MAKING UNDER UNCERTAINTY

A situation of uncertainty arises when there are more than one possible consequence of selecting any course of action. Decision making under uncertainty, as under risk, involves alternative actions whose payoffs depend on the states of nature

SOME SPECIAL DECISION CRITERIA

I. THE MINIMAX (MAXIMIN) CRITERION: The maximin (minimax) criterion is based on the conservative attitude of making the best of the worst-possible conditions).

The decision maker would zero upon such a decision which will give him optimum results under the given condition.

1. If $p(a_i , s_j)$ is loss or cost , then selection of an action is made on the basis of minimax criterion as the objective would be to minimise loss or cost (as the payoff denotes loss or cost)

2.If $p(a_i , s_j)$ is profit or revenue , then selection of an action is made on the basis of maximin criterion as the objective would be to maximise profit or revenue (as the payoff denotes profit or revenue).

II. THE LAPLACE CRITERION: This is based on the principle of insufficient reason. The simple argument is that because the probability distributions are not known, there is no reason to believe that the probabilities associated with the states of nature are different. The alternatives are thus evaluated on the basis of the assumption that all states of nature are equally likely to occur.

1. If payoff $p(a_i , s_j)$ represents gain, the best alternative is the one that yields the maximum expected value (using equal probability).

2. If payoff $p(a_i , s_j)$ represents loss the minimum value represents the best alternative.

III. THE SAVAGE CRITERION: Under this rule, the degree of conservatism in the minimax (maximin) is moderated by replacing the (gain or loss) payoff matrix p(ai , sj) with a loss (or regret) matrix, $r(a_i , s_j)$. This is also known as minimax regret criterion.

IV. THE HURWICZ CRITERION: The Hurwicz criterion, is designed to represent different decision-making attitudes, ranging from the most liberal (optimistic) to the most conservative (pessimistic). This is also referred as condition of equal likelihood. One parameter α is used as the index of optimism.

1. If $\alpha = 0$, then the criterion reduces to conservative minimax criterion, on the basis of the best of the worst conditions.

2. If $\alpha = 1$, then the criterion is generous because it is based on the underlying assumption of the best of the best conditions.

3. In the absence of strong feeling regarding extreme optimism and extreme pessimism, $\alpha = 0.5$ which indicates a fair choice, neither.

DECISION TREE

Decision trees are diagrams which illustrate the choices and possible outcomes of a decision. A decision tree is a pictorial method of showing a sequence of interrelated decisions and their expected outcomes. Decision trees can incorporate both the probabilities of, and values of, expected outcomes, and are used in decision-making.

Merits of Decision Trees

1. All the possible choices that can be made are shown as branches on the tree.
2. All the possible outcomes of each choice are shown as subsidiary branches on the tree.

CONSTRUCTING A DECISION TREE

There are two stages in preparing a decision tree.

1. Drawing the tree itself to show all the choices and outcomes
2. Putting in the numbers (the probabilities, outcome values and EVs)

Every decision tree starts from a decision point with the decision options that are currently being considered.

(a) It helps to identify the decision point, and any subsequent decision points in the tree, with a symbol. Here, we shall use a square shape.

(b) There should be a line, or branch, for each option or alternative.

The square is the decision point, and A, B, C and D represents four alternatives from which a choice must be made (such as buy a new machine with cash, hire a machine, continue to use existing machine, raise a loan to buy a machine).

If the outcome from any choice is certain, the branch of the decision tree for that alternative is complete.

If the outcome of a particular choice is uncertain, the various possible outcomes must be shown.