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COST & MANAGEMENT ACCOUNTING

The Institute of Chartered Accountants of Pakistan

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CHAPTER 1

INVENTORY VALUATION

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AT A GLANCE

Inventory is one of the major components of manufacturing and trading organizations and, in most cases, the biggest cost of any product. Therefore, proper procedures should be in place to put controls over inventory's cost and its usage cycle.

Inventory which is consumed during the production is treated as expense whereas the unused inventory at the end of reporting period is treated as an asset in the financial statements.

Net realizable value(NRV) is the estimated selling price in the ordinary course of business less the estimated cost of completion and estimated cost necessary to make the sale.

Inventory should be valued at lower of cost or NRV in the financial statements.

The inventories that are purchased in bulk quantities with different prices during a period are allocated cost on the basis of First In First Out (FIFO) or Weighted Average Cost (AVCO).

1. MATERIALS: PROCEDURES AND DOCUMENTATIONS

Materials are the basic components of manufacturing and production process in a goods manufacturing entity. Materials are also called raw materials which are used in the production of a finished products (such as Crude Oil is a raw material for Petrol, Milk is a raw material for Yogurt, Yarn is a raw material for Garment whereas Petrol, Yogurt and Garment are the finished products).

An entity that purchases materials to be used in its production or further sale, must ensure that proper procedures are in place to enable the controls over their costs, purchase quantity, quality as well as usage quantity.

In order to make the controls effective, their documentation is necessary so that verifiable records can be maintained.

The following example shall illustrate the procedure of purchasing, storing and issuing the raw materials to the production department.

- *Example 01:*

A Limited is engaged in the manufacturing of Cotton Garment. It uses yarn as its raw material. It requires 10 tons of yarn for the next production.

The Production Department raises the Material Requisition (M.R) to the Store / Warehouse of the company depicting the quantity and time at which the stock is needed. The Store / Warehouse of the company raises a Purchase Requisition (P.R) to the Purchase / Procurement Department. The Purchase / Procurement Department raises a request for quotation to the yarn suppliers and on the basis of accepted quotation, raises a Purchase Order (P.O) which is delivered to the supplier. The supplier on the basis of P.O (which includes quantity, rate and time of delivery) delivers the yarn at the store / warehouse of A Limited and issues a Goods Dispatch / Delivery Note (GDN) to the Store and Purchase/ Procurement Departments of A Limited. The storekeeper / warehouse in-charge of A Limited issues a Goods Received Note (GRN) the copy of which is given to the supplier and Purchase / Procurement Department after inspecting the goods along with the invoice.

The Storekeeper / Warehouse in-charge arranges the goods on the First in First Out (FIFO) basis or Weighted Average (AVCO) basis depending upon the company's policy (usually perishable products are carried at FIFO basis).

The Store then issues the raw materials to the Production Department and prepares a Goods Issue Note (GIN).

The following table summarizes the above procedures and documents.

Process	Documents
Production Department raise material requisition to Store / Warehouse	Material Requisition
Store / Warehouse issues purchase requisition to Procurement / Purchase Department	Purchase Requisition
Procurement Department raises Purchase Order to the approved supplier	Purchase Order
Supplier delivers goods at company's warehouse	Goods Dispatch / Delivery Note and Invoice / Bill
The warehouse in-charge receives the goods and inspect	Goods Received Note
The warehouse issues raw materials to the production department	Goods Issue Note

Documentation of purchase process is therefore needed:

- to ensure that the procedures for ordering, receiving and paying for materials has been conducted properly, and there is no error or fraud
- to provide a record of materials purchases for the financial accounts
- to provide a record of materials costs for the cost and management accounts.
- to ensure physical controls over the materials and to ensure they are used not used improperly

The detailed procedures for purchasing materials and the documents used might differ according to the size, complexity and nature of the business. However, the basic requirements are same for all types of business where material purchases are made.

2. INVENTORIES AND THEIR VALUATION

2.1. Types of Inventories:

Inventory comprises raw materials, work-in-process, stores, spares and tools and finished goods.

Raw materials are consumed in the production during a period. They are treated as expense whereas those raw materials that are remaining at the end of the reporting period are treated as current assets and are termed as inventories.

Work-in-process is the inventory on which partial costs have been incurred. For instance, for manufacturing a liter of mango juice, 100% of mango pulp (raw material) has been put into process whereas the labor has worked only 50% up to the end of the reporting period. Due to this, the product is not considered completed nor it is a raw material any more. This kind of inventory is called work-in-process and is treated as current asset.

Finished goods are the final products that are sold to the consumers / customers. The goods that have been sold to the customers are treated as expense in the financial statements whereas, the goods that have not been sold till the end of the reporting period are considered as inventories.

Stores, spares and loose tools are used in the equipment and machinery and are kept in inventory so that in case of any damage to the machinery or equipment, the production should not stop and necessary tools are available in stock to resume the production at earliest.

The companies usually maintain the stock of such tools and spare parts for all the machinery and equipment, whether or not such machinery or equipment are used in production. However, the cost of production shall only include the cost of those stores, spares and tools that are used in the production machinery and equipment. Accordingly, the units so used in the machineries or equipment are treated as expense and the ones which are unused are classified as current assets.

2.2. Cost of Inventory:

The following table explains the cost of each type of inventory:

Inventory	Cost
Raw Material	Purchase price including import duties & taxes (other than those subsequently recoverable by the entity), transport, handling and other cost directly attributable to the purchase of goods. Trade discounts, rebates and other similar items are deducted in determining the cost. (IAS 2)
Work-in-process	Cost of raw material as determined above, plus direct labor cost and production overhead costs to the extent of work done.
Stores, spares and tools	Same as Raw Material
Finished Goods	Cost of raw material as determined above, plus direct labor cost and production overheads.

Sometimes, the inventories are damaged or become wholly or partly obsolete. In such a case, the company

- Either have to incur more cost to bring them into saleable condition due to which the cost may exceed the selling price
- Or sell them in the damaged / obsoleted form for which the selling price would probably be lower than actual cost as demand of such obsoleted product may have come down

In such cases, the company needs to bring the inventories at their net realizable value.

2.3. Net Realizable Value:

Net realizable value is the estimated selling price in the ordinary course of business less the estimated cost of completion and estimated cost necessary to make the sale (IAS 2).

It refers to the net amount that an entity expects to realize from the sale of the inventory in the ordinary course of business (IAS 2).

2.4. Valuation of Inventory:

An entity is required to evaluate, at the end of each reporting period, the net realizable value of its inventories and value the inventories at lower of:

- Cost or
- Net realizable value

The cost of the inventories are ordinarily lower than the net realizable value. Therefore, the inventories are carried at their costs. However, the cost may exceed the net realizable value in the following cases:

- The inventories are damaged,
- The inventories have become wholly or partially obsolete,
- The selling price of the inventories have declined, or
- The estimated cost of completion or estimated cost to be incurred to make the sale have increased (IAS 2).

▶ *Example 02:*

A business has three items of inventory currently carried at their cost. The market prices of the inventories have fallen down due to sudden decrease in demand. Their estimated selling prices, cost of completion and selling costs are as under:

	Cost	Sales price	Cost of completion	Selling costs
	Rs.	**Rs.**	**Rs.**	**Rs.**
Finished Product A1	8,000	7,800	-	500
Finished Product A2	14,000	12,000	-	200
Work-in-process B1	16,000	14,000	1,500	200

Calculate the NRV of the inventories.

	Est. Selling price – Est. Cost of completion - Est. Selling Cost:	Rs.
Finished Product A1	7,800 – 500	7,300
Finished Product A2	12,000 – 200	11,800
Work-in-process B1	14,000 – 1,500-200	12,300

It is to be noted that for finished goods no further processing cost is needed and therefore, the formula for NRV does not include cost to complete.

▶ *Example 03:*

A business has following items of inventories with their costs and NRV. You are required to calculate the value at which the inventories should be carried.

Inventories	Cost	Cost of Completion	Cost to Sell	Selling Price
		---------------**Rs.**----------------		
Raw Materials	150,000	500,000	50,000	850,000
Work-in-process	450,000	250,000	50,000	850,000
Finished Goods – in good condition	700,000	-	50,000	850,000
Finished Goods – damaged during transport	700,000	300,000	50,000	850,000

Calculating the value of inventories:

Inventories	Cost	NRV (Est. Selling Price-Est. Cost to complete-Est. Cost to Sell)	Value at lower of cost or NRV
	---------------	Rs.	---------------
Raw Materials	150,000	300,000	150,000
Work-in-process	450,000	500,000	450,000
Finished Goods – in good condition	700,000	800,000	700,000
Finished Goods – damaged during transport	700,000	500,000	500,000

It is to be noted here that the finished goods that were damaged during transport need to be worked on further before sale, therefore, the formula of NRV shall now include cost to complete the goods.

2.5. Cost Formula

With some inventory items, particularly large and expensive items, it might be possible to recognize the actual cost of each item.

In practice, however, this is unusual because the task of identifying the actual cost for all inventory items is impossible because of the large numbers of such items and when the prices of those items differ in different periods. The following example explains the situation well.

► *Example 04:*

On 1 January a company had an opening inventory of 100 units which cost Rs.50 each.

During the year it made the following purchases:

- 5 April: 300 units at Rs. 60 each
- 14 July: 500 units at Rs. 70 each
- 22 October: 200 units at Rs. 80 each.

During the period it sold 800 units as follows:

- 9 May: 200 units
- 25 July: 200 units
- 23 November: 200 units
- 12 December: 200 units

This means that it has 300 units left at the end of the year (100 + 300 + 500 + 200 – (200 + 200 + 200 + 200 + 200))

But since the units were purchased at different prices so what price should the remaining units be allocated?

Should the units be allocated cost of units that were purchased last (that is Rs. 80)? But in that case the inventory shall be overstated as only 200 out of 300 units were purchased at Rs. 80.

Should the cost of oldest purchased units be used? But in this case inventory will be understated.

Should the units be given the weighted average cost?

A system is therefore needed for measuring the cost of inventory.

The historical cost of inventory is usually measured by one of the following methods:

- First in, first out (FIFO)
- Weighted average cost (AVCO)

The FIFO and weighted average cost (AVCO) methods of inventory valuation are used within perpetual inventory systems. They can also be used to establish a cost for closing inventory with the period-end inventory system.

First-in, first-out method of valuation (FIFO)

With the first-in, first-out method of inventory valuation, it is assumed that inventory is consumed in the strict order in which it was purchased or manufactured. The first items that are received into inventory are the first items that go out.

To establish the cost of inventory using FIFO, it is necessary to keep a record of:

- the date that units of inventory are received into inventory, the number of units received and their purchase price (or manufacturing cost)
- the date that units are issued from inventory and the number of units issued.

With this information, it is possible to put a cost to the inventory that is issued (sold or used) and to identify the cost of the items still remaining in inventory.

Since it is assumed that the first items received into inventory are the first units that are used, it follows that the value of inventory at any time should be the cost of the most recently-acquired units of inventory.

▶ *Example 05:*

Taking the data from example 04 above, we are preparing the cost ledger as per FIFO method:

	Receipts			Issues			Balance		
Date	**Qty**	**@**	**Rs.**	**Qty**	**@**	**Rs.**	**Qty**	**@**	**Rs.**
1 Jan b/f	100	50	5,000				100	50	5,000
5 Apr	300	60	18,000				300	60	18,000
							400	50/60	23,000
9 May				100	50	5,000	100	50	5,000
				100	60	6,000	100	60	6,000
				200	50/60	11,000	(200)	50/60	(11,000)
							200	60	12,000
14 Jul	500	70	35,000				500	70	35,000
							700	60/70	47,000
25 Jul				200	60	12,000	(200)	60	12,000
							500	70	35,000
22 Oct	200	80	16,000				200	80	16,000
							700	70/80	51,000
23 Nov				200	70	14,000	(200)	70	(14,000)
							500	70/80	37,000
12 Dec				200	70	14,000	(200)	70	(14,000)
	1,100		74,000	800		51,000	300	70/80	23,000
Note:	1,100		minus	800		equals	300		
			74,000	minus	51,000		equals	23,000	

Weighted average cost (AVCO) method

With the weighted average cost (AVCO) method of inventory valuation it is assumed that all units are issued at the current weighted average cost per unit.

The normal method of measuring average cost is the perpetual basis method. With the perpetual basis AVCO method, a new average cost is calculated whenever more items are purchased and received into store. The weighted average cost is calculated as follows:

- *Formula:*

$$\text{Average cost: } \frac{\text{Cost of inventory currently in store + Cost of new items received}}{\text{Number of units currently in store + Number of new units received}}$$

- *Example 06:*

Taking the data from example 04 above, we are preparing the cost ledger as per AVCO method:

	Receipts			Issues			Balance		
Date	**Qty.**	**@**	**Rs.**	**Qty.**	**@**	**Rs.**	**Qty.**	**@**	**Rs.**
1 Jan b/f	100	50	5,000				100	50	5,000
5 Apr	300	60	18,000				300	60	18,000
							400	57.5000	23,000
9 May				200	57.5000	11,500	(200)	57.5000	(11,500)
							200	57.5000	11,500
14 Jul	500	70	35,000				500	70	35,000
							700	66.4286	46,500
25 Jul				200	66.4286	13,286	(200)	66.4286	(13,286)
							500	66.4286	33,21
22 Oct	200	80	16,000				200	80	16,000
							700	70.3057	49,21
23 Nov				200	70.3057	14,061	(200)	70.3057	(14,061)
							500	70.3057	35,153
12 Dec				200	70.3057	14,061	(200)	70.3057	(14,061)
	1,100		74,000	800		52,912	300	70.3057	21,092
Note:	1,100	minus		800	equals		300		
	74,000		Minus	52,912		equals	21,092		

- *Example 07:*

XYZ Limited manufactures four products. The related data for the year ended December 31, 20X3 is given below:

	A	B	C	D
Opening inventory				
- Units	10,000	15,000	20,000	25,000
- Cost (Rs.)	70,000	120,000	180,000	310,000
- NRV (Rs.)	75,000	110,000	180,000	300,000
Production in units	50,000	60,000	75,000	100,000

	A	B	C	D
Costs of goods produced (Rs.)	400,000	600,000	825,000	1,200,000
Variable selling costs (Rs.)	60,000	80,000	90,000	100,000
Closing inventory (units)	5,000	10,000	15,000	24,000
Damaged units included in closing inventory	300	600	800	1,500

Inventory valuation method in use	Weighted Average	Weighted Average	FIFO	FIFO
Unit cost of purchase from market (Rs.)	10.50	11.00	11.50	13.00
Selling price per unit (Rs.)	10.00	12.00	12.00	12.50
Unit cost to repair damaged units (Rs.)	3.00	2.00	2.50	3.50

The company estimates that selling expenses will increase by 10% in January 20X4.

In computing the amount of closing inventory that should be reported in the statement of financial position as on December 31, 20X3, following are the considerations.

To calculate the cost of closing stock, we have to first calculate the cost of goods available for sale to determine the weighted average cost per unit for the purpose of AVCO method.

	Formula	A	B	C	D
Step 1: Calculating Units Sold during the period		Units			
Opening stock	Given	10,000	15,000	20,000	25,000
Production during the period	Given	50,000	60,000	75,000	100,000
Goods available for sale	Op. stock + production during the period	60,000	75,000	95,000	125,000
Closing Stock	Given	(5,000)	(10,000)	(15,000)	(24,000)
Units Sold	Goods available for sale – Closing Stock	55,000	65,000	80,000	101,000
*Units sold are calculated only to determine the mix of units for the purpose of costing of closing stock as per FIFO.					
Step 2: Calculating Cost of goods available for sale					
		-----------------Rs.--------------			
Opening stock valuation (at lower of cost and NRV)	From the given data	70,000	110,000	180,000	300,000
Cost of production for the period	Given	400,000	600,000	825,000	1,200,000
Cost of goods available for sale	Op. stock + production during the period	470,000	710,000	1,005,000	1,500,000

	Formula	A	B	C	D
Step 3: Calculating cost of closing stock					
A & B (W/Avg.):	(Cost of goods available for sale /Goods available for sale) x Closing Stock	39,167	94,667		
C & D (FIFO):	(Cost of goods produced during the period/Goods produced during the period) x Closing Stock			165,000	288,000
Step 4: Calculating NRV					
Sales price - per unit	Given	10.0	12.0	12.0	12.5
Total sales price of closing stock	(Closing Stock x Sales Price per unit)	50,000	120,000	180,000	300,000
Selling costs	(Selling Cost/Production Units) x Closing Stock	(6,000)	(13,538)	(18,563)	(26,139)
Repair cost of damaged units	Damaged units x repair cost per unit	(900)	(1,200)	(2,000)	(5,250)
NRV of Closing stock	Selling price – cost to sell – cost to complete	43,100	105,262	159,438	268,611
Value of closing stock to be reported in the SFP	Lower of cost and NRV	39,167	94,667	159,438	268,611

2.6. Comparison of Methods

The different methods of inventory valuation will give significantly different valuations for the cost of sales and the value of closing inventory during a period of high inflation (when prices are increasing)

- With FIFO during a period of high inflation, the cost of sales will be lower than the current replacement cost of materials used. The closing inventory value should be close to current value since they will be the units bought most recently.
- With AVCO during a period of high inflation, the cost of sales will be higher and the value of closing inventory lower than with FIFO valuation.

In the example used above to illustrate FIFO and AVCO, prices were rising and the valuations of the cost of goods issued and closing inventory were as follows

Valuation method	Cost of goods issued	Closing inventory
	Rs.	**Rs.**
FIFO	5,100	2,300
AVCO	5,290	2,110

The valuation of closing inventory is higher and the cost of goods issued is lower using FIFO. This is typical during a period when prices are rising steadily.

The opposite is true when prices are falling. The valuation of closing inventory is lower and the cost of goods issued is higher using FIFO.

Advantages & Disadvantages of FIFO

Advantages

- Logical (probably represents physical reality)
- Easy to understand and explain to managers
- Gives a value near to replacement cost

Disadvantages

- Can be cumbersome to operate
- Managers may find it difficult to compare costs and make decisions when they are charged with varying prices for the same materials

In a period of high inflation, inventory issue prices will lag behind current market value

Advantages & Disadvantages of AVCO

Advantages

- Smoothens out price fluctuations
- Easier to administer than FIFO and LIFO (Last in First Out)

Disadvantages

- Issue price is rarely what has been paid
- Prices tend to lag a little behind current market values when there is gradual inflation

3. COMPREHENSIVE EXAMPLES

▶ *Example 01:*

Mehanti Limited(ML) produces and markets a single product Wee. Two chemicals Bee and Gee are used in the ratio of 60:40 for producing 1 liter of Wee. ML follows perpetual inventory system and uses weighted average method for inventory valuation. The purchase and issue of Bee and Gee for May 20X3, are as follows:

Date	Bee			Gee		
	Receipt		Issue	Receipt		Issue
	Liter	Rate	Liter	Liter	Rate	Liter
02-05-20X3	-	-		450	110	-
05-05-20X3	-	-	560	-	-	650
09-05-20X3	-	-	300	-	-	300
12-05-20X3	420	52	-	700	115	-
18-05-20X3	-	-	250	-	-	150
24-05-20X3	500	55	-	250	124	-
31-05-20X3	-	-	500	-	-	450

Following further information is also available:

i. Opening inventory of Bee and Gee was 1,000 liters at the rate of Rs.50 per liter and 500 liters at the rate of Rs. 115 per liter respectively.

ii. The physical inventories of Bee and Gee were 535 liters and 140 liters respectively. The stock check was conducted on 01 June and 31 May 20X3 for Bee and Gee respectively.

iii. Due to contamination, 95 liters of Bee and 105 liters of Gee were excluded from the stock check. Their net realizable values were Rs20 and Rs.50 per liter respectively.

iv. 250 liters of Bee which was received on 01 June 20X3 and 95 liters of Gee which was issued on 31 May 20X3 after the physical count were included in the physical inventory.

v. 150 liters of chemical Bee was held by ML on behalf of a customer, whereas 100 liters of chemical Gee was held by one of the suppliers on ML's behalf.

vi. 100 liters of Bee and 200 liters of Gee were returned from the production process on 31May and 01 June 20X3 respectively.

vii. 240 liters of chemical Bee purchased on 12th May and 150 liters of chemical Gee purchased on 24th May 20X3 were in advertently recorded as 420 liters and 250 liters respectively.

a) Reconcile the physical inventory balances with the balances as per book.

Reconciliation (Bee)	Liters
Bal. as per physical count (1st June)	535
Add: Contaminated Stock	95
Less: Receipt of June, 1	(250)
Third party stock	(150)
Balance as per books (W-1)	230

Reconciliation (Gee)	Liters
Balance as per physical count (31st May)	140
Less: Issued after Count	(95)
Actual Physical as on 31.5.20X3	45
Add: Contaminated stock	105
Stock with 3rd party	100
Stock as per books (W-2)	250

AT A GLANCE SPOTLIGHT STIKCY NOTES

(W-1) (Bee)

Date	Receipts			Issues			Balance		
	Units	PUC	TC	Units	PUC	TC	Units	PUC	TC
1-5-X3							1,000	50	50,000
5-5- X3				560	50	28,000	440	50	22,000
9-5- X3				300	50	15,000	140	50	7,000
12-5- X3	420	52	21,840				560	51.5	28,840
18-5- X3				250	51.5	12,875	310	51.5	15,965
24-5- X3	500	55	27,500				810	53.66	43,465
31-5- X3				500	53.66	26,830	310	53.66	16,635
31-5- X3				(100)	(53.66)	5366	410	53.66	22,001
31-5- X3 (Adj)	(180)*	(52)	(9,360)				230	54.96	12,641

*Purchases of 240 litters erroneously recorded as 420 litters now corrected. It is assumed that the error was highlighted on 31st May or later.

(W-2) (Gee)

Date	Receipts			Issues			Balance		
	Units	PUC	TC	Units	PUC	TC	Units	PUC	TC
1-5- X3							500	115	57,500
2-5- X3	450	110	49,500				950	112.63	107,000
5-5- X3				650	112.63	73,210	300	112.63	33,790
9-5- X3				300	112.63	33,789	-	-	-
12-5-X3	700	115	80,500				700	115	80,500
18-5- X3				150	115	17,250	550	115	63,250
24-5- X3	250	124	31,000				800	117.81	94,250
31-5- X3				450	117.81	53,015	350	117.81	41,235
31-5- X3	*(100)	124	12,400				250	115.34	28,835

*Purchases of 150 litters were erroneously recorded as 250 litters. It is assumed that error is highlighted on 31st May 20X3.

b) Determine the cost of closing inventory of chemical Bee and Gee. Also compute the cost of contaminated materials as on 31 May 20X3.

Valuation of Bee

As on 31 May 20X3

	Units	PUC	TC
Balance as per books	230	54.96	12,641
Less: contaminated stock (BV)	(95)	(54.96)	(5,221)
Add: contaminated stock (NRV)	95	20	1,900
Balance as per books as on 31 May 20X3	230	40.52	9,320

Above calculated stock include 95 liters of contaminated stock @ 20/ liter i.e. its NRV

Thus the cost of closing inventory of Bee is Rs. 9,320 and cost of contaminated material would be Rs. 1,900 included above.

Valuation of Gee

As on 31 May 20X3

	Units	PUC	TC
Stock as per books	250	115.34	28,835
Less: Contaminated stock (BV)	(105)	(115.34)	(12,110.70)
Add: Contaminated stock (NRV)	105	50	5,250
Value of stock as on 31 May 20X3	250	87.90	21,974.30

Thus the cost of closing inventory of Gee is Rs. 21,974.30 including the cost of contaminated material Rs. 5,250.

Above calculated stock include 105 liters of contaminated material at its NRV i.e. Rs. 50/ liter.

- *Example 02:*

Quality Limited (QL) is a manufacturer of washing machines. The company uses perpetual method for recording and weighted average method for valuation of inventory.

The following information pertains to a raw material (SRM), for the month of June 20X3.

i. Opening inventory of SRM was 100,000 units having a value of Rs. 80 per unit.

ii. 150,000 units were purchased on June 5, at Rs. 85 per unit

iii. 150,000 units were issued from stores on June 6.

iv. 5,000 defective units were returned from the production to the store on June 12.

v. 150,000 units were purchased on June 15 at Rs. 88.10 per unit.

vi. On June 17, 50% of the defective units were disposed of as scrap, for Rs. 20 per unit, because these had been damaged on account of improper handling at QL.

vii. On June 18, the remaining defective units were returned to the supplier for replacement under warranty.

viii. On June 19, 5,000 units were issued to production in replacement of the defective units which were returned to store.

ix. On June 20, the supplier delivered 2,500 units in replacement of the defective units which had been returned by QL.

x. 150,000 units were issued from stores on June 21.

xi. During physical stock count carried out on June 30, 2010 it was noted that closing inventory of SRM included 500 obsolete units having net realizable value of Rs. 30 per unit. 4,000 units were found short.

Necessary journal entries to record the above transactions would be prepared as follows

Journal entries:		**Debit**	**Credit**
		Rupees	
5-Jun-20X3	Raw material	12,750,000	
	Account payable (150,000 x 85)		12,750,000
	(Cost of material purchased)		
6-Jun-20X3	Work in process	12,450,000	
	Raw material		12,450,000
	(Issue of raw material to production)		
12-Jun-20X3	Raw material	415,000	
	Work in process		415,000
	(Defective material returned from the production)		
15-Jun-20X3	Raw material	13,215,000	
	Account payable (150,000 x 88.1)		13,215,000
	(Cost of material purchased)		
17-Jun-20X3	Cash (2,500 x 20)	50,000	
	Factory overheads	165,000	
	Raw material		215,000
	(Defective units sold as scrapped)		
18-Jun-20X3	Account payable	212,500	
	Raw material		212,500
	(Defective material returned to the supplier)		

		Debit	Credit
		Rupees	
19-Jun-20X3	Work in process	430,050	
	Raw material		430,050
	(Replacement of defective material to production by the store)		
20-Jun-20X3	Raw material	212,500	
	Account payable (2,500 x 85)		212,500
	(Goods returned were replaced by the supplier)		
21-Jun-20X3	Work in process	12,900,000	
	Raw material		12,900,000
	(Issue of raw material to production)		
30-Jun-20X3	Factory overheads - {500 x (86-30)} (obsolete items)	28,000	
	Factory overheads - (4,000 x 86) (shortages)	344,000	
	Raw material		372,000
	(Cost of obsolete and shortages charged to factory overheads)		

Date	Particulars	Receipts /(Issues)		
		Quantity	Rate	Rupees
01-Jun-20X3	Balance	100,000	80.00	8,000,000
05-Jun-20X3	Purchases	150,000	85.00	12,750,000
	Balance	**250,000**	**83.00**	**20,750,000**
06-Jun-20X3	Issues	(150,000)	83.00	(12,450,000)
12-Jun-20X3	Returned from production	5,000	83.00	415,000
15-Jun-20X3	Purchases	150,000	88.10	13,215,000
	Balance	**255,000**	**86.00**	**21,930,000**
17-Jun-20X3	Defective goods sold	(2,500)	86.00	(215,000)
18-Jun-20X3	Returned to supplier	(2,500)	85.00	(212,500)
	Balance	**250,000**	**86.01**	**21,502,500**
19-Jun-20X3	Replacement to production	(5,000)	86.01	(430,050)
20-Jun-20X3	Replacement by supplier	2,500	85.00	212,500
	Balance	**247,500**	**86.00**	**21,284,950**

STICKY NOTES

Inventory is valued at lower of cost or NRV

Net Realizable value is the estimated selling price in the ordinary course of business

The costs of large volume inventories are calculated using FIFO or AVCO method

FIFO & AVCO methods provide different results of cost of sales and closing value of inventories if the prices are moving frequently

CHAPTER 2

INVENTORY MANAGEMENT

IN THIS CHAPTER

AT A GLANCE

Inventory management refers to the process of ordering, storing and using a company's inventories. Managers of inventory-intensive industries have to be very vigilant to manage the inventories in such a way so as to make adequate stock available to meet expected demands at minimum costs, while keeping it safe from obsolescence and damage.

They have to determine:

- order quantity at which the relevant cost is lowest and level of stock at which the order must be placed.
- quantity in addition to the normal usage to meet unexpected demand in order to avoid loss of profit whereas keeping the holding cost lowest.

Costs associated with inventories include: cost of purchasing, ordering and holding the inventory. Relevant costs are the costs that occur on the occurrence of an activity.

EOQ model is used to determine the order quantity at which the cost is minimum. EOQ can be determined using: Tabular Method, Graphical Method and EOQ Formula.

A business entity shall always maintain certain levels of inventories. These levels are: Re-order Level, Safety Stock / Buffer Stock, Maximum and Minimum Inventory Levels.

Probabilities are used to make the comparison of holding cost with stock-out cost to achieve cost efficiencies.

1. WHAT IS INVENTORY MANAGEMENT?

Inventory management refers to the process of ordering, storing and using a company's inventories. This includes management of raw materials, components and finished products as well as warehousing and processing such items.

Since the inventory is the most important component of any inventory-intensive sectors, special efforts are put to ensure that:

- There is sufficient inventory of raw materials available to produce the quantity of finished goods to meet the sale forecast,
- There is sufficient inventory of finished goods available to meet the immediate sales requirement (both expected and unexpected) to avoid stock out situations,
- The quantity so available is not in excess of the market needs to avoid any obsolescence, damage or blockage of finance and
- The costs associated with inventory are minimized.

1.1. Why do companies hold stocks?

There are three general reasons:

1. Transactions motive
2. Precautionary motive and
3. Speculative motive.

The **transactions motive** occurs when there is a need to hold stocks to meet production and sales requirements instantaneously.

The firm might also decide to hold additional amounts of stocks to cover the possibility that it may have underestimated its future production and sales requirements or the supply of raw materials may be unreliable because of uncertain events affecting the supply of materials. This represents **precautionary motive** which applies only when future demand is uncertain.

When it is expected that future input prices may change, a firm might maintain higher or lower stock levels to speculate on the expected increase or decrease in future prices. This is called **speculative motive**.

1.2. Costs Associated with Inventories:

Inventory management is quite critical for the companies as it includes substantial costs. Following are the costs that are associated with inventories:

1. **Cost of purchasing the inventory** – the price that is quoted by supplier
2. **Cost of ordering the inventory** – such as clerical costs of preparing the material requisition, purchase order, receiving deliveries and paying invoices, labor cost for the inspection of goods and placing the goods in warehouse and cost incurred in making payments.
3. **Cost of holding the inventory** – such as interest cost on borrowings for purchase of inventory, insurance cost, warehouse and storage cost, handling cost and cost of obsolescence, deterioration of inventory and opportunity cost of holding the stocks.

All these costs are financed either through company's own funding or borrowings from banks.

a) If inventories are financed using company's own funds, the company would have to bear the opportunity cost in a way had these funds were not invested in the inventories could be used in investing in any other avenues to earn a fixed return. The gain so forgone shall be treated as the opportunity cost.

b) Similarly, if the inventories are funded by obtaining bank loan, the interest on such loan shall make the part of cost of inventories.

Now if the investment on which a fixed return could be attained or the loan was obtained, for three months, the company would have to complete its cycle of purchasing, manufacturing, selling and realizing cash in three months to:

- adjust the opportunity cost with gain from sale of inventories or
- pay off the borrowings and interest

which if not materialize in the given time would make the company to bear more cost (more interest, more storage and insurance costs etc.). Therefore, to avoid such a situation the companies put substantial efforts to determine the expected market demand on the basis of which purchasing and manufacturing plans are made in order to achieve a point of inventory at which the cost is minimized.

The mathematicians have therefore derived quantitative models to determine the level of stock to be maintained at which the price is minimal (known as optimum stock level).

Such quantitative models undertake only relevant costs in calculation.

1.3. Relevant and Irrelevant Cost:

Relevant costs are the costs that occur on the occurrence of an activity.

Irrelevant costs are those that occur whether or not any activity is carried.

▶ *Example 01:*

A company is planning to shut down its operations for two months. The operations run on a factory for which company pay rent of Rs. 50,000 per month. The company uses raw material of Rs. 75,000 for monthly production and incurs Rs. 60,000 towards labor cost. Due to it shut down, the company would not purchase raw material for the two months and pay half to the labors as per labor unions agreement. However, it would be required to pay full amount of rent for the factory.

In this case the cost of raw materials and half cost of labor is relevant as the same occur when the factory runs. Whereas, the rent of the factory and half cost of labors shall occur irrespective the operations run or not and is irrelevant.

This concept shall be discussed in detail in chapter 'Budget, Budgetary Controls and Decision Making' and here we will look at areas that are relevant for decisions relating to inventories.

The relevant cost that should be considered when determining optimum stock levels are holding cost and ordering cost.

Relevant Holding Cost to be used in quantitative models should include only those items that will vary with the levels of stock. For example, in the case of storage and warehouse only those costs should be included that will vary with changes in number of units ordered. Such costs are called variable costs.

▶ *Example 02:*

Fixed and variable holding costs

Salaries of storekeepers, depreciation of equipment and fixed rental of equipment and buildings are often irrelevant because they are unaffected by changes in stock levels.

On the other hand, if storage space is owned and can be used for other productive purposes, such as to obtain rental income, then the opportunity cost must be included in the analysis.

Similarly, the insurance cost of stock must be undertaken when the premium are paid at the fluctuating value of stocks and not the fixed insurance cost per annum.

To the extent that funds are invested in stocks, the analysis must include opportunity cost (as explain in cost associated with inventories). The opportunity cost is reflected by the required return that is lost from investing in stocks.

The relevant holding costs for other items such as material handling, obsolescence and deterioration are difficult to estimate and these costs are not very critical to the investment decision.

Normally, the holding costs are expressed as a percentage rate per rupee of average investment.

Same as holding costs, the **ordering costs** that are common to all inventory decisions are irrelevant and only the incremental costs of placing an order are useful for this purpose.

Note: the cost of purchasing or manufacturing the inventories are irrelevant for the purpose of determining optimum stock level since it remains unchanged irrespective of the order size or stock levels unless quantity discounts are available.

- *Example 03:*

Ore Limited (OL) is a manufacturer of sports bicycles. The company buys tyres from a local vendor.

Following data, relating to a pair of tyres, has been extracted from OL's records:

Cost (per unit)	Rs.
Storage cost based on average inventory	80
Insurance cost based on average inventory	60
Store keeper's salary (included in absorbed overheads)	8
Cost incurred on final quality check at the time of delivery	10

Other relevant details are as follows:

i. The purchase price is Rs. 900 per pair.

ii. The annual demand for tyres is 200,000 pairs.

iii. The ordering cost per order is Rs. 8,000.

iv. The delivery cost per order is Rs. 3,000.

v. OL's rate of return on investment in inventory is 15%.

vi. Recently the vendor has offered a quantity discount of 3% on orders of a minimum of 5,000 pairs.

a) Annual Ordering Cost, can be calculated as follows:

Annual Ordering Cost = Number of orders per annum x cost per order

Number of orders = Annual demand / order size = 200,000/5000 = 40 orders per annum

Cost per Order = Ordering Cost + Delivery Cost = Rs. 8,000 + Rs. 3,000 = 11,000

Therefore, the annual ordering cost = 40 x 11,000 = Rs. 440,000

b) To calculate Average inventory, following calculations would be required:

Average Inventory = (Opening quantity of stock + Closing quantity of stock) / 2 (0+5000)/2 = 2,500 pairs

c) Annual Holding cost, to be calculated as follows:

Annual Holding Cost = Holding Cost per unit x Average Inventory

Holding cost per unit:

Storage cost based on average inventory =	80
Insurance cost based on average inventory =	60
Opportunity Cost = Rs. 900 x 97% x 15% =	130.95
Total (relevant) holding cost per unit =	270.95
Annual Holding Cost = 270.95 x 2,500 =	677,375

d) Lastly, Total Cost of Inventory would be

Total Cost of Inventory:

Purchase cost (net of discount) = 900 x 200,000 x 97% =	174,600,000
Annual Ordering Cost = (a) =	440,000
Annual Holding Cost = (c) =	677,375
Total Cost of Inventory per annum =	175,717,375

Note: for the purpose of average stock it is assumed that there is no inventory available when the order is received and the inventory is consumed at a constant rate throughout the period, therefore, opening stock is zero and closing stock is the order size.

Alternatively, it can be assumed that the stock level is at the quantity of order received (5,000 in this case) which is consumed at a constant rate and becomes zero before the new order is received. This way opening shall become 5,000 and closing will be zero. However, in both cases the answer will be same.

Therefore, the average inventory is quantity reordered divided by 2.

1.4. Quantitative Models for determining Optimum Stock Levels:

There are models which incorporate transactions motive for holding optimum level of stocks. This is possible where a company is able to predict the demand for its inputs and outputs with perfect certainty and where it knows with certainty that prices of inputs, will remain constant for some reasonable length of time.

In such a situation, the optimum order will be determined by those costs that are affected by either:

- the quantity of stocks held or
- the number of orders placed.

If more units are ordered at one time, fewer orders will be required per year. This will result in reduction in ordering costs.

As seen in above example, if order size is 10,000 units, the number of orders will be 200,000 / 10,000 = 20 orders which will reduce the ordering cost to Rs. 220,000

However, when fewer orders are placed, larger average stocks must be maintained which leads to increase in holding costs that is (10,000 / 2) x 270.95 = 1,354,750. Hence the total relevant cost (ordering cost + holding cost) shall become Rs. 1,574,750 that is Rs. 457,375 higher than the one calculated at 5,000 units (i.e. 440,000+677,375=1,117,375).

Therefore, an optimum level must be determined at which the total relevant cost is minimized. This optimum level is called **Economic Order Quantity (EOQ).**

The EOQ can be determined using the following methods:

1. Tabular Method
2. Graphical Method
3. EOQ Formula

We shall look into these methods using the following example.

► *Example 04:*

Stock items 6786:

A company uses 40,000 units of stock item 6786 each year. The item has a purchase cost of Rs.10 per unit. The cost of placing an order for re-supply is Rs.2. The annual holding cost of one unit of the item is 10% of its purchase cost.

if it would be required to calculate the economic order quantity for item 6786, to the nearest unit using:

a) Tabular method

b) Graphical method

a) Tabular Method:

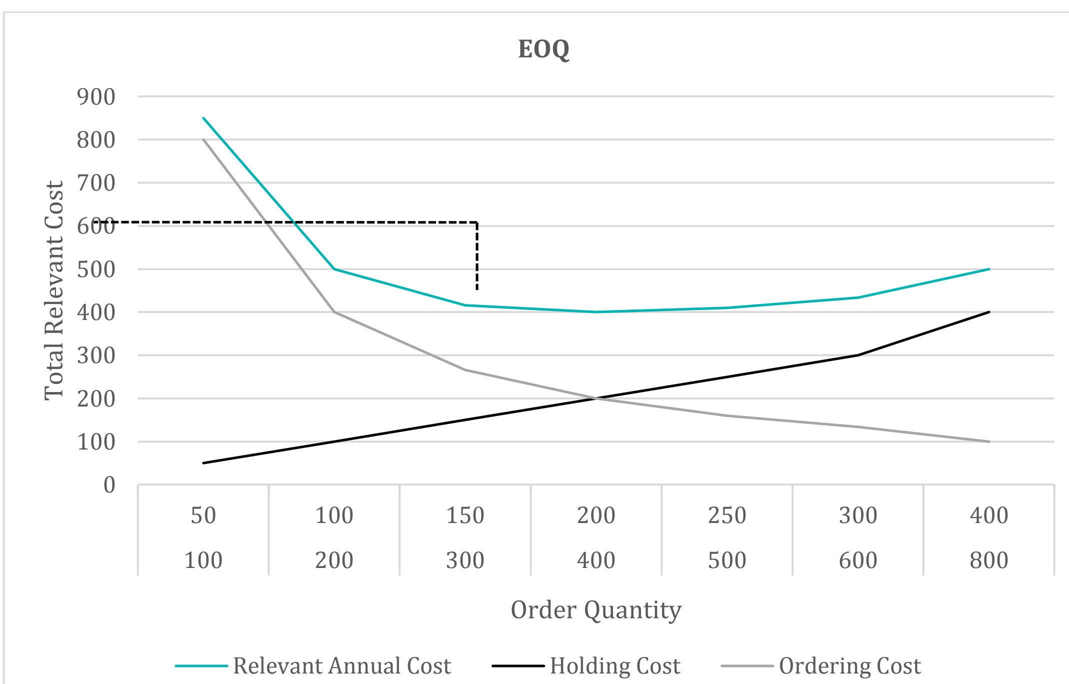
Order Quantity (Q)	100	200	300	400	500	600	800	10,000
Average Inventory (Q/2)	50	100	150	200	250	300	400	5000
Number of Purchase Orders (Annual Demand (A) / Q)	400	200	133	100	80	67	50	4
Annual Holding Cost (10% x 10 x Average Inventory)	50	100	150	200	250	300	400	5000
Annual Ordering Cost (2 x No. of Orders)	800	400	266	200	160	134	100	8
Total Relevant Cost	850	500	416	400	410	434	500	5,008
So the relevant cost is minimum at 400 units per order where OC and HC are equal. This is the optimum point or EOQ								

b) Graphical Presentation Method:

We have taken total relevant cost (ordering cost + holding cost) on the vertical axis and order quantity and average inventory on the horizontal axis.

We can see that as the average inventory and order size increases, the holding cost also increases whereas the order cost decreases.

It also to be noted here that the total relevant cost line is lowest at a point where ordering cost line and holding cost line are intersecting. This intersecting point determines our EOQ.



c) EOQ Formula:

EOQ can be identified using a formula. As of now we have understood the relationship of holding cost, ordering cost and order quantities. We have also understood that total relevant cost is the sum of holding cost and ordering cost:

Total Relevant Cost (TRC) = Annual Holding Cost (AHc) + Annual Ordering Cost (AOc)

We are now denoting the variables as:

Annual Demand = A

Quantity per Order / Order size = Q

Cost per Order = Oc

Holding cost per unit = Hc

Average Inventory = Q / 2

Annual Ordering Cost (AOc) shall be calculated as (A / Q) x Oc

Annual Holding (AHc) shall be calculated as (Q / 2) x Hc

TRC = $\frac{A}{Q} \times Oc + \frac{Q}{2} \times Hc$

When differentiating the above equation with respect to Q and setting the derivative equal to zero, we get the economic order quantity 'Q':

$$Q = \sqrt{\frac{2AOc}{Hc}}$$

Applying this formula to the example 2 above:

$$Q = \sqrt{\frac{(2 * 40{,}000 * 2)}{1}}$$

$$= 400\ units$$

Assumptions of EOQ:

EOQ model is valid only as per the following assumptions:

1. The holding cost per unit will be constant
2. The average inventory is equal to one half of the order quantity as the stock is consumed at a constant rate throughout the period.
3. The cost per order is constant
4. There are no quantity discounts available.
5. The demand for its inputs and outputs can be predicted with perfect certainty

► *Example 05:*

Taking the data from example 04, determine the effect of an increase in annual holding cost per unit on:

a) EOQ

b) Total annual ordering cost

In order to fulfil the requirement, assume that HC has increased to 15%, the revised HC will be = 15% x 10 = 1.5

The revised EOQ would be $\sqrt{\frac{(2\times40{,}000\times2)}{1.5}} = 326.6 \approx 327$

Effect: the order size shall decrease due to increase in holding cost.

The Annual Ordering Cost shall increase due to reduction in order size.

$$AOc = \frac{40{,}000}{326.6} \times 2 = Rs. 244.6$$

The AOC has increased by Rs. 44.6

1.5. Quantity Discounts affecting the decision of order size:

Sometimes, the suppliers offer discounts on bulk purchases. In such a case, the EOQ model can only be used when the total costs including purchase price after taking into account the discounts is more than the cost at EOQ. This means, the entity shall evaluate both the options and determine which option gives the lesser cost.

- *Example 06:*

Entity G uses 105 units of an item of inventory every week. These cost Rs.150 per unit. They are stored in special storage units and the variable costs of holding the item is Rs.4 per unit each year plus 2% of the inventory's cost.

a) If placing an order for this item of material costs Rs.390 for each order, the optimum order quantity to minimize annual costs would be calculated as follows. It is assumed that there are 52 weeks in each year.

The annual holding cost per unit of inventory = Rs.4 + (2% × Rs.150) = Rs.7.

Annual demand = 52 weeks × 105 units = 5,460 units.

$$EOQ = \sqrt{\frac{2 \times 390 \times 5{,}460}{7}} = 780 \text{ Units}$$

b) Now suppose that the supplier offers a discount of 1% on the purchase price for order sizes of 2,000 units or more. The order size to minimize total annual costs would require following calculations

A discount on the price is available for order sizes of 2,000 units or more, which is above the EOQ.

The order size that minimizes cost is therefore either the EOQ or the minimum order size to obtain the discount, which is 2,000 units.

Annual costs	Order size 780 units	Order size 2,000 units
	Rs.	Rs.
Purchases		
(5,460 × Rs.150): ((5,460 × Rs.150 × 99%)	819,000	810,810
Holding costs	2,730	6,970
(Rs.7 × 780/2): (Rs.6.97 × 2,000/2)		
Ordering costs	2,730	1,065
(Rs.390 × 5,460/780): (Rs.390 × 5,460/2,000)		
Total costs	824,460	818,875

Conclusion: The order size that will minimize total annual costs is 2,000 units

2. INVENTORY LEVELS AND BUFFER STOCK

A business entity shall always maintain certain levels of inventories. These levels are:

a) Re-order Level
b) Safety Stock / Buffer Stock
c) Maximum Inventory Level
d) Minimum Inventory Level

So far, it has been assumed that when an item of materials is purchased from a supplier, the delivery from the supplier will happen immediately. In practice, however, there is likely to be some uncertainty about when to make a new order for inventory in order to avoid the risk of running out of inventory before the new order arrives from the supplier. The period of time between placing a new order with a supplier and receiving the delivery of the same is called "**Lead Time**". This lead time could be in days, weeks or months.

On the basis of this lead time, the companies determine the level of stock at which the order should be placed to avoid stock-out situation. The level at which a new order is placed is called "**Re-order Level**".

Such re-order level is determined using the average consumption during lead time. However, sometimes the demand during lead time exceeds the expectations, in such case, if the demand is not fulfilled, the customers may move to competitors and result in loss of profit and good will. Also, the delivery may delay the expected time due to which the company may fail to produce the expected demand which again result in loss of profits. To avoid such risk, the company also maintains a level of stock which is called "**Safety Stock** or **Buffer Stock**"

The re-order level is determined by two ways:

- **Under certain circumstances** = Average consumption during lead time =Average Lead Time (days / week / month) x Average Consumption per day / week / month. This is also called **Minimum Inventory Level**
- **Under uncertain circumstances** = maximum lead time (days / weeks / month) x maximum demand per day / week / month

The **Safety Stock** is determined as:

Re-order level at uncertain circumstances – Re-order level at certain circumstances

(Maximum Demand x Maximum Lead Time) – (Average consumption x Average Lead Time)

Due to safety stock, the **average inventory** shall become:

$$\frac{Q}{2} + Safety\ Stock$$

This way, the entity carries safety stock on the basis of maximum demand as well as maximum delivery time. However, the probability of both the events occurring at the same time is very low. Thereby, the management is incurring excessive holding cost on safety stocks.

If the cost of holding safety stocks is greater than the cost of stock-out, the business would be incurring more loss. Therefore, a level should be set where the cost of stock-out plus the cost of holding the safety stock is minimized.

Stock-out Cost are the opportunity cost of running out of stock. As the stock-out occurs when there is demand but no stock available, therefore, the loss of profit, which could be earned had the stock available. It also leads to loss of customers' goodwill as the customers may move to the products of competitors. If the customer is permanently lost, the stock-out cost is determined using the loss of future profits as well.

Once the stock-out cost has been estimated, the cost of holding safety stocks should be compared for various demand levels. This can be done using probability theory by attaching probabilities to different potential demand levels.

2.1. Probability Theory to determine the Safety Stocks:

A probability table can be prepared. For each possible reorder level under consideration, we can calculate:

- the probable demand in the lead time between order and delivery;
- the risk of having excess inventory (buffer stock) and its cost;
- the risk of stock-outs, and their cost.

The reorder level selected might be the reorder level at which the expected value (EV) of cost is minimized

► *Example 07:*

Entity X uses item Z in its production process. It purchases item Z from an external supplier, in batches.

For item Z, the following information is relevant:

Holding cost	Rs.15 per unit per year
Stock out cost	Rs.5 for each stock-out
Lead-time	1 week
EOQ	270 units

Entity X operates for 48 weeks each year. Weekly demand for unit Z for production is variable, as follows:

Units demanded during the lead time	Probability
70	10%
80	20%
90	30%
100	40%

in suggesting, whether a reorder level of 90 units or 100 units would be more appropriate. The probabilities in the above example allow us to identify the possible stock-outs associated with different reorder levels.

Demand is always greater than 60 units in the lead time. Therefore, if the company allowed inventory to fall to 60 units before placing an order, it would face a stock shortage in every lead time. There is a 10% chance that demand would be 70 leading to a shortage of 10 units, a 20% chance that demand would be 80 leading to a shortage of 20 units, a 30% chance that demand would be 90 leading to a shortage of 30 units and a 10% chance that demand would be 100 leading to a shortage of 40 units. This can be used to work out the expected value of the stock out and its associated cost.

Setting a higher reorder level reduces the chance of a stock out but the company would then have more inventory on hand on average and this would increase holding cost. For example, if the company set the reorder level to 80 units it would only face stock-out if demand were greater than 80 in the lead time. The above information shows that there is a 30% chance that demand would be 90 leading to a shortage of 10 units and a 10% chance that demand would be 100 leading to a shortage of 20 units. Thus, the stock-out cost would be reduced. However, the company would hold an extra 20 units on average compared to a reorder level of 60 units.

In doing so, following steps are suggested:

Step 1: Calculate the average demand in the lead time

The average demand in the lead-time is:

(70 × 10%) + (80 × 20%) + (90 × 30%) + (100 × 40%) = 90 units

Average annual demand is 48 weeks × 90 units = 4,320 units.

Since the EOQ is 270 units, entity X will expect to place $\frac{4,320}{270}$ orders = 16 orders each year.

Therefore, there will be 16 lead times each year.

Step 2: Set up a probability table

(Starting with a reorder level set to the average demand in the lead time and then looking at higher reorder levels).

Reorder level of 90 (the company will be out of stock if demand is greater than 90)	
Demand = 100	
Stock outs if demand is 100	10 units
Probability of demand of 100	× 0.4
Cost per stock out	× Rs. 5
Number of orders per year	× 16
Annual stock out cost	320
Buffer stock (reorder level – average demand in lead time)	nil
	320
Reorder level of 100 (the company will never be out of stock)	
Stock out cost	nil
Buffer stock (reorder level – average demand in lead time)	10 units
Holding cost per unit per annum	× Rs. 15
	Rs. 150
The reorder level should be set at 100 units. The extra cost of the buffer stock (Rs. 150) achieves savings by reducing the stock out cost (Rs. 320).	

2.2. Maximum inventory level:

A company will set a maximum level for inventory. Inventory held above this would incur extra holding cost without adding any benefit to the company.

The inventory level should never exceed a maximum level. If it does, something unusual has happened to either the supply lead time or demand during the supply lead time. The company would investigate this and take action perhaps adjusting purchasing behavior.

When demand during the supply lead time is uncertain and the supply lead time is also uncertain, the maximum inventory level is found as follows.

Maximum inventory level:	
Re-order level	X
Add: Re-order quantity / EOQ	X
	XX
Less: Minimum Demand x Minimum Lead Time	(X)
	X

2.3. Minimum inventory level:

The inventory level could be dangerously low if it falls below a minimum warning level. When inventory falls below this amount, management should check that a new supply will be delivered before all the inventory is used up, so that there will be no stock-out.

When demand during the supply lead time is uncertain and the supply lead time is also uncertain, the minimum (warning) level for inventory is set as follows.

Minimum inventory level:	
Re-order level	X
Less: Average Demand x Average Lead Time	(X)
	X

- *Example 08:*

Stock Item 6787:

Data relating to stores item 6787 are as follows.

Daily use: 300 units

Lead time for re-supply: 5 – 20 days

Reorder quantity: 10,000 units

in order to identify the reorder level for this stock item, to avoid the possibility of inventory-outs, following calculations would be required:

Reorder level to avoid inventory-outs

= Daily demand × Maximum lead time

= 300 units × 20 days

= 6,000 units.

- *Example 09:*

Robin Limited (RL) imports a high value component for its manufacturing process. Following data, relating to the component, has been extracted from RL's records for the last twelve months:

Maximum usage in a month	300 units
Minimum usage in a month	200 units
Average usage in a month	225 units
Maximum lead time	6 months
Minimum lead time	2 months
Re-order quantity	750 units

The average stock level for the component would be calculated as follows:

Average stock level:

Average stock level = minimum level + ½ (reorder quantity)

As minimum level is not given it will be computed as follows:

Re-order level = maximum usage × maximum lead time

Re-order level = 300 × 6 = 1,800 units.

Minimum level = Re-order level – (average usage × average lead time)

Minimum level = 1,800 – (225 × (6+2/2) = 900 units.

Therefore, Average stock level = 900 + (½ 750) = 1,275 units.

3. COMPREHENSIVE EXAMPLES

- *Example 01:*

Orchid Limited (OL) is a trading concern. It is planning to implement Economic Order Quantity model (EOQ) from 1 April 2019. OL deals in four products each of which is purchased from a different supplier. To compute EOQ for one of its products Beta, the following data has been gathered:

i. Actual data for the last year relating to Beta:

Annual Sales	Units	72,000
Safety Stocks	Units	2,000
Transit Losses as % of purchases		10%
Average Holding Cost per Month	Rs.	500,000
Average Holding Cost per Month per Unit	Rs.	80
Number of Purchase Order issued for Beta		40

ii. Total cost of purchase department for the last year amounted to Rs. 4,500,000 which included fixed cost of Rs. 1,350,000. A total of 100 purchase orders were issued during the last year.

iii. Projections for the next year:

Increase in Sales Volume		25%
Safety Stock	Units	2,500
Transit Losses as % of Purchase		6%
Impact of inflation on all costs		10%

iv. Closing inventory (excluding safety stock) varies in line with the sale volume.

EOQ for Beta can be calculated as follows:

Annual demand (Purchases):		**Units**
Projected sales	72,000×1.25	90,000
Opening stock - including safety stock	(500,000÷80)	(6,250)
Closing stock - including safety stock	[(6,250–2,000)×1.25]+2,500	7,813
Purchases - net of transit losses		91,563
Purchases including transit losses of 6%	91,563÷0.94	**97,407**

Ordering cost per order:		**Rupees**
Variable cost	(4,500,000–1,350,000)×(1.1÷100)	34,650
Holding cost per unit per annum	80×1.1×12	1,056

Economic Order Quantity (EOQ):	**Units**
SQRT[(2×Annual demand × Ordering cost per order)÷Carrying cost per unit]	
SQRT[(2×97,407×34,650)÷1,056]	**2,528**

- *Example 02:*

ABC has recently established a new unit in Multan. Its planning for the first year of operation depicts the following:

i.	Cash sales	600,000 units
ii.	Credit sales	1,200,000 units
iii.	Ending inventory	Equivalent to 15 days sales
iv.	Number of working days in the year	300
v.	Expected purchase price	Rs. 450 per unit

Manufacturer offers 2% discount on purchase of 500 units or more as bulk quantity discount. The company intends to avail this discount.

vi. Carrying costs include:

- Financial cost of investment in inventory @ 16% per annum.
- Godown rent of Rs. 10,000 per month.

vii. Ordering costs are Rs. 300 per order.

Computation of the Economic Order Quantity (EOQ) and the estimated carrying costs and ordering costs for the first year of operation would be as follows.

Computation of annual requirement	
Units sold on cash basis	600,000
Units sold on credit basis	1,200,000
Ending Inventory (1.8 million x 15/300)	90,000
Annual purchases	1,890,000
Computation of Carrying Cost per unit	
Carrying cost per unit (Rs. 450 × 98% × 16%) (Bulk quantity discount availed)	Rs. 70.56

Computation of EOQ

EOQ = $\sqrt{\frac{2 \times 1{,}890{,}000 \times 300}{70.56}}$

= 4,009 units

Estimated carrying cost	= (EOQ/2) × carrying cost per unit
	= 4,009/2 × 70.56
	= Rs. 141,438
Add: Godown rent p.a.	= Rs. 120,000
Total carrying cost	= Rs. 261,438
Estimated ordering cost	= (annual requirement / EOQ) × cost per order
	= (1,890,000 / 4,009) × 300
	= Rs.141,432

► *Example 03:*

Karachi Limited is a large retailer of sports goods. The company buys footballs from a supplier in Sialkot. Karachi Limited uses its own truck to pick the footballs from Sialkot. The truck capacity is 2,000 footballs per trip and the company has been getting a full load of footballs at each trip, making 12 trips each year.

Recently the supplier revised its prices and offered quantity discount as under:

Quantity	Unit price (Rs.)
2,000	400
3,000	390
4,000	380
6,000	370
8,000	360

Other related data is given below:

- All the purchases are required to be made in lots of 1,000 footballs.
- The cost of making one trip is Rs. 15,000.
- The company has the option to hire a third party for transportation which would charge Rs. 9 per football. The cost of placing an order is Rs. 2,000.
- The carrying cost of one football for one year is Rs. 80.

i. When required to work out the most economical option, below are the computations involved

Karachi Limited

Price per football	A	400	390	380	370	360
Annual purchases (nos.)	B	24,000	24,000	24,000	24,000	24,000
Purchase cost	A × B	9,600,000	9,360,000	9,120,000	8,880,000	8,640,000
Minimum order size	C	2,000	3,000	4,000	6,000	8,000
No. of orders (B÷C)	D	12.00	8.00	6.00	4.00	3.00
Ordering cost	D × 2,000	24,000	16,000	12,000	8,000	6,000
Trips per order (C÷2,000)	E	1.00	1.00 + (hired transport)	2.00	3.00	4.00
Total no. of trips (D×E)	F	12.00	8.00	12.00	12.00	12.00
Transportation cost	F×15,000	180,000	120,000	180,000	180,000	180,000
Hired transport cost	8,000 units×9		72,000			
Average inventory (C÷2)	G	1,000	1,500	2,000	3,000	4,000
Inventory carrying cost	G × 80	80,000	120,000	160,000	240,000	320,000
Total cost (Rs.)		9,884,000	9,688,000	9,472,000	9,308,000	9,146,000

ii. Also computation of the annual savings in case the company revises its policy in accordance with the computation in (i) above, will be as follows.

The most economical option is to purchase 3 lots of 8,000 footballs each against the existing purchases of 12 lots of 2,000 footballs. The saving will be as under:

Cost for 12 lots of 2,000 footballs each.		9,884,000
Cost for 03 lots of 8,000 footballs each.		9,146,000
Cost saving	Rs.	738,000

▶ *Example 04:*

Modern Distributors Limited (MDL) is a distributor of CALTIN which is used in various industries and its demand is evenly distributed throughout the year.

The related information is as follows:

- Annual demand in the country is 240,000 tons whereas MDL's share is 32.5% thereof.
- The average sale price is Rs. 22,125 per ton whereas the profit margin is 25% of cost.
- The annual variable costs associated with purchasing department are expected to be Rs. 4,224,000 during the current year. It has been estimated that 10% of the variable costs relate to purchasing of CALTIN.
- Presently, MDL follows the policy of purchasing 6,500 tons at a time.
- Carrying cost is estimated at 1% of cost of material.
- MDL maintains a buffer stock of 2,000 tons.

AT A GLANCE SPOTLIGHT STIKCY NOTES

Computation of the amount of savings that can be achieved if MDL adopts the policy of placing orders based on Economic Order Quantity would be as follows:

Purchase department's variable cost:	Rs.	4,224,000
Costs applicable to product CALTIN - 10% of above	Rs.	422,400
Ordering costs per purchase order		
Annual purchases of CALTIN (tons) [240,000 x 32.5%)	Tons	78,000
Existing size of purchase order (tons)	Tons	6,500
No. of orders (78,000 / 6,500)	Orders	12
Ordering cost per order (422,400/12)	Rs.	35,200
Carrying costs per ton (22,125 / 1.25 x 1%)	Rs. Per Ton	177
Computation of EOQ $\sqrt{\frac{2 \times 78{,}000 \text{ tons x } 35{,}200}{177}} = 5{,}570$ tons		

		EOQ	Existing
Demand of CALTIN	Tons	78,000	78,000
Order quantity	Tons	5,570	6,500
No. of orders		14	12
Average inventory excluding buffer stock (Q / 2)	Tons	2,785	3,250
Cost of placing orders (Rs 35,200 per order)	Rupees	492,800	422,400
Carrying cost ([Avg. Inventory x Rs. 177)	Rupees	492,945	575,250
Total costs	Rupees	985,745	997,650
Savings on adoption of EOQ	Rupees	11,905	

► *Example 05:*

Aroma Herbs (AH) deals in a herbal tea. The tea is imported on a six monthly basis. The management is considering to adopt a stock management system based on Economic Order Quantity (EOQ) model. In this respect, the following information has been gathered:

i. Annual sale of the tea is estimated at 60,000 kg at Rs. 1,260 per kg. Sales are evenly distributed throughout the year.

ii. C&F value of the tea after 10% discount is Rs. 900 per kg. Custom duty and sales tax are paid at the rates of 20% and 15% respectively. Sales tax paid at import stage is refundable in the same month.

iii. Use of EOQ model would reduce the quantity per order. As a result, bulk purchase discount would be reduced from 10% to 8%.

iv. Cost of financing the stock is 1% per month.

v. Annual storage cost is estimated at Rs. 320 per kg.

vi. Administrative cost of processing an order is Rs. 90,000. Increase in number of purchase orders would reduce this cost by 10%.

vii. AH maintains a buffer stock equal to fifteen days' sales.

a) Economic order quantity can be computed as follows (EOQ):

Annual demand of herbal tea	**(A) kg**		60,000.00

			Rupees
Purchase cost per kg (C&F + Import duty)	[(900÷0.9)*0.92 ×1.2]	B	1,104.00
Ordering cost per purchase order	90,000×90%	C	81,000.00
Annual holding cost per kg			

		Rupees
- Finance cost	B×1%×12	132.48
- Storage cost		320.00
	(D)	452.48
EOQ =		
SQRT [(2×annual demand × ordering cost) ÷ Holding cost per kg)]		
SQRT [(2×60,000×81,000)÷452.48)]	(E) kg	4,635.00

b) Determination of the amount of savings (if any) which can be achieved by AH by adopting the stock management system based on EOQ model would be as follows

Savings on adopting EOQ:

No. of purchase orders (A÷E) (F)		13	2
Holding of inventory:			
- Average inventory	(E÷2); (A÷F ÷2)	2,318	15,000
- Buffer stock		2,500	2,500
	(G)	4,818	17,500

		-------- Rupees --------	
Ordering costs	(C×F); (90,000×F)	1,053,000	180,000
Holding costs of inventory	(G×D); (G×*449.6)	2,180,049	7,868,000
Purchasing cost of tea	(A×B); (60,000×900×1.2)	66,240,00 0	64,800,000
Cost of 60,000 kg of tea		69,473,04 9	72,848,000
Savings on using EOQ model (72,848,000 – 69,473,049)		3,374,951	
**Existing holding cost per unit (900×1.2×0.12)+320=449.6*			

▶ *Example 06:*

Chocó-king Limited (CL) produces and markets various brands of chocolates having annual demand of 80,000 kg. The following information is available in respect of coco powder which is the main component of the chocolate and represents 90% of the total ingredients.

i. Cost per kg is Rs. 600.

ii. Process losses are 4% of the input.

iii. Purchase and storage costs are as follows:

- Annual variable cost of the procurement office is Rs. 6 million. The total number of orders (of all products) is estimated at 120.
- Storage and handling cost is Rs. 20 per kg per month.
- Other carrying cost is estimated at Rs. 5 per kg per month.

iv. CL maintains a buffer stock of 2,000 kg.

a) Economic order quantity (EOQ) can be calculated as follows:

Annual requirement of the coco powder	80,000÷0.96×90% kg	75,000
Ordering cost per order	(6,000,000÷120) Rs.	50,000
Storage and handling	20×12	240
Other carrying cost	5×12	60
Carrying cost per kg	Rs.	300
Economic order quantity (EOQ)		
SQRT[(2 × Annual demand × Ordering cost per order) ÷ Carrying cost per kg]		
SQRT[(2×75,000×50,000)÷300] = $\sqrt{25,000,000}$ = 5,000		

AT A GLANCE SPOTLIGHT STIKCY NOTES

A vendor has offered to CL a quantity discount of 2% on all orders of minimum of 7,500 kg. Advise CL, whether the offer of the vendor may be accepted. This would require computation as below:

b) Analysis of purchases using EOQ / minimum quantity as offered by the vendor:

			EOQ	Vendor's offer
No. of orders	(75,000÷5,000), (75,000÷7,500)	A	15.00	10.00
Average inventory including buffer stock (Order quantity÷2)+2,000		B	4,500	5,750

		Rs.	Rs.
Annual cost of placing orders	(A×50,000)	750,000	500,000
Carrying cost	(B×300)	1,350,000	1,725,000
Discount on placing order of 7,500 kg each	(75,000×600×2%)	-	(900,000)
Net cost		2,100,000	1,325,000
Annual saving on acceptance of vendor's offer			775,000

- *Example 07:*

Hockey Pakistan Limited (HPL) is engaged in the manufacturing of a single product 'H-2' which requires a chemical 'AT'. Presently, HPL follows a policy of placing bulk order of 60,000 kg of AT. However, HPL's management is presently considering to adopt economic order quantity model (EOQ) for determining the size of purchase order of AT.

Following information is available in this regard:

i. Average annual production of H-2 is 45,600 units. Production is evenly distributed throughout the year.

ii. Each unit of H-2 requires 10 kg of AT. Cost of AT is Rs. 200 per kg. 5% of the quantity purchased is lost during storage.

iii. Annual cost of procurement department is Rs. 2,688,000. 65% of the cost is variable.

iv. AT is stored in a third party warehouse at a cost of Rs. 6.25 per kg per month.

v. HPL's cost of financing is 8% per annum.

a) Computation of Economic Order Quantity (Units to order) would be as follows

SQRT [(2×annual demand × ordering cost) ÷ Holding cost per kg)]		
SQRT [(2×480,000 (W-4) × 218,400 (W-1) ÷ 91(W.5)]		48,000
W-1: Ordering cost per order (Rs.)	(1,747,200(W-2)÷8 (W-3)	218,400
W-2: Purchase department cost -Variable cost (Rs.)	2,688,000×65%	1,747,200
W-3: Number of orders	480,000 (W-4)÷60,000	8
W-4: Annual Requirement of AT (kg)	45,600×10/95%	480,000
W-5: Holding cost (Rs. per unit)		Rs. per unit
Storage cost	(6.25 per kg per month×12)	75
Finance cost	200×8%	16
Total holding cost (Rs. per unit)		91

b) Supplier of AT has offered a discount of 5% quantity per order is increased to 120,000 kg. Whether HPL should accept the offer or not, the evaluation would involve following:

Evaluation of discount offer from supplier of AT

Comparison of cost		EOQ	As per offer
Annual Requirement of AT (kg)	A (W-4)	480,000	480,000
Order quantity (kg)	B (EOQ, Given)	48,000	120,000
Number of orders	C=A/B	10	4
Average inventory (kg)	D=B/2	24,000	60,000
		--------- Rupees ---------	
Ordering cost	C×218,400 (W-1)	2,184,000	873,600
Holding cost D×91(W-5);[D×{75(W-5)+(16(W-5)×95%)}]		2,184,000	5,412,000
Purchase cost (200×480,000); (200×480,000×95%)		96,000,000	91,200,000
Total cost		100,368,000	97,485,600

Opinion: Offer from AT's supplier should be accepted as it would reduce the purchase cost.

c) The practical limitations/assumptions of EOQ are as follows

i. The formula assumes that demand/usage is constant throughout the period. In practice, actual demand/usage may be uncertain and subject to seasonal variations.

ii. Holding cost per unit are assumed to be constant. Further, many holding costs are fixed throughout the period and not relevant to the model whereas some costs (e.g. store keepers' salaries) are fixed but change in steps.

iii. Purchasing cost per unit is assumed to be constant for all purchase quantities and is ignored while calculating order size in EOQ. In practice, quantity discounts can be available in case of bulk purchasing.

iv. The ordering costs are assumed to be constant per order placed. In practice, most of the ordering costs are fixed or subject to stepwise variation. It is therefore, difficult to estimate the incremental cost per order.

► *Example 08:*

Alpha Motors (Pvt.) Ltd. uses a special gasket for its automobiles which is purchased from a local manufacturer. The following information has been made available by the procurement department:

Annual requirement (no. of gaskets)	162,000
Cost per gasket (Rs.)	1,000
Ordering cost per order (Rs.)	27,000
Carrying cost per gasket (Rs.)	300

The gaskets are used evenly throughout the year. The lead time for an order is normally 11 days but it can take as much as 15 days. The delivery time and the probability of their occurrence are given below:

Delivery time (in days)	Probability of occurrence
11	68%
12	12%
13	10%
14	6%
15	4%

AT A GLANCE SPOTLIGHT STIKCY NOTES

a) Computation of EOQ and Ordering Costs, Assuming a 360 day year.

$$EOQ = \sqrt{\frac{2 \times 162{,}000 \times 27{,}000}{300}}$$

EOQ = 5,400 gaskets

Number of orders = 162,000 / 5,400 = 30 Orders

Ordering costs = 30 x Rs. 27,000 = Rs. 810,000

b) Computation of the safety stock and re-order level if the company is willing to take (Assuming a 360 day year):

- 20% risk of being out of stock?
- 10% risk of being out of stock?

Safety stock required to be maintained at 20% and 10% risk level

	Risk level	
	20%	10%
Number of days required to be maintained	1	2
Safety Stock		
1 x 450 (W-1)	450	
2 x 450 (W-2)		900

W-1

Average Stock requirements per day = Annual Demand ÷ 360 days

= 162,000 ÷ 360 = 450

Re-Order Level at 20% and 10% risk level

Re-order level = (Average Consumption x Average Lead Time) + Safety Stock

Re-order level at 20% = (450 x 11) + 450 = 5,400 gaskets

Re-order level at 10% = (450 x 11) + 900 = 5,850 gaskets

Notice the trade off, in the above example, between the cost of stock out and the holding costs at different reorder levels. A higher reorder level reduces the chance of a stock out but incurs higher holding costs.

Practically the risks associated with a stock out are so great that the company always tries to avoid it even if it leads to extra holding cost.

► *Example 09:*

Hi-way Engineering Limited uses budgeted overhead rate for applying overhead to production orders on a direct labor cost basis for department A and on a machine hour basis in department B.

The company made the following forecasts for August 2006:

	Dept A	Dept B
Budgeted factory overhead (Rs.)	216,000	225,000
Budgeted direct labor cost (Rs.)	192,000	52,500
Budgeted machine hours	500	10,000

During the month, 50 units were produced in Job no. CNG-011. The job cost sheet for the month depicts the following information:

	Dept A	Dept B
Material issued (Rs.)	1,500	2,250
Direct labor cost (Rs.)	1,800	1,250
Machine hours	60	150

Actual data for the month were as follows:

	Dept A	Dept B
Factory overhead (Rs.)	240,000	207,000
Direct labor cost (Rs.)	222,000	50,000
Machine hours	400	9,000

a) Predetermined overhead rates for each department would be computed as follows:

	Dep A	Dep B
Budgeted factory overhead (Rs.)	216,000	225,000
Pre determined Overhead rate	216,000/192,000*100= 125% of labor cost (activity= labor cost)	225,000/10,000= 22.5 per machine hours (activity=machine hour)

b) The total costs and unit cost of Job no. CNG-011, would be as follows

	Dep A	Dep B	Total cost
Material issued (Rs.)	1500	2250	3750
Direct labor cost (Rs.)	1800	1250	3050
Factory overheads (actual activity*predetermined overhead rate)	2250	3375	5625
Total cost	5550	6875	12425
Number of units	50	50	50
Per unit cost (total cost/number of units)	111	137.5	248.5

c) The over / under applied overhead for each department would be as follows:

	Dep A	Dep B
Actual factory overheads	240,000	207,000
Applied factory overheads (actual activity*predetermined overhead rate)	277,500	202,500
(over) under applied factory overheads	(37,500)	4500

STICKY NOTES

Inventory management refers to the process of ordering, storing and using a company's inventories

Relevant costs are the cost that occur on the occurrence of an activity.

Economic order quantity is used to determine the order quantity at which cost is minimum.

The EOQ can be determined using tabular method, graphical method and EOQ formula

Inventory management includes determining re-order level, safety stock, minimum and maximum inventory levels.

CHAPTER 3

OVERHEADS

IN THIS CHAPTER

AT A GLANCE

Overheads are the costs those that incur in the course of making a product, providing of service or running department but which cannot be traced directly and fully to the product, service or department.

Overheads are charged to departments, cost center, cost pools and products using a predetermined rate.

Predetermined rate is determined using estimated figures of the overhead cost and the activity level.

Shared costs of service departments are distributed among departments first and then total overheads are calculated for the production departments to be further allocated to products.

At the end of the period, the applied overhead is compared with actual overhead to determine over or under absorption of overheads.

1. MANUFACTURING EXPENSES

Manufacturing expenses are of two types:

1. **Direct expenses** – expenses that are fully traceable to the product, service or department that is being costed.

▶ *Examples:*

- Raw Materials that are specifically used for the product in consideration,
- Labor which is directly involved in converting the raw material
- Other expenses that are specifically incurred for the product.

2. **Indirect expenses (Production overheads)** –are those expenses that incur in the course of making a product, providing of service or running department but which cannot be traced directly and fully to the product, service or department.

▶ *Examples:*

- Labor which is not directly involved in the conversion of raw material but indirectly involved in making of the product. Such as supervisor who is responsible to supervise the production process is not directly involved and therefore treated as indirect cost,
- Tools, spares and materials that are used in the machinery or equipment used in the production,
- Factory rent if the factory premises are hired,
- Depreciation of machinery and equipment.
- Electricity and other utility expenses incurred for the production facilities

The manufacturing expenses generally comprise:

a) Direct materials,
b) Direct labors and
c) Production / manufacturing / factory overheads.

Note:
Material cost + Labor cost are called 'Prime Costs'
Labor cost + Overhead cost are called 'Conversion Costs'

1.1 Cost Behaviors:

Cost behaviors refer to how a cost reacts to changes in the level of activity. As the activity level rises or falls, a particular cost may rise or fall as well or it may remain constant. To help make such distinctions, the costs are often categorized as 'variable cost' or 'fixed cost'

Variable costs are those that vary with the level of output. For example, 100 units of raw materials are used to produce 100 units of the final product. It means for one unit of final product one unit of raw material will be required. Where the cost of one unit of material is Rs.10, the cost of 100 units will be (10x100) Rs. 1,000. Similarly, labors take two hours to produce 1 unit of final product and so 400 hours will be used to produce 200 units. The labors charge Rs. 5 per hour and so there cost at 200 units using 400 hours will be Rs. 2,000. Since these costs vary with the variations in the output therefore, these are called variable costs.

The variable expenses are fixed per unit of output while they vary in total.

Note: there are few expenses that are called **'Semi-variable'** because they carry some fixed part of cost and some variable. For example, electricity bill comprises of fixed charges as line rent / fixed connection charges as well as variable charges based on units of power consumed.

Fixed costs are those that occur irrespective of the level of output. For example, the rent of the factory shall be charged on monthly basis whether or not the production is carried. The rent is charged for the occupation of the premises and therefore, do not vary with the production.

Fixed expenses vary per unit of output while they are fixed in total.

For example, factory rent is Rs. 10,000 per month. During month 1, the company produced 100 units and during month 2 it produced 150 units. The rent per unit for month 1 and 2 would be Rs. 100 (10,000/100) and Rs. 66.67 (10,000/150) however, the actual cost paid is Rs. 10,000 each month.

Note: Few fixed costs are called **'Step fixed costs'** which remains same at certain activity level and changes when the activity level changes. For example, a company uses one supervisor to supervise up to 25 labors who produce 100,000 units a month. The cost of supervisor is Rs. 15,000. Next month, the company intends to produce 125,000 units using 6 more labors. Now a new supervisor would be required to supervise additional 6 labors and 25,000 units. The cost is now increased to 30,000 when the activity level increased.

1.2 Production overheads and non-production overheads:

Production Overheads:

Overheads that incur in relation to the production processes are called production overheads (also called manufacturing overheads / factory overheads). For example, salary of factory supervisor, depreciation of production machine, electricity cost of factory, rent of factory premises etc.

Non-Production Overheads:

Overheads that incur to support the overall objectives of the business are called non-production overheads. For example, salaries of sales team, salaries of finance, HR and IT teams, rent of the building occupied by finance, IT, sales and HR departments (other than production department), Depreciation of computers being used in these departments etc. These are classified as 'Administrative Expenses, Marketing, Selling and Distribution Expenses' in the Statement of Comprehensive Income.

Administrative Expenses:

The term administration generally relates to the functions necessary for the overall running of the business. Administrative costs include all costs associated with the general management of the organization rather than with manufacturing or selling. Examples of administrative activities include implementing and ensuring the effectiveness of fire extinguishing system for the safety of employees and overall business, ensuring the overall security of the business premises, the accounting and finance, human resource and information technology functions of the business are classified under administration and the cost incurred to run these functions are called administrative expenses.

These are mostly fixed expenses and charged to profit and loss account in the period in which they occur.

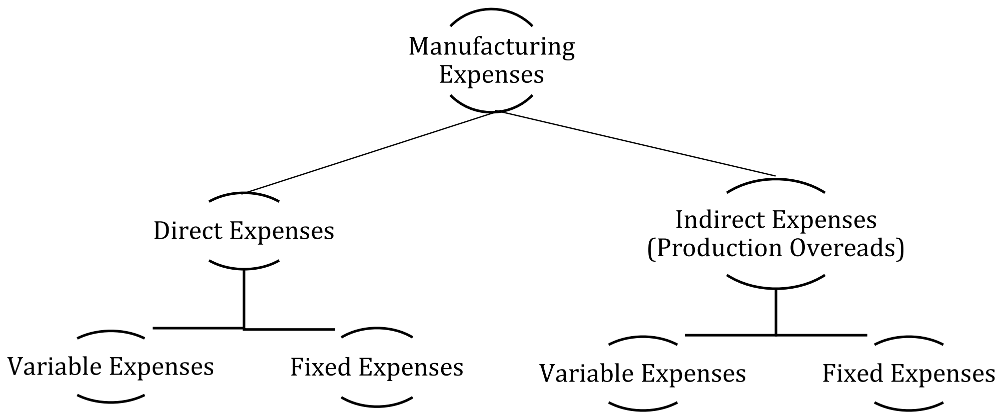
Marketing, Selling and Distribution Expenses:

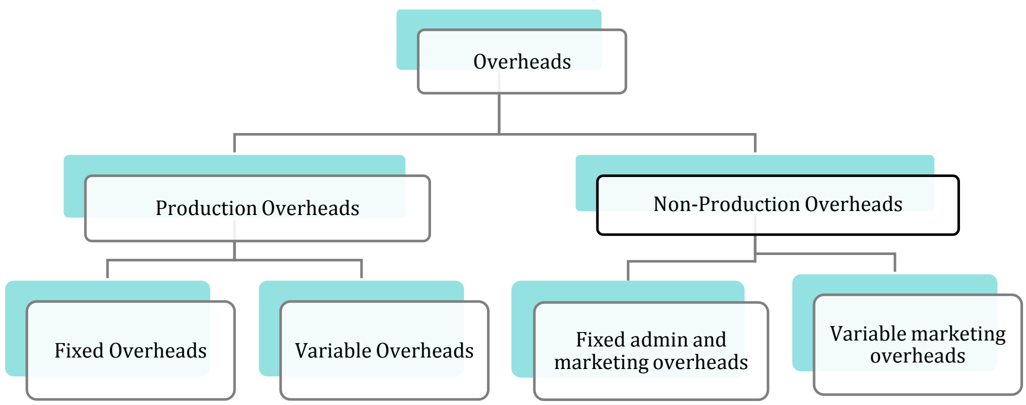
These expenses are related to the process of selling inventory to customers. These costs include all costs that are incurred to secure customer orders and get the finished product to the customer. Examples of marketing, selling and distribution activities are advertising the company's products / services on electronic and print media, devising and implementing marketing strategies to enter new markets, obtaining information about customers and competitors, distributing products to the markets for the customers, obtaining feedbacks from customers after sales and providing after sales services. The costs so incurred in performing such activities are classified as marketing, selling and distribution expenses.

These are both fixed and variable. Salaries of marketing staff, cost of advertisement, depreciation of equipment used in the marketing and distribution department etc. are fixed expenses. Commission of sales staff which depends on the number of units sold, delivery charges per weight of the unit or area of the carrier occupied by the unit are considered as variable expenses.

The administrative and marketing, selling and distribution expenses are never made part of the cost of the product. However, for internal reporting purposes (marginal costing) the variable marketing and selling costs are charged to cost of goods sold in determining the contribution margin. (This concept is discussed in Chapter 5)

These multiple bifurcations of expenses are elaborated as under:





In addition to classifying costs as manufacturing and non-manufacturing, they can also be classified as period cost and product cost. To understand the difference between product costs and period costs, we must first recall the matching principle from financial accounting.

The matching principle is based on the accrual concept that costs incurred to generate a particular revenue should be recognized as expenses in the same period that the revenue is recognized. This means that if a cost is incurred to acquire or make something that will eventually be sold, then the cost should be recognized as an expense only when the sale takes place—that is, when the benefit occurs. Such costs are called **product costs.**

Period costs are all costs that are not product costs. Period costs are not included as part of the cost of either purchased or manufactured goods instead, period costs are expensed in the period in which they are incurred.

Identifying manufacturing overheads:

Overhead	Classification
Depreciation of factory machinery	Manufacturing overhead
Factory insurance	Manufacturing overhead
Salary of the Finance Director	Administration overhead
Depreciation of the accounts clerk's computer	Administration overhead
Petrol used in delivery vehicles	Selling overhead
Cost of an advertising campaign	Selling overhead

2. COSTING OF PRODUCTION OVERHEADS

When more than one products are being produced using the same facilities, then they are allocated cost on individual basis. The costs that are directly attributable to the product can be easily allocated to that product. However, costs that are incurred in accumulation for all the products, need to be allocated on systematic basis.

The simplest way to allocate such cost is to divide the total cost on total units produce. If all the products utilize same amount of the resources, then such a method is acceptable. However, practically, the products use the resources in different proportion.

Also, businesses tend to keep their costs at predetermined / estimated rates (standard rates) so that planning and budgeting can be made with some certainty.

Furthermore, as the fixed cost per unit change when the volume changes, it will not be good to charge the cost of inefficiency (that is low production volumes) to the customers as the cost per unit will increase if volume decreases. Similarly, the savings on high volume production is also not offered to the customers.

Another reason is that sales price is kept constant during a certain period (say for one year) because if on the basis of fixed costs, the cost per unit changes every month and the company changes the sale price accordingly, the customers would have to compare the prices with competitors each time the price changes, which may result in loss of customers as well as fluctuating results every month. Therefore, the sales price is kept constant. When the sale price is constant, the management should want the cost per unit be constant so as to identify inefficiencies and to avoid month to month fluctuations.

Therefore, an overhead rate is determined using estimates of cost and activity level rather than actual results.

2.1 Predetermined Factory Overhead Rate:

$$\frac{Estimated\ Factory\ Overhead}{Estimated\ Base\ to\ be\ Used}$$

Estimated factory overhead:

The estimated factory overhead is the amount of overheads that management expects to incur in the coming periods. This shows that factory overhead rate is calculated in advance and for certain length of period (say for one year).

Base to be used:

The following bases can be used for this purpose:

1. Physical output
2. Direct material cost
3. Direct labor cost
4. Direct labor hours
5. Machine hours

The selection of the base depends upon the nature or the function of the factory overhead. For example, if the factory overhead cost comprises indirect labor predominantly, the direct labor cost or hour can be used as base. If it relates to machine expenditures such as maintenance, depreciation and normal wear tear, then the base could be machine hours.

The base selection also depends on the nature of business and it may vary from company to company, department to department and one cost center to the other.

- *Example 01:*

Ahsan Enterprises (AE) produces three products Alpha, Beta and Gamma. The management has some reservations on the method of costing. Consequently, the cost accountant has reviewed the records and gathered the following information:

i. The costs incurred during the latest quarter were as follows:

	Rupees
Direct material	240,000
Direct labor	1,680,000
Indirect wages – machine maintenance	600,000
– stores	360,000
– quality control	468,000
– cleaning and related services	400,000
Fuel and power	2,800,000
Depreciation on plant, machinery and building	1,560,000
Insurance on plant and machinery	240,000
Insurance on building	60,000
Stores, spares and supplies consumed	1,800,000
Rent, rates and taxes	1,200,000

ii. The production report for the previous quarter depicted the following information:

	Production (units)	Direct labor hours per unit	Machine hours per unit	Inspection hours per unit
Alpha	12,000	20.00	6.00	2.00
Beta	20,000	5.00	8.00	3.00
Gamma	45,000	4.00	10.00	4.00

The rate of depreciation for plant and machinery is 10% per annum.

a) Calculations that would be required to determine the factory overhead rate on various basis are as follows:

a) Physical Output Bases:

$$\frac{Factory\ Overhead\ Cost}{Total\ Units\ Produced}$$

$$\frac{9{,}488{,}000}{77{,}000\ (w-1)}$$

Factory Overhead Rate = Rs. 123.221 per unit

b) Direct Labor Cost Bases:

$$\frac{Factory\ Overhead\ Cost}{Total\ Direct\ Labour\ Cost} \times 100$$

$$= \frac{9{,}488{,}000}{1{,}680{,}000\ (given)} \times 100$$

Factory Overhead Rate = 564.76%

c) Direct Labor Hour Bases:

$$\frac{Factory\ Overhead\ Cost}{Total\ Direct\ Labour\ Hours}$$

$$\frac{9{,}488{,}000}{520{,}000\ (w-1)}$$

Factory Overhead Rate = Rs. 18.246 per direct labor hour

d) Machine Hour Bases:

$$\frac{Factory\ Overhead\ Cost}{Total\ machine\ Hours}$$

$$\frac{9{,}488{,}000}{682{,}000\ (w-1)}$$

Factory Overhead Rate = Rs. 13.912 per machine hour

W-1	Alpha	Beta	Gamma	Total
Physical Output	12,000	20,000	45,000	77,000
Direct Labor Hours per unit	20.00	5.00	4.00	
Total Hours	(12,000 x 20) = 240,000	(20,000 x 5) = 100,000	(45,000 x 4) =180,000	520,000
Machine Hours per unit	6.00	8.00	10.00	
Total Hours	(12,000 x 6) 72,000	(20,000 x 8) 160,000	(45,000 x 10) 450,000	682,000

b) Factory overhead cost allocable to each product can be determined as follows:

	Alpha	Beta	Gamma	Total
Allocation based on physical units:				
Physical Units	12,000	20,000	45,000	77,000
Factory Overhead Rate based on physical output	123.221	123.221	123.221	
Cost allocated to the products	(12,000* 123.221) = 1,478,652	(20,000* 123.221) = 2,464,420	(45,000* 123.221) = 5,544,945	9,488,000
Allocation based on direct labor cost:				
Direct Labor cost per unit	(1,680,000 /77,000) = 21.818	(1,680,000 /77,000) = 21.818	(1,680,000 /77,000) = 21.818	
Labor Cost for total units	(12,000* 21.818) = 261,818.182	(20,000* 21.818) = 436,363.636	(45,000* 21.818) = 981,818.182	1,680,000
Factory Overhead rate	564.76%	564.76%	564.76%	
Cost allocated to the products	(564.76%* 261,818.182) = 1,478,649.340	(564.76% * 436,363.636) = 2,464,415.605	(564.76% * 981,818.182) = 5,544,935.168	9,488,000

	Alpha	Beta	Gamma	Total
Allocation based on direct labor hours:				
Direct Labor Hours (w-1)	240,000	100,000	180,000	520,000
Factory overhead rate	18.246	18.246	18.246	
Cost allocated to the products	(240,000x 18.246) = 4,379,076.923	(100,000x 18.246) = 1,824,615.385	(180,000x 18.246) = 3,284,307.692	9,488,000
Allocation based on machine hours:				
Machine Hours (w-1)	72,000	160,000	450,000	682,000
Factory overhead rate	13.912	13.912	13.912	
Cost allocated to the products	(72,000x 13.912) = 1,001,665.689	(160,000x 13.912) = 2,225,923.754	(450,000* 13.912) = 6,260,410.557	9,488,000

Here, we can see that once the predetermined rate is calculated using all the bases, the factory overhead cost is then allocated to the products in the proportion of the utilization of such bases on which the rate was calculated.

Once the amount is distributed to the products, factory overhead cost per unit can be calculated.

We must also note that factory overhead cost allocated to products in each case is different. This is why selection of base is very crucial and management must determine with vigilance the appropriate base to be used.

2.2 Factors affecting the predetermined overhead rate:

In addition to the selection of bases, the following more factors are also considered:

1. Activity level selection
2. Inclusion or exclusion of fixed overheads
3. Single rate or several rates

2.2.1. Activity Level Selection:

Activity level can be described as the level at which the business performs its production activities. For example, a company has the capacity to produce 100,000 units every month using 7,000 labor hours and 5,000 machine hours. However, in past months the company has only produced 80,000 units due to the market demand. This shows that company's activity level is 80% (80,000/100,000) of its maximum capacity.

The company expects that there is no change in the demand and therefore, the same number of units shall be produced. This is called **Normal Capacity**.

If the company expects that the demand will increase or decrease and estimates a level at 90% or 70%, this is called **Expected Actual Capacity**.

In normal capacity, the overhead rate is calculated using average utilization of plant and expenditures over a period long enough to level out the highs and lows that occur in every business venture. A rate based on normal capacity should not change periodically because of change in actual production. The rate will be changed when the prices of certain expense items change or when fixed costs increase or decrease.

In expected actual capacity, the overhead rate is determined using the expected cost and production at expected actual output for the next production period. This method usually results in different predetermined rates for each period. When the company is unable to judge its current performance on a long range (normal capacity) then this activity level is used.

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2.2.2. Inclusion and Exclusion of Fixed Overheads:

In cost accounting there are two methods of assigning costs to the product:

a) Absorption costing / conventional costing or full costing
b) Marginal Costing or Direct Costing

In **Absorption costing**, both fixed and variable manufacturing expenses are included in product cost. However, in **Marginal costing**, fixed expenses are considered as period cost and not the product cost and therefore, are not included in the cost of the product.

Similarly, when predetermined overhead rate is determined, both fixed and variable overhead expenses are taken into account when using absorption costing, whereas, only variable overhead costs are taken into account in marginal cost system. This way, the fixed expenses shall be charged off in the profit and loss account in full unlike absorption where the portion of fixed cost is absorbed in the actual production.

2.2.3. Single Overhead Rate or Several Rates:

Overhead rates can be classified as:

a) Blanket rate or Plant-wide rate,
b) Departmental rates or Cost centers or cost pool rates.

A **plant-wide or blanket overhead rate** is used to describe a single overhead rate that is established for the organization as a whole.

If a business produces single product using one or more producing departments, a single overhead rate can be used. However, if more than one products are produced using more than one departments, and each of them consuming different amount of overheads in each department, then using a blanket rate would not allocate the justified cost to products. Therefore, a separate rate is determined for each independent department and are called **departmental rates**. Departments are also called cost centers. However, cost centers may be a small segment within a department.

► *Example 02:*

A company makes two products, Product X and Product Y. Each product is processed through two cost centers, CC1 and CC2. The following budgeted data is available.

	CC1	CC2
Allocated and apportioned overheads	Rs. 126,000	Rs. 180,000
(All overheads are fixed costs.)		
Direct labor hours per unit		
Product X	1.5	2.0
Product Y	1.2	2.6

The budgeted production is 12,000 units of Product X and 10,000 units of Product Y. Fixed overheads are absorbed into costs on a direct labor hour basis.

The budgeted total fixed overhead cost per unit for Product X and for Product Y can be calculated using:

a) Blanket rate

In blanket rate, the overhead costs and labor hours of both departments / cost centers shall be summed and evenly distributed between both the products irrespective of their usage of the labor hours. Thereafter, using the blanket overhead rate, the overhead cost shall be allocated to each product using number of hours used by each product. Then the total allocated cost is divided by total units to arrive at the cost per unit.

Factory Overhead rate = $(Factory\ Overhead)/(Direct\ Labour\ Hours)$

FOH rate = $144{,}000/((1.5 + 2.0) \times 12{,}000 + (1.2 + 2.6) \times 10{,}000)$

FOH rate = 144,000 / 80,000

Blanket rate of overhead = Rs. 1.8 per direct labor hour

b) Cost center rates:

In cost center rates, the total hours of each center shall be calculated first. The overhead cost of each department shall be divided by the total hours of that department to arrive at the absorption rate for each department / cost center. Thereafter, the overhead cost shall be charged to products on the basis of hours used by each unit of products.

		CC1		CC2
		Total hours		Total hours
Product X	12,000 × 1.5	18,000	12,000 × 2.0	24,000
Product Y	10,000 × 1.2	12,000	10,000 × 2.6	26,000
		30,000		50,000
Total overheads		Rs.126,000		Rs.180,000
Absorption rate per hour		Rs.4.20		Rs.3.60

Fixed overhead cost/unit		Product X		Product Y
		Rs.		Rs.
CC1	1.5 × Rs.4.20	6.30	1.2 × Rs.4.20	5.04
CC2	2.0 × Rs.3.60	7.20	2.6 × Rs.3.60	9.36
Total		13.50		14.40

We can see that in blanket rate, the overhead cost per unit is almost equal for both the products irrespective of the hours used by them. Therefore, departmental rates system provides more accurate allocation of overheads.

In some situations, it is possible to go a stage further and establish separate overhead rates for small segments within a department (such as group of similar machines in a department). These small segments are called cost centers. A department can be reciprocated as cost center. However, a cost center or cost pool describes a location to which overhead costs are initially assigned. The total cost accumulated in each cost center are then assigned to cost objects using a separate allocation base for each cost center. Therefore, it can be a department but it can also be a smaller segment.

When a departmental overhead rate is determined for the entire department, it may result in inaccurate allocation of overheads when a department consists of a number of different production centers with products passing through the departments consume overheads of each production center in different proportions. Therefore, determining overhead rates for each production centers / cost pools would help achieving the more accurate results.

- *Example 03:*

Using the data in Example 01, when required to calculate the factory overhead cost per unit, for each product, by allocating individual expenses on the basis of specific utilization of related facilities, please see below

	Allocation basis	Alpha	Beta	Gamma	Total
Production (no. of units) A		12,000	20,000	45,000	77,000
Machine hours per unit		6	8	10	
Total machine hours	Units x Machine hours per unit	72,000	160,000	450,000	682,000
Units inspected		600	400	1,350	2,350
Per unit inspection hours		2	3	4	
Total no. of hrs for units inspected	Units inspected x hours per unit	1,200	1,200	5,400	7,800
Overhead allocation:					
Indirect wages:					
Machine maintenance	Machine hours	63,343	140,763	395,894	600,000
Stores	Store consumption	144,000	54,000	162,000	360,000
Quality control	Inspected hours	72,000	72,000	324,000	468,000
Cleaning and related services	Factory space utilization	160,000	140,000	100,000	400,000
Fuel and power	Machine hours	295,601	656,892	1,847,507	2,800,000
Depreciation on plant and machinery	Machinery cost	600,000	400,000	300,000	1,300,000
Depreciation on building (1,560,000-1,300,000)	Factory space utilization	104,000	91,000	65,000	260,000
Insurance on plant and machinery	Cost of Machinery	110,769	73,846	55,385	240,000
Insurance on building	Factory space utilization	24,000	21,000	15,000	60,000
Stores, spares and supplies consumed	Actual	720,000	270,000	810,000	1,800,000
Rent, rates and taxes	Factory space utilization	480,000	420,000	300,000	1,200,000
Total overheads B	Rs.	2,773,714	2,339,500	4,374,786	9,488,000
Cost per unit (B/A)	Rs.	231.14	116.98	97.22	

In this example we could see that rate is calculated for each expense using its related activity and then allocation is based on the proportion utilized by the products of such activities.

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- *Example 04:*

A production center has three production departments, A, B and C.

Budgeted production overhead costs for the next period are as follows:

	Rs.
Factory rent	60,000
Equipment depreciation	80,000
Insurance	20,000
Heating and lighting	18,000
Indirect materials:	
Department A	7,000
Department B	6,600
Department C	9,400
Indirect labor:	
Department A	40,000
Department B	27,000
Department C	20,000

Insurance costs relate mainly to health and safety insurance, and will be apportioned on the basis of the number of employees in each department. Heating and lighting costs will be apportioned on the basis of volume.

Other relevant information is as follows:

	Total	Department A	Department B	Department C
Direct labor hours	18,000	8,000	6,000	4,000
Number of employees	50	20	16	14
Floor area (square metres)	1,200	300	400	500
Cost of equipment (Rs.000s)	1,000	200	600	200
Volume (cubic metres)	18,000	8,000	6,000	4,000

a) Calculation for the overhead costs and overhead absorption rate for the period for each production department, assuming that a separate direct labor hour absorption rate is used for each department, would be as follows.

	Basis of apportionment	Total	A	B	C
		-------------------Rs.----------------			
Indirect materials	Given	23,000	7,000	6,600	9,400
Indirect labor	Given	87,000	40,000	27,000	20,000
Rent	Floor area	60,000	15,000	20,000	25,000

	Basis of apportionment	Total	A	B	C
		--------------------Rs.------------------			
Depreciation	Equipment cost	80,000	16,000	48,000	16,000
Insurance	Employee numbers	20,000	8,000	6,400	5,600
Heating, lighting	Volume	18,000	8,000	6,000	4,000
Total		288,000	94,000	114,000	80,000
Direct labor hours			8,000	6,000	4,000
Absorption rate	(per direct labor hour)		Rs. 11.75	Rs.19.00	Rs.20.00

b) Then, overhead absorption rate for the period, assuming that a single factory-wide direct labor hour absorption rate is use, would be calculated as below:

If a single factory-wide absorption rate is used instead of separate absorption rates for each department, the absorption rate would be Rs.16 per direct labor hour (=Rs.288,000/18,000 hours).

2.3 Apportionment of Shared Overhead Costs of departments and cost centers:

Some costs cannot be allocated in full to a cost center, because they are shared by two or more cost centers. These are divided between the cost centers on a reasonable basis.

Before going further in this concept, we must know the types of departments within an organization.

With respect to the production process of an organization, there are two types of departments involved

1. Production / Manufacturing Department(s) – that are directly involved in the manufacturing such as cutting, assembling, finishing, machining and so on.
2. Service / Support Department(s) – that provide support to the manufacturing department(s) such as packaging department, materials procurement department, shipping, storage, inspection and so on.

Now, as the service centers provide support to all the production centers, their costs should be divided among those production centers in a systematic basis. Thereby, the process of cost accumulation to apportionment / allocation to absorption can be understood as:

1. Costs of all departments and cost pools are accumulated in those departments and cost pools.
2. The accumulated costs of service departments is then apportioned / allocated to the production departments.
3. The total accumulated costs (own plus allocated costs) of production departments are allocated to cost pools within those departments.
4. Cost accumulated at cost pools is then used to calculate the absorption rate.

► *Example 05:*

On December 1, 20X3 Zia Textile Mills Limited purchased a new cutting machine for Rs. 1,300,000 to augment the capacity of five existing machines in the Cutting Department. The new machine has an estimated life of 10 years after which its scrap value is estimated at Rs. 100,000. It is the policy of the company to charge depreciation on straight line basis.

The new machine will be available to Cutting Department with effect from February 1, 20X4. It is budgeted that the machine will work for 2,600 hours in 20X4. The budgeted hours include:

- 80 hours for setting up the machine; and
- 120 hours for maintenance.

The related expenses, for the year 20X4 have been estimated as under:

i. Electricity used by the machine during the production will be 10 units per hour @ Rs. 8.50 per unit.

ii. Cost of maintenance will be Rs. 25,000 per month.

iii. The machine requires replacement of a part at the end of every month which will cost Rs. 10,000 on each replacement.

iv. A machine operator will be employed at Rs. 9,000 per month.

v. It is estimated that on installation of the machine, other departmental overheads will increase by Rs. 5,000 per month.

Cutting Department uses a single rate for the recovery of running costs of the machines. It has been budgeted that other five machines will work for 12,500 hours during the year 20X4, including 900 hours for maintenance. Presently, the Cutting Department is charging Rs. 390 per productive hour for recovery of running cost of the existing machines.

In Computing the revised machine hour rate which the Cutting Department should use during the year 20X4, following working would be required.

Calculation of Annual Charges of New Machine

	Rupees
Total budgeted costs of existing five machines (Rs. 390 x (12,500 - 900))	4,524,000
Add: Costs of new machines	
i. Depreciation (1,300,000 – 100,000)/10 x 11/12	110,000
ii. Electricity (2,400 x 10 x Rs. 8.5)	204,000
iii. Cost of maintenance (Rs. 25,000 x 11)	275,000
iv. Part replacement (Rs. 10,000 x 11)	110,000
v. Operator Wages (Rs. 9,000 x 11)	99,000
vi. Departmental expenses (Rs. 5,000 x 11)	55,000
Total Cost	**5,377,000**
Productive Budgeted hours (12,500 + 2,600 - 900 - 120 - 80)	14,000
Adjusted machine hours rate	384.07

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3. BASIS OF APPORTIONMENT OF SERVICE CENTRE COSTS TO PRODUCTION DEPARTMENTS

Case 1

The costs of service centers usually is apportioned among the production departments on the basis of their usage of services. For example, Service department X provides electricity to three production departments A, B and C in the ratio of 3:2:1 therefore, the cost of department X must be allocated to production departments in the same ratio.

- *Example 06:*

Ternary Engineering Limited produces front and rear fenders for a motorcycle manufacturer.

It has three production departments and two service departments. Overheads are allocated on the basis of direct labor hours. The management is considering changing the basis of overhead allocation from a single overhead absorption rate to departmental overhead rate. The estimated annual overheads for the five departments are as under:

	Production Departments			Service	
	Fabrication	Phosphate	Painting	Inspection	Maintenance
	Rs.000	Rs.000	Rs.000	Rs.000	Rs.000
Direct materials	6,750	300	750		
Direct labor	1,200	385	480		
Indirect material				30	75
Other variable overheads	200	70	100	30	15
Fixed overheads	480	65	115	150	210
Total departmental expenses	8,630	820	1,445	210	300
Maximum production capacity	20,000	25,000	30,000		
Direct labor hours	24,000	9,600	12,000		
Machine hours	9,000	1,000	1,200		
Use of service departments:					
Maintenance - Labor hours	630	273	147		
Inspection - Inspection hours	1,000	500	1,500		

a) Computation of the single overhead absorption rate for the next year, would be as follows

Production departments	Rs. (000)
Variable overhead	370
Fixed overhead	660
Service department	
Inspection	210
Maintenance	300
	1,540

Production departments	Rs. (000)
Estimated direct labor hours (DLH)	
Fabrication	24,000
Phosphate	9,600
Painting	12,000
Total estimated direct labor hours	45,600

$$\text{Single overhead absorption rate} = \frac{\text{Estimated Total Overheads}}{\text{Estimated Direct Labor Hours}}$$

$$= \frac{\text{Rs. } 1{,}540{,}000}{45{,}600 \text{ hours}} = \text{Rs. } 33.77 \text{ per direct labor hour}$$

b) Computation of the departmental overhead absorption rates in accordance with the below circumstances would be as follows:

- The Maintenance Department costs are allocated to the production department on the basis of labor hours.
- The Inspection Department costs are allocated on the basis of inspection hours.
- The Fabrication Department overhead absorption rate is based on machine hours whereas the overhead rates for Phosphate and Painting Departments is based on direct labor hours.

	Production			Service	
	Fabrication	Phosphate	Painting	Inspection	Maintenance
	Rupees in thousand				
Variable Overhead	200	70	100	60	90
Fixed Overhead	480	65	115	150	210
Allocation of Maintenance Department Costs on the basis of labor hours					
630 ÷ 1,050 x 300	180				(180)
273 ÷ 1,050 x 300		78			(78)
147 ÷ 1,050 x 300			42		(42)
Allocation of Inspection Department Costs on the basis of Inspection hours					
1,000 ÷ 3,000 x 210	70			(70)	
500 ÷ 3,000 x 210		35		(35)	
1,500 ÷ 3,000 x 210			105	(105)	
	930	248	362	-	-

Base	Machine hours	Direct labor hours	
number of hours	9,000	9,600	12,000
Departmental Overhead Rate (Rs.)	103.33	25.83	30.17

► *Example 07:*

Sparrow (Pvt) Limited (SPL) is engaged in the manufacture of two products A and B. These products are manufactured on two machines M1 and M2 and are passed through two service departments, Inspection and Packing, before being delivered to the warehouse for final distribution. SPL's overhead expenses for the month of August 2011 were as follows:

	Rupees
Electricity	2,238,000
Rent	1,492,000
Operational expenses of machine M1	5,500,000
Operational expenses of machine M2	3,200,000

Following information relates to production of the two products during the month:

	A	B
Units produced	5,600	7,500
Labor time per unit – Inspection department	15 minutes	12 minutes
Labor time per unit – Packing department	12 minutes	10 minutes

The area occupied by the two machines M1 and M2 and the two service departments is as follows:

	Square feet
Machine M1	5,500
Machine M2	4,800
Inspection department	12,000
Packing department	15,000

Machine M1 has produced 50% units of product A and 65% units of product B whereas machine M2 has produced 50% units of product A and 35% units of product B.

For Allocating overhead expenses to both the products A and B., the following calculation shall be made

Allocation of costs to cost centers	Basis	Machine M1	Machine M2	Inspection	Packing	Total
Area Occupied		5,500	4,800	12,000	15,000	37,300
Allocation of Electricity	Area	330,000	288,000	720,000	900,000	2,238,000
Allocation of rent	Area	220,000	192,000	480,000	600,000	1,492,000
Operational cost		5,500,000	3,200,000	-	-	8,700,000
		6,050,000	3,680,000	1,200,000	1,500,000	12,430,000

ALLOCATION OF COST TO PRODUCTS			
Basis of Cost Allocation	**A**	**B**	**TOTAL**
Units produced	5,600	7,500	
Inspection time (hrs.) (5,600 x 15 min /60) & (7,500 x 12 min /60)	1,400	1,500	2,900
Packing time (hrs.) (5,600 x 12 min /60) & (7,500 x 10 min /60)	1,120	1,250	2,370
Units produced on Machine M1 (50% A and 65% B)	2,800	4,875	7,675
Units produced on Machine M2 (50% A and 35% B)	2,800	2,625	5,425
Cost Allocated			
Machine M1 cost	2,207,166	3,842,834	6,050,000
Machine M2 cost	1,899,355	1,780,645	3,680,000
Inspection department cost	579,310	620,690	1,200,000
Packing department cost	708,861	791,139	1,500,000
	5,394,692	**7,035,308**	**12,430,000**

Case 2

However, in some cases, one or more service departments use other service department. In such a case, the cost of that service department shall be distributed first which provides services to other service departments too and the cost shall be distributed to all the departments (that is production and service departments which receive its services). Thereafter, the cost of remaining service departments are distributed to production departments.

Case 3

In some cases, the structure becomes complex when service departments share services with each other. For example, Department X and Y provides services to each other as well as to production departments. In such a case, reciprocal apportionment of cost is carried. The following methods are used for such apportionment:

a) Repeated distribution method
b) Simultaneous equation method

Repeated Distribution Method:

In this method, cost of one service department is apportioned to all the departments according to the determined proportion. This way, the cost of that department becomes zero. Thereafter, the cost of other service department is distributed to all the departments in the given proportion. Now since the departments share services, the department whose cost is distributed first has receive the portion of cost from the departments whose costs are subsequently apportioned. This will happen with all the service departments. Therefore, the process of distribution should be repeated till all the costs including the ones after repeated distribution have become zero.

Simultaneous Equation Method:

In this method, simultaneous equations are made to solve the problem in shortest way.

These methods can be best understood through examples.

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- *Example 08:*

In a factory with four production departments and two service departments, the operating costs for the month of October were as shown below.

	Rs.
Production Department 1	700,000
Production Department 2	300,000
Production Department 3	400,000
Service departments	
Canteen	78,000
Boiler house	100,000
	1,578,000

The costs of running the canteen are apportioned to each department on the basis of the estimated use of the canteen by employees in each department.

The costs of the boiler house are apportioned on the basis of the estimated consumption of power by each department.

The service departments' costs are therefore apportioned as follows:

	Canteen	Boiler house
	%	%
Production Department 1	40	30
Production Department 2	20	30
Production Department 3	30	20
Service departments		
Canteen	-	20
Boiler house	10	-

Preparation of a statement showing the allocation of costs to the production departments using the repeated distribution method would be as follows:

C = Canteen

BH = Boiler house

	Dept 1	Dept 2	Dept 3	C	BH
	Rs.	Rs.	Rs.	Rs.	Rs.
Initial overheads	700,000	300,000	400,000	78,000	100,000
Apportion:					
BH (30:30:20:20)	30,000	30,000	20,000	20,000	(100,000)
				98,000	
C (40:20:30:10)	39,200	19,600	29,400	(98,000)	9,800
BH (30:30:20:20)	2,940	2,940	1,960	1,960	(9,800)
C (40:20:30:10)	784	392	588	(1,960)	196
BH (30:30:20:20)	59	59	39	39	(196)
C (40:20:30:10)	15	8	12	(39)	4
BH (30:30:20:20)	1	1	1	1	(4)
C (40:20:30:10)	1	0	0	(1)	0
Total overhead	**773,000**	**353,000**	**452,000**		

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a) the simultaneous equations method.

Let Y = the total overheads apportioned from the Boiler House

This gives us the simultaneous equations:

X = 78,000 + 0.2 Y ... (1)

Y = 100,000 + 0.1 X ... (2)

Re-arrange:

78,000 = X – 0.2 Y ... (1)

100,000 = – 0.1 X + Y ... (2)

Multiply (2) by 10

1,000,000 = – X + 10Y ... (3)

Add (1) and (3)

1,078,000 = 9.8Y

Y = 110,000

Therefore, from (1) and substituting Y = 110,000:

X = 78,000 + 0.2 (110,000) = 100,000.

	Dept 1	Dept 2	Dept 3
	Rs.	Rs.	Rs.
Initial overheads	700,000	300,000	400,000
Apportion:			
BH (30%, 30% and 20% of 110,000)	33,000	33,000	22,000
C (40%, 20% and 30% of 100,000)	40,000	20,000	30,000
Total overhead apportionment	773,000	353,000	452,000

► *Example 09:*

The expenses of the production and service departments of a company for a year are as follows:

Department	Expenses before distribution of service department cost Rs. '000	Service provided (%age)	
		Dept. X	Dept. Y
Production department - A	500	50	40
- B	400	30	50
Service department – X	100	-	10
- Y	60	20	-

For allocating the service departments expenses to production departments by:

a) Repeated distribution method

	Production Department		Service Department	
	A	B	X	Y
Total expenses as given	500	400	100	60
Allocation of X department cost	50	30	(100)	20
Allocation of Y department cost	32	40	8	(80)
Allocation of X department cost	4	2	(8)	2
Allocation of Y department cost	1	1	-	(2)
	587	473	-	-

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b) Simultaneous equation method

Let total expenses of department X inclusive of expenses allocated from department Y = x

Let total expenses of department Y inclusive of expenses allocated from department X = y

Then according to question

$$x = 100 + 0.1\,y \text{ ------------ } eq.\ (1)$$

$$y = 60 + 0.2\,x \text{ -------------- } eq.\ (2)$$

Putting the value of y from *eq.(1)* in *eq.(2)*

$$x = 100 + 0.1\,(60 + 0.2x)$$

$$= 100 + 6 + 0.02\,x$$

$$x - 0.02\,x = 106$$

$$x = 108$$

$$y = 60 + 0.2x$$

$$= 60 + 22 = 82$$

ALLOCATIONS		
Description	**Production Department**	
	A	**B**
Product department costs	500	400
Distribution of X department cost (108 × 50%) & (108 × 30%)	54	32
Distribution of Y department cost (82 × 40%) & (82 × 50%)	33	41
	587	473

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4. OVER OR UNDER APPLIED / ABSORBED OVERHEAD

Once the factory overhead rate is determined using the estimated amount of factory overhead and estimated base, it is used to charge overhead cost to the jobs, products or work performed.

Since, not all overhead costs are known at the time of making the product, (such as electricity bill is received after the month end) therefore, the estimated rate is used to apply the overhead cost to the job or product using actual activity level. This is called absorption or application of overheads to the products / jobs.

Due to this, at each period end, the management calculates and compares the actual overhead cost with the applied overhead cost and determine the over or under applied overheads.

The over or under absorbed overhead is calculated as follows:

Actual Factory Overhead	xxx
Applied / Absorbed Factory Overhead (Budgeted overhead rate x actual activity level of the selected base)	(xxx)
Over or Under Applied / Absorbed Overhead	xxx

- Over applied / absorbed means the actual overhead cost is lesser than the cost applied to the production
- Under applied / absorbed means the actual overhead cost is greater than the cost applied to the production

Treatment of Over or Under Applied / Absorbed Overhead:

The over or under applied overhead so calculated is treated either as:

a) Period cost – charged to cost of goods sold, or

b) Product cost – charged to production (including closing inventory)

For financial reporting purposes, it is often closed to cost of goods sold as period cost.

► *Example 10:*

Amber Limited (AL) manufactures a single product. Following information pertaining to the year 20X4 has been extracted from the records of the company's three production departments.

	Department	Material	Labor	Machine
		Rs. in million	Hours	
Budgeted	A	80	200,000	400,000
	B	150	500,000	125,000
	C	120	250,000	350,000
Actual	A	80	220,000	340,000
	B	150	530,000	120,000
	C	120	240,000	320,000

AL produced 3.57 million units during the period. The budgeted labor rate per hour is Rs. 120. The overheads for Department-A is budgeted at Rs. 5.0 million, for Department-B at 15% of labor cost and for department-C at 5% of prime cost of the respective departments. Actual overheads for department A, B and C are Rs. 5.35 million, Rs. 8.90 million and Rs. 7.45 million respectively.

Overheads are allocated on the following basis:

Department-A	Machine hours
Department-B	Labor hours
Department-C	Percentage of Prime cost

There was no beginning or ending inventory in any of the production departments.

a) For calculating budgeted overhead application rate for each department, the following working shall be made

Budgeted overhead rate for department-A	Rs. in million
Budgeted Overhead rate per machine hour (OHD/MH Rs.5m/400,000)	Rs. 12.5
Budgeted overhead rate for department-B	
Budgeted labor cost (Rs. 120 × 500,000)	60
Budgeted overhead (Rs. 60 m × 15%)	9
Budgeted overhead rate per labor hour (Rs. 9 m/0.5 m)	18
Budgeted overhead rate for department-C	
Budgeted overhead as a % of Prime Cost (Rs.7.5 m /150 m)	5%

b) For calculation of the total and departmental actual cost for each unit of product, the following working shall be made

	Departments		
	Rupees in million		
	A	B	C
Material cost	80.00	150.00	120.00
Labor cost			
(0.22 m × Rs. 120)	26.40		
(0.53 m × Rs. 120)		63.60	
(0.24 m × Rs. 120)			28.80
Actual overhead cost	5.35	8.90	7.45
Total Cost	111.75	222.50	156.25
Unit cost (Cost/3.57 m. units) **(Rs.)**	31.30	62.32	43.77
Total Actual Cost per unit (Rs.)		137.39	

c) For calculation of over or under applied overhead for each department, the following working shall be made.

(0.34 m × 12.5)	4.25		
(0.53 m × Rs. 18)		9.54	
(Rs. 148.8 m × 5%)			7.44
Actual Overhead Cost	5.35	8.90	7.45
Under applied / (over applied)	1.10	(0.64)	0.01

5. COMPREHENSIVE EXAMPLES

- *Example 01:*

Salman Limited (SL) has two production departments, PD-A and PD-B, and two service departments, SD-1 and SD-2. A summary of budgeted costs for the year ending June 2015 is as follows:

	PD-A	PD-B	SD-1	SD-2	Total
	---------------------- Rs. in '000 ----------------------				
Direct labor	5,400	3,648	-	-	9,048
Direct material	13,500	9,120	-	-	22,620
Indirect labor	1,900	600	50	20	2,570
Indirect materials	900	1,100	150	55	2,205
Factory rent	-	-	-	-	1,340
Power cost	-	-	-	-	1,515
Depreciation	-	-	-	-	3,500

Other related data is as follows:

	PD-A	PD-B	SD-1	SD-2
Production (units)	2,250	800	-	-
Direct labor hours (per unit)	20	38	-	-
Machine hours	19,250	12,250	2,800	700
Kilowatt hours (000)	800	600	50	150
Floor area (square feet)	5,000	4,000	500	500
Basis of overhead application	Machine hours	Direct labor hours	-	-

SL allocates the costs of service departments applying repeated distribution method. Details of services provided by SD-1 and SD-2 to the other departments are as follows:

Service Departments	PD-A	PD-B	SD-1	SD-2
SD-1	30%	65%	-	5%
SD-2	55%	35%	10%	-

The departmental overhead absorption rate can be calculated as follows:

Allocation of overheads and overheads absorption rate

	Allocation basis	Total	PD-A	PD-B	SD-1	SD-2
		Rs. in 000				
Direct labor		-	-	-	-	-
Direct material		-	-	-	-	-
Indirect labor		-	1,900	600	50	20
Indirect materials		-	900	1,100	150	55

	Allocation basis	Total	PD-A	PD-B	SD-1	SD-2
		Rs. in 000				
Factory rent	Floor area	1,340	670	536	67	67
Power	Kilowatt hrs.	1,515	758	568	47	142
Depreciation	Machine hrs.	3,500	1,925	1,225	280	70
			6,153	4,029	594	354
Allocation of service departments cost:						
SD-1	30:65:5		178	386	(594)	30
SD-2	55:35:10		211	134	39	(384)
SD-1	30:65:5		12	25	(39)	2
SD-2	55:35:10		1	1	0	(2)
			6,555	4,576	-	-
Allocation basis			**Machine hrs.**	**D. labor hrs.**		
Machine/D. labor hours			19,250	30,400	800×38	
Overhead absorption rate per hour		Rs.	340.52	150.53		

- *Example 02:*

Opal Industries Limited (OIL) produces various products which pass through Processing and Finishing departments. Logistics and Maintenance departments provide necessary support for the production. Following information is available from OIL's records for the month of June 2017:

(i)	Overhead costs		Direct labor hours	
Departments	*Budgeted	Actual	Budgeted	Actual
	-------- Rupees --------		-------- Rupees --------	
Processing	560,000	536,000	14,000	14,350
Finishing	320,000	258,000	10,000	9,800
Logistics	-	56,700	-	-
Maintenance	-	45,000	-	-

*including apportionment of overhead costs of support departments

(ii) Costs of support departments are apportioned as under:

	Processing	Finishing	Logistics	Maintenance
Logistics	50%	40%	-	10%
Maintenance	35%	45%	20%	-

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a) Allocate actual overhead costs of support departments to production departments using repeated distribution method.

Allocation of support departments' actual overheads:				
	Production departments		**Support departments**	
	Processing	**Finishing**	**Logistics**	**Maintenance**
	Rupees			
Cost incurred	536,000	258,000	56,700	45,000
Allocation of support departments' costs:				
Logistics 50%:40%:0%:10%	28,350	22,680	(56,700)	5,670
Maintenance 35%:45%:20%:0%	17,734	22,802	10,134	(50,670)
Logistics	5,067	4,054	(10,134)	1,013
Maintenance	354	456	203	(1,013)
Logistics (Being immaterial amount, allocated to production dept. only) 50:40	113	90	(203)	-
Total - Actual overhead costs A	587,618	308,082	-	-

b) Compute under/over applied overheads for the month of June 2017.

Under/over applied overheads:				
Predetermined overhead rate:				
Budgeted direct labor hours B	14,000	10,000		
Budgeted overhead costs C	560,000	320,000		
Budgeted overhead rate (C÷B) D	40.00	32.00		
Overheads applied:				
Actual direct labor hours E	14,350	9,800		
Overheads applied (D×E) F	574,000	313,600		
Overheads under/(over) applied (A-F)	13,618	(5,518)		

- *Example 03:*

Following information has been extracted from the records of RT Limited for August 20X3:

	Departments				
	Production			Service	
	P-1	P-2	P-3	S-1	S-2
Budgeted machine hours	60,000	100,000	120,000		
Actual machine hours	60,500	110,000	100,000		
Budgeted labor hours	50,000	200,000	75,000		
Actual labor hours	55,000	190,000	75,000		
Budgeted material cost (Rs. '000)	50,000	40,000	3,000		
Actual material cost (Rs. '000)	50,000	42,000	3,200		
Budgeted overheads (Rs. '000)	1,200	2,000	2,250	600	700
Actual overheads (Rs. '000)	1,250	2,000	1,800	500	750
Services provided by S-1	20%	30%	40%	-	10%
Services provided by S-2	30%	40%	20%	10%	-
Basis of overhead application	Machine hours	Labor hours	75% of Material cost		

a) Allocation of Service dept. cost to production dept. - Repeated distribution method:

	Production Dept.			Service Dept.	
	P1	P2	P3	S1	S2
	Rupees in thousand				
S1 overheads allocation %	20%	30%	40%		10%
S2 overheads allocation %	30%	40%	20%	10%	
Actual overheads as given	1,250	2,000	1,800	500	750
Allocation of S2 cost					
30:40:20:10	225	300	150	75	(750)
Allocation of S1 cost					
20:30:40:10	115	172	230	(575)	58
Allocation of S2 cost					
30:40:20:10	17	23	11	6	(58)
Allocation of S1 cost					
20:30:40:10	1	2	3	(6)	
Allocation from service dept.	358	497	394		
Total	1,608	2,497	2,194	–	–

b) Compute department wise over / under applied overheads.

Department wise over / under applied overheads:			
	P1	**P2**	**P3**
Budgeted OH's	1,200,000	2,000,000	2,250,000
Re-distributed OH's of service departments (W-2)	365,657	510,101	424,242
Total budgeted OH's (I)	1,565,657	2,510,101	2,674,242
Budgeted Base	Machine Hours	Labor Hours	Material Cost
	60,000	200,000	-
Budget OAR (II)	Rs. 26.0943	Rs. 12.5505	75% of DMC
	Per M.H	Per L.H	Given
Actual data of Base (III)	60,500	190,000	Rs. 3,200,000
Applied FOH (III x II) Rs.	1,578,705	2,384,595	2,400,000
Actual FOH (W-1)	1,608,586	2,497,475	2,193,939
(Under)/Over FOH Applied	(29,881)	(112,880)	206,061

(W-1)			
	P-1	**P-2**	**P-3**
Actual FOH			
Direct Incurred	1,250,000	2,000,000	1,800,000
Share of service dept's (part a)	358,586	497,475	393,939
	1,608,586	2,497,475	2,193,939

(W-2) Allocation of Service departments using Repeated Distribution Method.

R.T Limited FOH Distribution Sheet
For the month of August, 2009 (Based on Budgeted Cost for Computation of Budgeted OAR)

Date	Particulars	Head of A/c	Amount	Basis	Production Department			Service Department	
					P_1	P_2	P_3	S_1	S_2
	Budgeted Overheads Redistribution		1,300,000					600,000	700,000
	S – 1			20:30:40:10	120,000	180,000	240,000	(600,000)	60,000
									760,000
	S – 2			30:40:20:10	228,000	304,000	152,000	76,000	**(760,000)**
	S – 1			20:30:40:10	15,200	22,800	30,400	(76,000)	7,600
	S – 2			30:40:20:10	2,280	3,040	1,520	760	**(7,600)**
	S – 1			20:30:40:10	152	228	304	(760)	76
	S – 2			30:40:20:10	23	30	15	8	**(76)**
	S – 1			20:30:40:10	2	3	3	(8)	-
			1,300,000		**365,657**	**510,101**	**424,242**	**0**	**0**

STICKY NOTES

Manufacturing expenses are of two types: Direct expenses and Indirect Expenses.

Direct expenses are fully traceable to the product/service/department being costed. E.g. Raw material and Labor. Indirect expenses (Production overheads) –incur in the course of making a product/providing service/ running department but cannot be traced directly and fully to the product, service or department

Costs are often categorized as variable cost that vary with the level of output and fixed cost that occur irrespective of the level of output.

Production Overheads incur in relation to the production processes (also called manufacturing overheads / factory overheads). Non-Production Overheads incur to support the overall objectives of the business. (classified as 'Administrative Expenses, Marketing, Selling and Distribution Expenses' in the Statement of Comprehensive Income.)

Estimated factory overheads can be calculated using physical output, direct material cost, direct labor cost, direct labor hours, machine hours.

In addition to the selection of bases, the following factors are also considered to estimate factory overheads:

1. **Activity level: at which the business performs its production activities**
2. **Inclusion or exclusion of fixed overheads: Absorption costing / conventional costing/full costing or Marginal Costing/Direct Costing**
3. **Single rate or several rates Blanket rate/Plant-wide rate, Departmental rates or Cost centers/cost pool rates.**

The overhead costs of servicing departments are transferred to production departments and service departments in the proportion of the facilities used

When service departments share services with each other, reciprocal apportionment of cost is carried with one of the following methods:

a) Repeated distribution method

b) Simultaneous equation method

All the production related overhead costs are to be accumulated at the smallest segment of the production process

Budgeted overhead rate is calculated to allocate cost to the products

At the period end, actual overhead is compared with applied

Overhead rate to calculate the over or under absorption

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CHAPTER 4

LABOR COSTING

IN THIS CHAPTER

AT A GLANCE

Labor is an important element in a production cost.

Industries that are dependent on human workforce have to adopt strategies that benefit them in terms of human resource retention as well as keeping their labor cost low.

Various wage systems are designed to achieve these objectives.

Management must have to monitor labor performance in terms of productivity (efficiency) and effectiveness (cost).

A quantitative method called 'Learning Curve' is used to calculate in advance the expected time to be taken by the labors when they become fully conversant with the work.

1. INTRODUCTION TO LABOR COSTING AND LABOR COST CONTROL

Labor cost is the second important element of the cost of production after material cost. Labor costs constitute a major portion of the total cost of a product or service that may take the form of wages, salaries and/or other incentives of employee remunerations. The profitability and growth of the entity depends greatly upon the proper utilization of the human resources that in turn needs to be properly recoded and controlled.

1.1. Types of labor cost:

The labor cost has two types:

a) **Direct Labor Cost:** Direct labor cost is any cost that is specifically incurred for or can be readily charged to or recognized with any specific contract, job or work order. In cost accounting it is classified as direct labor cost which becomes part of prime cost. For example: In a watch manufacturing factory, a worker operating a molding machine to produce a part of wrist watch.

b) **Indirect Labor Cost:** Where the direct labor can be recognized with and charged to the job, the indirect labor cannot be so charged and hence is treated as part of the factory overheads. For example: Wages paid to supervisor of a factory or salary paid to driver of delivery van used for distribution of the product.

Wage payments are generally based on the productivity, time and skill or their combination. Proper control and accounting for this cost factor and motivation of worker is important in bringing efficiency to an enterprise.

▶ *For example:*

Wage payment based on productivity: Wages paid on the basis of number of units produced, like stitching 2000 pieces of shirts at Rs. 75 per piece.

Wage payment based on time: Wages paid on the basis of number of hours a worker performed his in a production line, like 160 hours paid at Rs. 175 per hour.

Wage payment based on skill: A wage differentiation due to varied skills, like skilled workers are paid higher than apprentice for the same job.

1.2. Measuring labor activity:

It is important to differentiate between "production" and "productivity" while measuring labor activity.

- **Production:** Production refers to the quantity or volume of the output produced i.e. the total number of units produced. Production therefore is a measure of quantity of work.
- **Productivity:** Productivity unlike production is a measure of efficiency with which the units have been produced.

▶ *Example 01:*

Mr. X is supposed to produce six units in every hour at work. The standard productivity rate is six units per hour for every employee. During the week he made 252 units in 38 hours of work. The productivity ratio is worked out as:

The total production in the week is 252 units.

Productivity is a relative measure of the hours actually taken and the hours that should have been taken to make the output. It might be determined in either of the following two methods

Method 1:

252 units should take	42 hours
But took	38 hours
Productivity ratio = 42/38 x 100	110.5%

Method 2:

In 38 hours Mr.X should make	228 units
But made	252 units
Productivity ratio = 252/228 x 100	110.5%

Comment: A productivity ratio greater than 100% indicates that the actual efficiency is better than the standard or expected level of efficiency.

1.3. Labor payment methods:

The choice of appropriate labor payment method is very important for any organization as it:

- may affect the cost of the finished products specially when it is a labor intensive organization,
- casts a major impact on the morale and efficiency of the employees and serious consideration should therefore be given to the possible motivational impact of the remuneration method being adopted.

The two widely known basic labor payment methods are time rate and piece work. These are discussed in detail below:

Time rate

Time rate/ time work or basic pay is where the employee gets paid on the basis of his time spent at work. The most common form of this type is a day-rate system.

The formula used for calculating wages under this method is:

Wages = Hours worked x Per hour pay rate

- If an employee works for more hours than the basic daily requirement or on days which do not constitute a part of the working week (e.g. Saturdays and Sundays), then he may be entitled to an **overtime payment**. The overtime hours are usually paid at a premium rate such as "time and a quarter", "time and a half" or "double-time".

  Time and a quarter for example, means that 1.25 times the basic hourly rate is paid for hours worked in excess of the basic requirement. The overtime premium is the extra rate paid over and above the basic rate.

  If employees work unsocial hours, e.g. overnight, then they are entitled to a shift premium which is quite similar to an overtime premium and means that the employees are paid at an increased hourly rate.

▶ *Example 02:*

If the basic rate of pay per hour is Rs. 6 and overtime rate is time and a half, then calculating the overtime premium for 8 hours worked in excess of the basic requirement would involve below working

	Rs.
Basic Pay (8 x Rs. 6)	48
Overtime premium (8 x Rs. 3)	24
Total (8 x Rs. 9)	72

Piecework:

Under this method the employee is paid an agreed amount for each unit of output completed or for each task carried out. Output units per hour may also be an agreed upon number that is referred to as "standard hour produced". It is also normal under piecework scheme that the employees get a guaranteed minimum wage regardless of the number of units produced. This safeguards them from loss of earnings when the production is low and is not on account of their own fault.

The wages under the piecework system can be calculated as:

Wages = Units produced x Per unit pay rate

- *Example 03:*

Straight piecework with guaranteed minimum wage

Sara is paid Rs. 20 for each unit produced with a guaranteed wage of Rs. 2000 for a 40-hour week. For a series of 4 weeks of the month she produced 140, 160, 180 and 200 units. In order to calculate total amount for the month, please see below:

	Rs.
Week 1 [(140 units x Rs. 20) + Rs. 2000]	4,800
Week 2 [(160 units x Rs. 20) + Rs. 2000]	5,200
Week 3 [(180 units x Rs. 20) + Rs. 2000]	5,600
Week 4 [(200 units x Rs. 20) + Rs. 2000]	6,000
Total for the month	21,600

1.4. Basis of labor cost control:

Labor cost control requires analysis of labor cost with different angles and perspectives, such as, cost per hour, cost by departments, by product lines, by direct and indirect angle, by rates, by jobs or processes.

Labor cost controls aim to achieve maximum efficiency without compromising the quality and effectiveness of the operations. Cost analysis and wage system help in achieving this objective.

- *Example 04:*

ABC Publishers Limited pays wages to workers working on book binding machine at the rate of Rs. 17 per book. Workers are not paid for the misaligned binding and such book is scraped for Rs. 15 per kg. The policy motivates the workers to work hard and maximize productivity. However, the rate of wastage in ABC is 3% as against industry average of 1%.

ABC re-visited the wage policy and felt that it is likely that workers tend to compromise the quality because of insignificant loss they suffer due to bad quality. It intends to bring a policy whereby a deduction of Rs. 70 will be made from the wages for each misaligned binding beyond 1% industry average. However, it is estimated that such policy will reduce the efficiency of workers because they would reduce the speed to achieve desired quality benchmark and avoid deduction.

The cost controller of ABC is supposed to work out the differential cost and revenue to evaluate the policy before implementation. For this purpose, cost controller needs precise data with reasonable accuracy about the machine capacity, labor related wastage, impact of slow speed and contribution margin per unit.

Effective labor cost control is achieved through different tools including;

- analyzing the targeted production,
- preparing labor budget and standardizing labor cost per unit,
- monitoring output, quality, wastage ratios, rework cost due to bad workmanship
- wage incentive systems.

2. MANAGEMENT OF PRODUCTIVITY AND EFFICIENCY

2.1. Labor Productivity:

Labor productivity can be described as a ratio between labor hours and units produced.

2.2. Labor Efficiency:

Labor efficiency measures how efficiently workers produce a given quantity of units.

Productivity can be stated in one figure, such as; in Engine Installation Department of Motor company, 3 units per 8 labor hours is the productivity of the department. In assessing efficiency, a single figure would not suffice. There should be any comparable figure, like own historical data, industry average or budgeted productivity.

If Motors company achieved 3 units per 8 labor hours' productivity in 2018 in Engine Installation Department as against 2.8 units per 8 labor hours in 2017. The department efficiently utilized its human resources in the year 2018 as compared to 2017

Efficiency is achieved through high motivation and skills of workers and by better processes and quality of machines and tools. Improved productivity positively impacts the business profits and the earnings of workers.

It may be noted that productivity and efficiency measures generally indicate number of output as against the labor input and do not usually refer to the quality and level of bad workmanship. The quality aspect is also important to achieve the objectives of cost controls.

2.3. The importance of measuring productivity and efficiency:

In a competitive business environment where the price of a product is difficult to be controlled by the producers, the efficient utilization of resources is the key. Labor cost in many industries is so significant that its efficiency can make the difference. A producer should be able to set standards of performance in terms of hours and cost per hour or cost per unit of production.

The performance standards measure the performance in unit and rupee term and variances help the managers to focus around the problem areas.

► *Example 05:*

In a production department the performance standards for a production of 3,000 units are set as 2,000 hours at Rs. 90 per hour. If 2,200 hours are used at standard rate of Rs. 90 per hour to produce 3,000 units then there is an unfavorable labor efficiency ratio of 90.91% (2,000 /2,200). In rupee term the unfavorable variance is Rs. 18,000 computed as (100%-90.91%) * 2,200*90

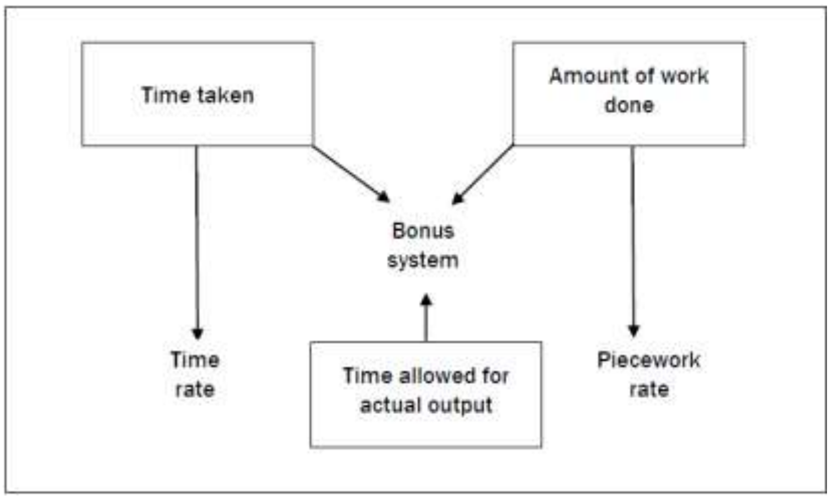
There can be a variance as against the performance standards, which arises due to difference in wage rates. Therefore, a total variance between the performance standards and actual results is analyzed in a way that we arrive at the break up of both variances, namely, labor efficiency variance and labor rate variance.

3. WAGE INCENTIVE PLANS

Initially, bonus/incentive schemes had been introduced for workers who had been working under a time-based system, in order to compensate them for their inability to increase their earnings. Wage incentive plans refer to performance linked compensation paid to improve motivation and productivity. Incentive schemes may either be short-term or long-term schemes.

3.1. Bonus Systems:

Bonus systems base workers' earnings on a combination of extra time served and work done. The indirect labor is usually paid on a weekly or monthly basis, such wages and salaries may also be increased by bonus payments.



Characteristics of bonus systems:

- A target is set and the performance is matched against that target.
- Employees feel trusted and motivated, the productivity increase and they are paid more for their increased efficiency.
- Despite of the organization's labor cost being increased in terms of bonus payments, the total unit cost of the output stands reduced and the profit per unit of sale is increased.

The widely known bonus/ incentive schemes are discussed in the following paragraphs.

3.2. High day-rate system:

Under a high day-rate system employees get paid at a higher than average hourly rate provided they agree to produce a given amount of product at a given quality.

▶ *Example 06:*

Shahid makes 200 units in a 40-hour week if he were to be paid Rs. 4 per hour, but 240 units if he were paid Rs. 5 per hour.

a) The amount to be paid to Shahid in both the cases, would be calculated as

				Rs.
i.	Amount to be paid to Shahid			
	a.	Under low day-rate scheme	40 hours x Rs. 4	160
	b.	Under high day-rate scheme	40 hours x Rs. 5	200

b) In order to calculate labor cost per unit, amount paid would be

ii. Labor cost per unit			
a.	Under low day-rate scheme	(40 x 4) / 200	0.8/unit
b.	Under high day-rate scheme	(40 x 5) / 240	0.833/unit

c) cost per unit of output if the production overhead is recorded at the rate of Rs. 4 per direct labor hour, would be as follows

Cost per unit			
a.	Under low day-rate scheme	(40 x 8) / 200	1.60/unit
b.	Under high day-rate scheme	(40 x 9) / 240	1.5/unit

Comment:

Though in the given example the labor cost per unit is lower under the low day-rate scheme but the total unit cost is lower under the high day-rate scheme. Therefore, we see that the high day-rate scheme in the given scenario would reward both i.e. the employer (a lower unit cost by 10p) and employee (an extra Rs.1 earned per hour).

Advantages

- It is easier to calculate and understand.
- It assures the employee a consistently high wage.

Disadvantages

- Employees cannot go beyond the fixed hourly rate for the extra effort they put in. In the example given above if the employee makes 280 units instead of 240 units in a 40 hours week, the cost per unit would decrease even further but all the savings would go to the benefit of the employer and none would go to the employee.
- The high wages might become the accepted wage level for normal working. Management might need to keep checks on the productivity and efficiency levels of the employees.

3.3. Individual bonus schemes:

An individual bonus scheme sets out performance objectives/targets and usually forms part of the performance appraisal systems of organizations. Every individual's bonus is calculated separately and is unique to every employee. So basically it is an incentive whereby an employee has to qualify to be entitled for a bonus on top of his/ her basic wage.

▶ *Example 07:*

Rs.100 per unit bonus is paid to an employee if he produced at least 500 units per month. If an employee achieves that performance standard, then he will be entitled to get a bonus on all units produced.

3.4. Group bonus schemes:

In cases where individual efforts cannot be exactly measured and employees work as a team, individual incentive schemes become impracticable. In such scenarios, group incentive schemes are found to be more relevant and feasible. Even in cases where an individual alone cannot complete his job without the cooperation of his fellow workers, there too, group incentive schemes are given preference over the individual bonus schemes.

Group bonus plans reward all team members equally based on overall performance of the team members. It usually comes into play when individual output cannot be measured with accuracy. Therefore, team performance is evaluated on the basis of time taken to complete the job rather than output produced. Usually, the bonus earned by the group is divided among the group members in accordance with their respective base rates.

For Example, a bonus may be paid to department which has a reject rate in unit of output below a specified ratio in proportion to their respective basic wages.

Advantages

- Group schemes reduce the clerical efforts to be put in for the calculations of individual incentive schemes.
- They are easy to be administered.
- Group schemes improve the team cohesion.

Disadvantages

- Employees might demand for minimum targets for accepting the scheme.
- Employees doing the best and the worst might fall victim to team's politics.

3.5. Profit sharing schemes:

A profit sharing scheme offers the employees a certain proportion of the organization's profits. The size of this offer is related to the designation of the employee and also the length of the employment period to date.

Advantages

- The biggest advantage is that the organization will pay only what it can afford to pay out of the actual profits earned.
- Such schemes can be offered to indirect labor as well.

Disadvantages

- Employees may be putting in best of their efforts yet the organization might still incur losses on account of issues beyond the control of the employees.
- It is a long term commitment that the organization is asking for. The employees have to wait for the bonus until the year ends. The reward is not an immediate one.

3.6. Share incentive schemes:

A share incentive scheme is where the employees of the company are given an option to acquire the shares as an incentive. In this way the employees' morale rises so does their loyalty due to the feeling that they now have a stake in the company they work for.

4. LEARNING CURVE THEORY

4.1. Learning Effect:

Learning is the process by which an individual acquires skill, knowledge and ability. When a new product or process is started, the performance of the worker is relatively low since the job has just recently started but if it is fairly repetitive in nature then the learning phenomenon takes place. When the experience is gained, the worker is likely to become more confident and knowledgeable about the task thus the performance improves, which in turn reduces the time taken per unit and increases the productivity.

The effect that learning casts on employees, can be represented by a line called a learning curve. It displays the relationship between the production time per unit and the cumulative number of units produced. Learning curve has a direct impact on direct labor wages.

Eventually when the worker has had enough experience and nothing more is left for him to learn, then the learning process stops i.e. the learning would stop after a certain time limit and beyond specific number of units produced.

Assumptions

- The amount of time required to complete a unit of a product or a given task will decrease every time the task is undertaken.
- The unit time will decrease at a decreasing rate, and
- The time reductions will have a predictable pattern.

4.2. Learning curve theory:

The learning curve theory refers to the phenomenon that the cumulative average time required per unit will decrease by a constant percentage every time total output of the product doubles. Doubling of output is an important part of the measurements determining the learning effect.

For example, if we take 80% learning effect, the cumulative average time required per unit is reduced to 80% of the previous cumulative average time when the output is doubled. Note that the cumulative average time is the average time per unit for all units produced till now, inclusive of the first unit made.

▶ *Example 08:*

If the first unit of output requires 100 hours and a 70% learning effect occurs, then determine the production times for:

- Total production
- Incremental total hours
- Incremental hours per unit

Cumulative no. of units produced		Cumulative avg. time/unit		Total Time	Incremental time		
					Total time		Time per unit
		Hours		Hours	Hours		Hours
1		100.0	(x1)	100			
2	(70%)	70.0	(x2)	140	40	÷ 1	40
4	(70%)	49.0	(x4)	196	56	÷ 2	28
8	(70%)	34.3	(x8)	274.4	78.4	÷ 4	19.6

- *Formula:*

Y = axb
Where
Y = cumulative average time per unit to produce x units
a = the time taken for the first unit of output
x = the cumulative number of units produced (output)
b = the learning curve factor (i-e. log LR/log2)
LR = the learning rate as a decimal

- *Example 09:*

Find the value of b when a 90% learning curve effect takes place.

b = log 0.9/log 2
= -0.0458/0.3010
= -0.152

5. RECORDING AND ACCOUNTING FOR LABOR COST

5.1 Recording labor costs

There are various departments within an organization that are involved in collecting, recording and costing of labor. The procedures involve production planning, time and motion study, timekeeping, labor budgeting, etc. A brief detail of the departments involved and procedures performed by them in the due process is discussed below.

Human Resource department

The HR department is primarily responsible for the hiring of employees, engaging them, their transfer, departure and termination etc. This department maintains employees' records and issues the reports for the management to facilitate the decision making process of HR related issues.

Production Planning department

The Production Planning department schedules work, issues the job orders to production departments and chases up jobs in the factory when they run late.

Time keeping department

The timekeeping department keeps track of the time spent in the factory by each worker and the time spent by each worker on each job. The time keeping activity might be carried out using any of the following tools with reference to the relevance and importance to the nature of activity.

- **Daily time sheets:** The daily time sheet is filled in by the employee on everyday basis. It will record how his/ her time in the factory has been spent. The total time on the sheet should however correspond to the record on the attendance form.
- **Weekly time sheets:** They are similar to the daily time sheets but are sent to the cost office towards the end of every week.
- **Job cards:** Job cards are job specific and are prepared for every job or batch separately. In a time sheet the worker if engaged with many jobs will have several entries related to the respective jobs wherein in case of job cards, each job card will contain the detail of activities carried out by the employee in respect to that specific job only.
- **Piecework or operation card:** A Piecework ticket contains the record of total number of items produces by the employee and the total number of the units rejected. Payment would be made for only the items that are as per the required standards.

Cost accounting department

The cost accounting department accumulates and classifies all the data related to the labor costs. The information is then shared with the management to help determine the control measures if required.

5.2 Journal entries for recording labor costs

The primary journal entry for payroll is the summary-level entry that is compiled from the payroll register and which is recorded in either the payroll journal or the general ledger. This entry usually includes debits for the direct labor expense, salaries and the company's portion of payroll taxes. There will also be credits to the liability for payroll taxes that have not been paid, as well as for the amount of cash already paid to employees for their net pay. The basic entry (assuming no further breakdown of debits by individual department) is:

AT A GLANCE
SPOTLIGHT
STIKCY NOTES

(i) to record the total wages earned		
	Debit	**Credit**
Payroll	xxx	
Accrued Payroll tax		xxx
Payroll advances		xxx
Payroll deductions		xxx
Accrued Payroll		xxx
(ii) to record payment of the payroll		
	Debit	**Credit**
Accrued Payroll	xxx	
Cash/Bank		xxx
(iii) To record the closure of the Payroll account		
	Debit	**Credit**
W-I-P – Direct Labor	xxx	
FOH – Indirect Labor	xxx	
Selling Expenses Control a/c – Sales Salaries	xxx	
Administrative Exp – Office Salaries	xxx	
Payroll		xxx

6. COMPREHENSIVE EXAMPLES

- *Example 01:*

Quality Plastics Limited (QPL) produces plastic bodies of various appliances according to the customers' specifications. It has received an order for supply of 10,000 plastic bodies of a washing machine. The supply is to be made within 30 days.

The following information is available:

i. QPL carries out production process in batches of 100 units each. Cost of the first batch is estimated as under:

	Rupees
Direct material (inclusive of 10% input losses) - 1,100 kg	66,000
Direct labor cost at normal rate - 200 hours	44,000
Overheads at normal rate 200 hours	30,000

ii. It is estimated that due to learning curve effect, completion of the first, second, third and fourth batch would require 200, 160, 148 and 140 hours respectively.

This learning effect would continue till completion of 64 batches only.

Learning effect at various learning levels is as under:

80%	85%	90%
−0.322	−0.235	−0.152

iii. It is estimated that after completion of the first 16 batches, material input losses would be reduced from 10% to 6%.

iv. QPL works a single shift of 8 hours per day. For the above order, QPL can spare 8,000 direct labor hours. Overtime hours can be worked at 1.5 times the normal rate. During the overtime hours, overheads would be 1.25 times the normal rate.

The price that QPL should quote in order to earn a margin of 25% of the selling price would be computed as follows

Material	**Rs.**
First 16 batches (16*66,000)	1,056,000
Next 84 batches 84*(66,000*.9/.94)	5,308,085
Direct labor cost	
Normal hours at Rs. 220	1,760,000
Overtime hours at Rs. 330	686,070
Overheads	
Normal hours at Rs. 150	1,200,000
Overtime hours at Rs. 187.5	389,813
Total costs	10,399,968
Order price at a margin of 25% of the selling price	13,866,624

AT A GLANCE SPOTLIGHT STIKCY NOTES

W.1: Learning curve %:			
Batch No.	**Cumulative hours**	**Average hours per batch**	**Learning curve %**
1	200.00	200.00	
2	(200+160) 360.00	180.00	(180/200) 90%
4	(360+148+140) 648.00	162.00	(162/180) 90%
Hours for first 64 batches		64*200*(64)-0.152	6,803
Hours for first 63 batches		63*200*(63) -0.152	(6,712)
Hours per batch after 63rd batch			91
Hours required:			
First 64 batches			6,803
Last 36 batches		(91×36)	3,276
Total hours			10,079
Overtime hours		(10,079 – 8,000)	2,079

- *Example 02:*

Smart Processing Limited (SPL) is considering to sign a contract for manufacturing 10,000 auto parts for a large automobile assembler. The parts would be produced in batches of 500 units each. The estimated cost of the first batch is as under:

	Rupees
Direct material (kg)	135,000
Direct labor (1,500 hours)	225,000
Variable overheads (Rs. 120 per direct labor hour)	180,000
Set-up cost per batch	40,000
Fixed costs:	
- Depreciation of equipment purchased for the project	45,000
- Allocation of existing overheads @ Rs. 16 per hour	24,000
Cost of first batch	649,000

Additional information:

i. The set-up cost per batch would be reduced by 5% for each subsequent batch. However, there would be no further reduction in the set-up cost from the 5th batch onward.

ii. Learning curve effect is estimated at 90% but would remain effective for the first eight batches only.

iii. The index of 90% learning curve is -0.152.

The contract price that would enable SPL to earn an incremental profit of 30% of the contract price would be computed as follows

Computation of contract price			**Rupees**
Cost of material		135,000×20	2,700,000
Direct labor cost:			
- For the first 8 batches	(W-1)	8,748	
- For the last 12 batches	(W-1) 937×12	11,244	
		19,992 ×150	2,998,800
Variable overheads		19,992 ×120	2,399,040
Batch set-up cost:			
- For the first 4 batches		$40{,}000+[40{,}000\times(0.95)^1]+[40{,}000\times(0.95)^2]+[40{,}000\times(0.95)^3]$	148,395
- For the last 16 batches		$[(40{,}000\times(0.95)^3)]\times16$	548,720
Fixed costs:			
- Depreciation on equipment purchased for the project		45,000×20	900,000
- Allocation of existing fixed overheads		Irrelevant cost	-
Total incremental cost of the contract		A	9,694,955
Contract price		(A÷70%)	13,849,936

W-1: Direct labor hrs. per batch for batch 9 onward:		**Hours**
Direct labor hours for the first 8 batches	$8\times1{,}500\times(8)^{-0.152}$	8,748
Direct labor hours for the first 7 batches	$7\times1{,}500\times(7)^{-0.152}$	(7,811)
Hours per batch for 8th and onward batches		937

STICKY NOTES

Labor cost is measured with respect to 'Production' and 'Productivity'

Labor intensive industries tend to develop labor and production designated wage policies

Labor performances are worked out at each period end to analyze the cost and productivity outcome

Learning curve is used to quantify the expected output in the expected time

Payroll account generally includes debit for direct labor expense, salaries and the company's portion of payroll taxes. Credit would be liability or amount of cash paid to the employees.

CHAPTER 5

MARGINAL COSTING AND ABSORPTION COSTING

IN THIS CHAPTER

AT A GLANCE

In marginal costing only variable costs (marginal costs) are charged to the cost of making and selling a product or service. Fixed costs are treated as period costs and are deducted from profit. They are charged in full against the profit of the period in which they are incurred.

In absorption costing variable costs as well as fixed production costs are charged to the cost of making the product or service. Fixed production cost are absorbed using a predetermined absorption rate.

In marginal costing the closing stocks are valued at marginal (variable) production cost where as in absorption costing stocks are valued at their full production cost which includes absorbed fixed production overhead.

If the opening and closing stock levels differ the profit for the accounting period under the two methods of cost accumulation will be different because the two systems value stock differently.

1. MARGINAL COST AND MARGINAL COSTING

1.1 Marginal cost

The marginal cost of an item is its variable cost.

- **Marginal production cost** = Direct materials + Direct labor + Direct expenses + Variable production overhead.
- **Marginal cost of sale** for a **product** = Direct materials + Direct labor + Direct expenses + Variable production overhead + Other variable overhead (for example, variable selling and distribution overhead).
- **Marginal cost of sale** for a **service** = Direct materials + Direct labor + Direct expenses + Variable overhead.

It is usually assumed that **direct labor costs** are variable (marginal) costs, but often direct labor costs might be fixed costs, and so would not be included in marginal cost. E.g. If the workers are not being paid on piece rate basis but rather on fixed salary.

Variable overhead costs might be difficult to identify. In practice, variable overheads might be measured using a technique such as high/low analysis or linear regression analysis, to separate total overhead costs into fixed costs and a variable cost per unit of activity.

- For variable production overheads, the unit of activity is often either direct labor hours or machine hours, although other suitable measures of activity might be used.
- For variable selling and distribution costs, the unit of activity might be sales volume or sales revenue.
- Administration overheads are usually considered to be fixed costs, and it is very unusual to come across variable administration overheads.

In simple words…

In marginal costing the cost of the product is variable Production Cost only.

1.2 Marginal costing and its uses

Marginal costing is a method of costing with marginal costs. It is an alternative to absorption costing as a method of costing. In marginal costing, fixed production overheads are not absorbed into product costs.

There are several reasons for using marginal costing:

- To measure profit (or loss), as an alternative to absorption costing
- To forecast what future profits will be
- To calculate what the minimum sales volume must be in order to make a profit

It can also be used to provide management with information for decision making.

Its main uses, however, are for planning (for example, budgeting), forecasting and decision making as it deals with costs that can be directly changed in the short term.

1.3 Assumptions in marginal costing

For the purpose of marginal costing, the following assumptions are normally made:

- Every additional unit of output or sale, or every additional unit of activity, has the same variable cost as every other unit. In other words, the variable cost per unit is a constant value.
- Fixed costs are costs that remain the same in total in each period, regardless of how many units are produced and sold.
- Costs are either fixed or variable, or a mixture of fixed and variable costs. Mixed costs can be separated into a variable cost per unit and a fixed cost per period.

- The marginal cost of an item is therefore the extra cost that would be incurred by making and selling one extra unit of the item. Therefore, marginal costing is particularly important for decision making as it focuses on what changes as a result of a decision.

1.4 Contribution margin

Contribution is a key concept in marginal costing.

Contribution margin = Sales – Variable costs

Fixed costs are a constant total amount in each period. To make a profit, an entity must first make enough contribution to cover its fixed costs. Contribution therefore means: 'contribution towards covering fixed costs and making a profit'.

Total contribution margin – Fixed costs = Profit

In simple words…

Contribution margin is sales minus all Variable costs

2. REPORTING PROFIT WITH MARGINAL COSTING

2.1 Total contribution minus fixed costs

Profit is measured by comparing revenue to the cost of goods sold in the period and then deducting other expenses.

The cost of goods sold is the total cost of all production costs in the period adjusted for the inventory movement.

In a marginal cost system, the opening and closing inventory is measured at its marginal cost. The cost per unit only includes the variable costs of production (direct materials + direct labor + direct expenses + variable production overhead).

When measuring profits using marginal costing, it is usual to identify contribution, and then to subtract fixed costs from the total contribution, in order to get to the profit figure.

Illustration:	Rs.	Rs.
Sales		360,000
Direct costs	105,000	
Variable production costs	15,000	
Variable sales and distribution costs	10,000	
Total marginal costs		(130,000)
Total contribution		230,000
Total fixed costs		(150,000)
Profit		80,000

Total contribution and contribution per unit

In marginal costing, it is assumed that the variable cost per unit of product (or per unit of service) is constant. If the selling price per unit is also constant, this means that the contribution earned from selling each unit of product is the same.

Total contribution can therefore be calculated as: Units of sale × Contribution per unit.

- *Example 01:*

A company manufactures and sells two products, A and B.

Product A has a variable cost of Rs.6 and sells for Rs.10, and product B has a variable cost of Rs.8 and sells for Rs.15.

During the period, 20,000 units of Product A and 30,000 units of Product B were sold.

Fixed costs were Rs.260,000. What was the profit or loss for the period?

Contribution per unit:

Product A: Rs.10 – Rs.6 = Rs.4

Product B: Rs.15 – Rs.8 = Rs.7

	Rs.
Contribution from Product A: (20,000 × Rs.4)	80,000
Contribution from Product B: (30,000 × Rs.7)	210,000
Total contribution for the period	290,000
Fixed costs for the period	(260,000)
Profit for the period	30,000

2.2 A marginal costing income statement with opening and closing inventory

The explanation of marginal costing has so far ignored opening and closing inventory.

In absorption costing, the production cost of sales is calculated as 'opening inventory value + production costs incurred in the period – closing inventory value'.

The same principle applies in marginal costing. The variable production cost of sales is calculated as 'opening inventory value + variable production costs incurred in the period – closing inventory value'.

When marginal costing is used, inventory is valued at its **marginal cost of production** (variable production cost), without any absorbed fixed production overheads.

If an income statement is prepared using marginal costing, the opening and closing inventory might be shown, as follows:

Illustration: Marginal costing income statement for the period	Rs.	Rs.
Sales		440,000
Opening inventory at variable production cost	5,000	
Variable production costs		
Direct materials	60,000	
Direct labor	30,000	
Variable production overheads	15,000	
	110,000	
Less: Closing inventory at variable production cost	(8,000)	
Variable production cost of sales	102,000	
Variable selling and distribution costs	18,000	
Variable cost of sales		120,000
Contribution		320,000
Fixed costs:		
Production fixed costs	120,000	
Administration costs (usually 100% fixed costs)	70,000	
Selling and distribution fixed costs	90,000	
Total fixed costs		280,000
Profit		40,000

If the variable production cost per unit is constant (i.e. it was the same last year and this year), there is no need to show the opening and closing inventory valuations separately, and the income statement could be presented more simply as follows:

Illustration: Marginal costing income statement for the period	Rs.	Rs.
Sales		440,000
Variable production cost of sales	102,000	
Variable selling and distribution costs	18,000	
Variable cost of sales		120,000
Contribution		320,000

	Rs.	Rs.
Fixed costs:		
Production fixed costs	120,000	
Administration costs (usually 100% fixed costs)	70,000	
Selling and distribution fixed costs	90,000	
Total fixed costs		280,000
Profit		40,000

2.3 Calculation of marginal cost profit

The following example illustrates the calculation of marginal cost profit.

In the next section the same scenario will be used to show the difference between marginal cost profit and total absorption profit.

- *Example 02:*

Mingora Manufacturing makes and sells a single product:

	Rs.
Selling price per unit	150
Variable costs:	
Direct material per unit	35
Direct labor per unit	25
Variable production overhead per unit	10
Marginal cost per unit	70

Budgeted fixed production overhead	Rs. 110,000 per month	
The following actual data relates to July and August:		
	July	August
Fixed production costs	Rs. 110,000	Rs. 110,000
Production	2,000 units	2,500 units
Sales	1,500 units	3,000 units

There was no opening inventory in July.

This means that there is no closing inventory at the end of August as production in the two months (2,000 + 2,500 units = 4,500 units) is the same as the sales (1,500 + 3,000 units = 4,500 units)

The profit statements for each month are shown below. Work through these carefully one month at a time.

	July	August
Sales:		
1,500 units × Rs. 150	225,000	
3,000 units × Rs. 150		450,000
Opening inventory	nil	35,000
Variable production costs		
Direct material: 2,000 units × Rs. 35	70,000	
Direct labor: 2,000 units × Rs. 25	50,000	
Variable overhead 2,000 units × Rs. 10	20,000	
Direct material: 2,500 units × Rs. 35		87,500
Direct labor: 2,500 units × Rs. 25		62,500
Variable overhead 2,500 units × Rs. 10		25,000
Closing inventory		
500 units @ (70)	(35,000)	
Zero closing inventory		nil
Cost of sale	(105,000)	(210,000)
Contribution	120,000	240,000
Fixed production costs (expensed)	(110,000)	(110,000)
Profit for the period	10,000	130,000

In simple words…

To calculate profit, we have to deduct all Fixed Cost from Contribution Margin.

3. REPORTING PROFIT WITH ABSORPTION COSTING

3.1 Reporting profit with absorption costing

Absorption costing is the 'traditional' way of measuring profit in a manufacturing company. Inventory is valued at the full cost of production, which consists of direct materials and direct labor cost plus absorbed production overheads (fixed and variable production overheads).

Fixed production overhead may be under- or over- absorbed because the absorption rate is a predetermined rate. This was covered in chapter 3.

Over and under absorption is the difference between absorbed and actual overheads. If absorbed are greater than actual overheads, it is over absorption and vice versa.

The full presentation of an absorption costing income statement might therefore be as follows (illustrative figures included):

Illustration: Total absorption costing income statement for the period	Rs.	Rs.
Sales		430,000
Opening inventory at full production cost	8,000	
Production costs		
Direct materials	60,000	
Direct labor	30,000	
Production overheads absorbed	100,000	
	198,000	
Less: Closing inventory at full production cost	(14,000)	
Full production cost of sales		(184,000)
		246,000
(Under)/over absorption		
Production overheads absorbed	100,000	
Production overheads incurred	(95,000)	
Over-absorbed overheads		5,000
		251,000
Administration, selling and distribution costs		(178,000)
Profit		73,000

3.2 Calculation of total absorption costing profit

The following example uses the same base scenario as that used to illustrate marginal costing. This means you can compare the difference between absorption and marginal costing profits.

▶ *Example 03:*

Mingora Manufacturing makes and sells a single product

	Rs.
Selling price per unit	150
Variable costs:	
Direct material per unit	35
Direct labor per unit	25
Variable production overhead per unit	10
	70
Fixed overhead per unit (see below)	50
Total absorption cost per unit	120

Normal production	2,200 units per month
Budgeted fixed production overhead	Rs. 110,000 per month

Fixed overhead absorption rate	Rs. 110,000/2,200 units= Rs. 50 per unit

The following data relates to July and August:

	July	August
Fixed production costs	Rs. 110,000	Rs. 110,000
Production	2,000 units	2,500 units
Sales	1,500 units	3,000 units

There was no opening inventory in July.

This means that there is no closing inventory at the end of August as production in the two months (2,000 + 2,500 units = 4,500 units) is the same as the sales (1,500 + 3,000 units = 4,500 units)

Total absorption cost profit statement

	July	August
Sales:		
1,500 units × Rs. 150	225,000	
3,000 units × Rs. 150		450,000

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	July	August
Opening inventory	nil	60,000
Variable production costs		
Direct material: 2,000 units × Rs. 35	70,000	
Direct labor: 2,000 units × Rs. 25	50,000	
Variable overhead 2,000 units × Rs. 10	20,000	
Direct material: 2,500 units × Rs. 35		87,500
Direct labor: 2,500 units × Rs. 25		62,500
Variable overhead 2,500 units × Rs. 10		25,000
Fixed production costs (absorbed)		
2,000 units × Rs. 50	100,000	
2,500 units × Rs. 50		125,000
Closing inventory		
500 units @ (70 + 50)	(60,000)	
Zero closing inventory		nil
Cost of sale	(180,000)	(360,000)
Profit for the period before adjustment for over and under absorption		
(Under)/over absorption	45,000	90,000
Production overheads absorbed	100,000	125,000
Production overheads incurred	110,000	110,000
Over- (under)absorbed overheads	(10,000)	15,000
Profit for the period after adjustment for over and under absorption	35,000	105,000

- *Example 04:*

Silver Limited (SL) produces and markets a single product. Following budgeted information is available from SL's records for the month of March 20X4:

Volumes	
Sales	100,000 units
Production	120,000 units
Standard costs:	
Direct materials per unit	0.8 kg at Rs. 60 per kg
Labor per unit	27 minutes at Rs. 80 per hour
Variable production overheads	Rs. 40 per labor hour
Variable selling expenses	Rs. 15 per unit
Fixed selling expenses	Rs. 800,000

Fixed production overheads, at a normal output level of 105,000 units per month, are estimated at Rs. 2,100,000. The estimated selling price is Rs. 180 per unit.

Assuming there are no opening stocks, preparation SL's budgeted profit and loss statement for the month of March 20X4 using absorption costing would be as follows:

Absorption costing:	**Rupees**
Sales [100,000 x Rs. 180]	18,000,000
Less: Cost of sales:	
Opening stock	-
Add: Direct materials [0.8 x 120,000 x 60]	5,760,000
Direct labor [27/60 x 120,000 x 80]	4,320,000
Variable overheads [27/60 x 120,000 x 40]	2,160,000
Fixed overheads [2,100,000 / 105,000 x 120,000]	2,400,000
	14,640,000
Less: Closing stock [14,640,000 / 120,000 x 20,000]	(2,440,000)
Cost of sales	(12,200,000)
Less: Over-absorbed overheads [2,100,000 / 105,000 x 15,000]	(300,000)
Gross profit	6,100,000
Less: Selling expenses:	
Variable [100,000 x 15]	(1,500,000)
Fixed	(800,000)
	(2,300,000)
Net profit	3,800,000

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4. MARGINAL COSTING AND ABSORPTION COSTING COMPARED

4.1 The difference in profit between marginal costing and absorption costing

The profit for an accounting period calculated with marginal costing is different from the profit calculated with absorption costing.

The difference in profit is entirely due to the differences in inventory valuation as fixed overheads are treated as period cost in marginal costing and as product cost in absorption costing.

The main difference between absorption costing and marginal costing is that in absorption costing, inventory cost includes a share of fixed production overhead costs.

- The opening inventory contains fixed production overhead that was incurred last period. Opening inventory is written off against profit in the current period. Therefore, part of the previous period's costs is written off in the current period income statement provided that the opening inventory is sold during the current year.
- The closing inventory contains fixed production overhead that was incurred in this period. Therefore, this amount is not written off in the current period income statement but carried forward to be written off in the next period income statement.

The implication of this is as follows (assume costs per unit remain constant):

- When there is no change in the opening or closing inventory, exactly the same profit will be reported using marginal costing and absorption costing.
- If inventory increases in the period (closing inventory is greater than opening inventory), the fixed production overhead brought forward from last period will be less than share of production overhead carried forward to next period, thus the absorption costing profit would be higher than marginal costing profit.
- Similarly, if inventory decreases in the period (closing inventory is less than opening inventory), marginal costing profit would be higher than absorption costing.

The difference in the two profit figures is calculated as follows:

► *Formula:*

Profit difference under absorption costing (TAC = total absorption costing) and marginal costing (MC)
Assuming cost per unit is constant across all periods under consideration.
Number of units increase or decrease × Fixed production overhead per unit

► *Example 04 (Contd):*

Profit difference	July	August	Over the two months
Absorption costing profit	35,000	105,000	140,000
Marginal costing profit	10,000	130,000	140,000
Profit difference	25,000	(25,000)	nil

This profit can be explained the different way the inventory movement is cost under each system:

	Units	Units	Units
Closing inventory		nil	nil
2,000 units made less 1,500 sold	500		
Opening inventory	nil	500	nil
	500	(500)	nil
Absorbed fixed production overhead per unit	Rs. 50	Rs. 50	Rs. 50
Profit difference	25,000	(25,000)	nil

Note that the difference is entirely due to the movement in inventory value:

Profit difference – due to inventory movement

TAC inventory movement:	July	August	Over the two months
Closing inventory	60,000	nil	nil
Opening inventory	nil	(60,000)	nil
	60,000	(60,000)	nil
MC inventory movement			
Closing inventory	35,000	nil	nil
Opening inventory	nil	(35,000)	nil
	35,000	(35,000)	nil
Profit difference	25,000	(25,000)	nil

Reconciliation between absorption costing profit and marginal costing profit

	July	August
Marginal costing profit	10,000	130,000
July-adjust for FOH in inventory (500 units x Rs. 50)	25,000	
August-adjust for FOH in inventory (500 units x Rs. 50)		(25,000)
Absorption costing profit	35,000	105,000

4.2 Summary: comparing marginal and absorption costing profit

To calculate the difference between the reported profit using marginal costing and the reported profit using absorption costing, you might need to make the following simple calculations.

- the increase or decrease in inventory during the period, in units.
- the fixed production overhead cost per unit.

The important points to remember are:

- The difference in profit is the increase or decrease in inventory quantity multiplied by the fixed production overhead cost per unit.
- If there has been an increase in inventory, the absorption costing profit is higher. If there has been a reduction in inventory, the absorption costing profit is lower.
- Ignore fixed selling overhead or fixed administration overhead. These are written off in full as a period cost in both absorption costing and marginal costing, and only fixed production overheads are included in inventory values.

▶ *Example 05:*

A company uses marginal costing. In the financial period that has just ended, opening inventory was Rs.8,000 and closing inventory was Rs.15,000. The reported profit for the year was Rs.96,000.

If the company had used absorption costing, opening inventory would have been Rs.15,000 and closing inventory would have been Rs.34,000.

What would have been the profit for the year if absorption costing had been used?

In doing so, please see the following:

There was an increase in inventory. It was Rs.7,000 using marginal costing (= Rs.15,000 – Rs.8,000). It would have been Rs.19,000 using absorption costing.

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	Rs.
Increase in inventory, marginal costing	7,000
Increase in inventory, absorption costing	19,000
Difference (profit higher with absorption costing)	12,000
Profit with marginal costing	96,000
Profit with absorption costing	108,000

The profit is higher with absorption costing because there has been an increase in inventory (production volume has been more than sales volume.)

- *Example 06:*

A company uses absorption costing. In the financial period that has just ended, opening inventory was Rs.76,000 and closing inventory was Rs.49,000. The reported profit for the year was Rs.183,000.

If the company had used marginal costing, opening inventory would have been Rs.40,000 and closing inventory would have been Rs.28,000.

What would have been the profit for the year if marginal costing had been used?

There was a reduction in inventory. It was Rs.27,000 using absorption costing (= Rs.76,000 – Rs.49,000). It would have been Rs.12,000 using marginal costing.

	Rs.
Reduction in inventory, absorption costing	27,000
Reduction in inventory, marginal costing	12,000
Difference (profit higher with marginal costing)	15,000
Profit with absorption costing	183,000
Profit with marginal costing	198,000

Profit is higher with marginal costing because there has been a reduction in inventory during the period.

- *Example 07:*

The following information relates to a manufacturing company for a period.

Production	16,000 units	Fixed production costs	Rs.80,000
Sales	14,000 units	Fixed selling costs	Rs.28,000

Using absorption costing, the profit for this period would be Rs.60,000. Assuming there is no opening inventory

What would have been the profit for the year if marginal costing had been used?

Ignore the fixed selling overheads. These are irrelevant since they do not affect the difference in profit between marginal and absorption costing.

There is an increase in inventory by 2,000 units, since production volume (16,000 units) is higher than sales volume (14,000 units).

If absorption costing is used, the fixed production overhead cost per unit is Rs.5 (=Rs.80,000/16,000 units).

The difference between the absorption costing profit and marginal costing profit is therefore Rs.10,000 (= 2,000 units × Rs.5).

Absorption costing profit is higher, because there has been an increase in inventory.

Marginal costing profit would therefore be Rs.60,000 – Rs.10,000 = Rs.50,000.

- *Example 08:*

Red Company is a manufacturing company that makes and sells a single product. The following information relates to the company's manufacturing operations in the next financial year.

Opening stock:	Nil
Production:	18,000 units
Sales:	15,000 units
Fixed production overheads:	Rs.117,000
Fixed sales overheads:	Rs.72,000

Using absorption costing, the company has calculated that the budgeted profit for the year will be Rs.43,000.

What would be the budgeted profit if marginal costing is used, instead of absorption costing?

In completing the requirement, Production overhead per unit, with absorption costing, please see below:

= Rs.117,000/18,000 units

= Rs.6.50 per unit.

The budgeted increase in inventory = 3,000 units (18,000 – 15,000).

Production overheads in the increase in inventory = 3,000 × Rs.6.50 = Rs.19,500.

With marginal costing, profit will be lower than with absorption costing, because there is an increase in inventory levels.

Marginal costing profit = Rs.43,000 - Rs.19,500 = Rs.23,500.

- *Example 09*

Entity T manufactures a single product, and uses absorption costing. The following data relates to the performance of the entity during October.

Profit	Rs.37,000
Over-absorbed overhead	Rs.24,000
Sales (48,000 units)	Rs.720,000
Non-production overheads (all fixed costs)	Rs.275,000
Opening inventory	Rs.144,000
Closing inventory	Rs.162,000

Units of inventory are valued at Rs.9 each, consisting of a variable cost (all direct costs) of Rs.3 and a fixed overhead cost of Rs.6. All overhead costs are fixed costs.

a) When required to calculate the actual production overhead cost for October and the profit that would have been reported in October if Entity T had used marginal costing, see below working.

	units
Opening inventory (Rs.144,000/Rs.9)	16,000
Closing inventory (Rs.162,000/Rs.9)	18,000
Increase in inventory in October	2,000
Sales	48,000
Production in October	50,000

	Rs.
Absorbed production overhead (50,000 × Rs.6)	300,000
Over-absorbed overheads	24,000
Actual production overhead expenditure	276,000

a) Since, inventory increased during October; therefore, the reported profit will be higher with absorption costing than with marginal costing, as below

	Rs.
Absorption cost profit	37,000
Increase inventory × fixed production overhead per unit	
(2,000 × Rs.6)	12,000
Marginal costing profit	25,000

Proof:

	Rs.	Rs.
Sales		720,000
Variable cost of sales (48,000 × Rs.3)		144,000
Contribution		576,000
Fixed production overheads (see above)	276,000	
Other fixed overheads	275,000	
Total fixed overheads		551,000
Marginal costing profit		25,000

5. ADVANTAGES AND DISADVANTAGES OF ABSORPTION AND MARGINAL COSTING

The previous sections of this chapter have explained the differences between marginal costing and absorption costing as methods of measuring profit in a period. Some conclusions can be made from these differences.

- The amount of profit reported in the cost accounts for a financial period will depend on the method of costing used.
- Since the reported profit differs according to the method of costing used, there are presumably reasons why one method of costing might be used in preference to the other. In other words, there must be some advantages (and disadvantages) of using either method.

5.1 Advantages and disadvantages of absorption costing

Absorption costing has a number of advantages and disadvantages.

Advantages of absorption costing

- Inventory values include an element of fixed production overheads. This is consistent with the requirement in financial accounting that (for the purpose of financial reporting) inventory should include production overhead costs.
- Calculating under/over absorption of overheads may be useful in controlling fixed overhead expenditure.
- By calculating the full cost of sale for a product and comparing it will the selling price, it should be possible to identify which products are profitable and which are being sold at a loss.

Disadvantages of absorption costing

- Absorption costing is a more complex costing system than marginal costing.
- Absorption costing does not provide information that is useful for decision making (like marginal costing does).
- Assigning of Production overheads always include an element of discretion; and
- It might led to sub-optimal decision-making as a product might be discontinued due to loss which might be caused by fixed production over head.

5.2 Advantages and disadvantages of marginal costing

Marginal costing has a number of advantages and disadvantages.

Advantages of marginal costing

- It is easy to account for fixed overheads using marginal costing. Instead of being apportioned they are treated as period costs and written off in full as an expense the income statement for the period when they occur.
- There is no under/over-absorption of overheads with marginal costing, and therefore no adjustment necessary in the income statement at the end of an accounting period.
- Marginal costing provides useful information for decision making.

Disadvantages of marginal costing

- Marginal costing does not value inventory in accordance with the requirements of financial reporting. (However, for the purpose of cost accounting and providing management information, there is no reason why inventory values should include fixed production overhead, other than consistency with the financial accounts.)
- Marginal costing can be used to measure the contribution per unit of product, or the total contribution earned by a product, but this is not sufficient to decide whether the product is profitable enough. Total contribution has to be big enough to cover fixed costs and make a profit.

6. COMPREHENSIVE EXAMPLES

▶ *Example 01:*

Entity RH makes and sells one product. Currently, it uses absorption costing to measure profits and inventory values. The budgeted production cost per unit is as follows:

		Rs.
Direct labor	3 hours at Rs.6 per hour	18
Direct materials	4 kilograms at Rs.7 per kilo	28
Production overhead	(Fixed cost)	20
		66

Normal output volume is 16,000 units per year and this volume is used to establish the fixed overhead absorption rate for each year.

Costs relating to sales, distribution and administration are:

Variable 20% of sales value

Fixed Rs.180,000 per year.

There were no units of finished goods inventory at 1 October Year 5.

The fixed overhead expenditure is spread evenly throughout the year.

The selling price per unit is Rs.140.

For the two six-monthly periods detailed below, the number of units to be produced and sold are budgeted as follows:

	Six months ending 31 March Year 6	Six months ending 30 September Year 6
Production	8,500 units	7,000 units
Sales	7,000 units	8,000 units

The entity is considering whether to abandon absorption costing and use marginal costing instead for profit reporting and inventory valuation.

a) Calculation of the budgeted fixed production overhead costs each year, is as follows.

Budgeted production overhead expenditure =

Normal production volume × Absorption rate per unit

= 16,000 units × Rs.20 = Rs.320,000.

Since expenditure occurs evenly throughout the year, the budgeted production overhead expenditure is Rs.160,000 in each six-month period.

b) Statements for management showing sales, costs and profits for each of the six-monthly periods using marginal and absorption costing would be prepared as follows

i. marginal costing

ii. absorption costing

Workings	Rs. per unit
Direct material	18
Direct labor	28
Marginal cost of sale	46

i. Marginal costing

	Six months to 31 March		Six months to 30 September	
Units sold		7,000		8,000
	Rs.	**Rs.**	**Rs.**	**Rs.**
Sales at Rs.140		980,000		1,120,000
Marginal cost of sales (at Rs.46)		322,000		368,000
		658,000		752,000
Variable admin & distribution (20% of sales value)		196,000		224,000
Contribution		462,000		528,000
Fixed costs				
Production (Rs.320,000/2)	160,000		160,000	
Other (Rs.180,000/2)	90,000	250,000	90,000	250,000
Profit		212,000		278,000

ii. Absorption costing

The fixed overhead absorption rate is based on the normal volume of production. Since budgeted output in each six-month period is different from the normal volume, there will be some under- or over-absorption of production overhead in each six-month period.

	Six months to 31 March		Six months to 30 September	
Units sold		7,000		8,000
	Rs.	**Rs.**	**Rs.**	**Rs.**
Sales at Rs.140		980,000		
Production cost of sales (at Rs.66)		462,000		528,000
		518,000		592,000
Production overhead absorbed	170,000		140,000	
(8,500 × Rs.20: 7,000 × Rs.20)				
Actual production overhead	160,000		160,000	
Over-/(under-) absorbed overheads		10,000		(20,000)
		528,000		572,000

	Six months to 31 March		Six months to 30 September	
Sales, distribution, admin costs				
Variable	196,000		224,000	
(7,000 × Rs.28: 8,000 × Rs.28)				
Other	90,000		90,000	
		286,000		314,000
Profit		242,000		258,000

c) An explanatory statement reconciling for each six-monthly period the profit using marginal costing with the profit using absorption costing, is prepared below.

Reconciliation of profit figures

Six months to 31 March Year 6		
Increase in inventory	(8,500 – 7,000 units)	1,500 units
Production overhead absorbed in these units (absorption costing)		Rs.20 per unit
Therefore absorption costing profit higher by		Rs.30,000
Six months to 30 SeptemberYear 6		
Reduction in inventory	(7,000 – 8,000 units)	1,000 units
Production overhead absorbed in these units (absorption costing)		Rs.20 per unit
Therefore absorption costing profit lower by		Rs.20,000

The difference in reported profits is due entirely to differences in the valuation of inventory (and so differences in the increase or reduction in inventory during each period).

► *Example 02:*

Zulfiqar Limited makes and sells a single product and has the total production capacity of 30,000 units per month. The company budgeted the following information for the month of January 20X4:

Normal capacity (units)	**27,000**
Variable costs per unit:	
Production (Rs.)	110
Selling and administration (Rs.)	25
Fixed overheads:	
Production (Rs.)	756,000
Selling and administration (Rs.)	504,000

The actual operating data for January 20X4 is as follows:

Production	**24,000 units**
Sales @ Rs. 250 per unit	22,000 units
Opening stock of finished goods	2,000 units

During the month of January 20X4, the variable factory overheads exceeded the budget by Rs. 120,000.

a) Preparation of profit statement for the month of January using marginal and absorption costing would be as follows

Profitability Statement under Marginal Costing	**Rupees**	
Sales (22,000 units @ Rs. 250)		5,500,000
Variable Costs:		
Production Costs:		
Cost of productions (24,000 x Rs.110)	2,640,000	
Additional Variable Costs.	120,000	
	2,760,000	
Less: Closing stocks (2,760,000 / 24,000 x 4,000)	(460,000)	
Add: Opening stocks (2,000 x Rs. 110)	220,000	
	2,520,000	
Selling and administrative expenses (22,000 x 25)	550,000	
		3,070,000
Contribution Margin		2,430,000
Less: Fixed costs		
Production	756,000	
Selling and administrative expense	504,000	
		1,260,000
Net Profit		**1,170,000**

Profitability Statement under Absorption Costing	**Rupees**	
Sales (22,000 units @ Rs. 250)		5,500,000
Cost of Goods Sold		
Cost of production (24,000 x Rs. 138 **(W-1)**	3,312,000	
Additional variable costs.	120,000	
	3,432,000	
Less: Closing stocks (3,432,000 / 24,000 x 4,000)	(572,000)	
Add: Opening stocks (2,000 x Rs. 138)	276,000	
	3,136,000	
Under applied factory overhead (3,000 **(W-2)** x Rs.28 **(W-1)**)	84,000	
		3,220,000
Gross Profit		2,280,000
Selling expenses		
(Rs. 504,000 + 22,000 x Rs.25)		1,054,000
		1,226,000

W-1:	Rupees
Variable overhead per unit	110
Fixed overhead per unit (Rs. 756,000 / 27,000)	28
	138

W-2:	Units
Budgeted production - Normal capacity	27,000
Actual production	24,000
Under-utilized capacity	3,000

b) Then, if required to reconcile the difference in profits under the two methods, please see below

	Rupees
Profit under absorption costing	1,226,000
Less: Closing stock (under-valued in marginal costing)	
(Rs. 572,000 - Rs. 460,000)	(112,000)
Add: Opening stock (under-valued in marginal costing)	
(Rs. 276,000 - Rs. 220,000)	56,000
Profit under marginal costing	**1,170,000**

- *Example 03:*

Following information has been extracted from the financial records of ATF Limited: Production during the year units 35,000

Finished goods at the beginning of the year	**units**	**3,000**
Finished goods at the end of the year	units	1,500
Sale price per unit	Rs.	200
Fixed overhead cost for the year	Rs.	1,000,000
Administration and selling expenses	Rs.	200,000
Annual budgeted capacity of the plant	units	40,000

The actual cost per unit, incurred during the year, was as follows:

	Rupees
Material	70
Labor	40
Variable overheads	30

Company uses FIFO method for valuation of inventory. The cost of opening finished goods inventory determined under the absorption costing method system was Rs. 450,000. Fixed overhead constituted 16% of the total cost last year.

a) Preparation of profit statements for the year, under absorption and marginal costing systems, would be as follows

	Absorption Costing (Rs.)	Marginal Costing (Rs.)
Sales (3,000 + 35,000-1,500) × Rs. 200	7,300,000	7,300,000
Cost of goods manufactured		
Opening Inventory	450,000	378,000*
Add: Cost of goods manufactured (35,000 × 165) & (35,000 / 140)	5,775,000	4,900,000
	6,225,000	5,278,000
Less: Ending inventory (1,500 x 165) & (1,500 × 140)	(247,500)	(210,000)
	(5,997,500)	5,068,000
Gross profit / contribution margin	1,322,500	2,232,000
Less: unabsorbed overheads [1,000,000 – (Rs. 25 × 35,000)]	(125,000)	-
Less: Administration and selling expenses	(200,000)	(200,000)
Fixed overheads	-	(1,000,000)
Net Profit	997,500	1,032,000

*Cost of opening finished goods under marginal costing Rs. 450,000 × (100%-16%) = Rs. 378,000

Computation of Cost of goods manufactured (COGM) & Ending Inventory:

	Rupees
Material Cost	70
Labor Cost	40
Variable overhead	30
Cost per unit under marginal costing system	140
Fixed overhead (Rs. 1,000,000/40,000)	25
Cost per unit under absorption costing system	165

b) Then, if required to reconcile net profits determined under each system, following computations would be required.

	Rupees
Net Profit under Absorption Costing	997,500
Add: Difference in opening finished goods (Rs. 450,000 – 378,000)	72,000
Less: Difference in ending finished goods (Rs. 247,500 – 210,000)	(37,500)
Net Profit under Marginal Costing	1,032,000

STICKY NOTES

In marginal costing, cost of product is variable production cost only but in absorption costing the cost of the product is variable plus fixed production cost

In marginal costing there is a concept of contribution margin i.e.
Contribution Margin = Sales – all variable cost (both production and non-production)

To arrive at profit all Fixed cost (both production and non-production) should be deduced from contribution margin.

In Absorption costing the cost of the product includes variable production cost plus fixed production overheads estimated by using predetermined absorption rate

In absorption costing over / under absorbed overheads are calculated by comparing absorbed overheads with actual overheads.

In marginal costing the stock is valued at variable production cost only but in absorption costing it is valued at variable plus fixed production cost. This is the reason that the profit figure is different in marginal and absorption costing.

CHAPTER 6

COST FLOW IN PRODUCTION

IN THIS CHAPTER

AT A GLANCE

Accounting is a systematic process of identifying, recording, measuring, classifying, verifying, summarizing, interpreting and communicating financial information

Cost accounting is primarily about costing of the product and Management accounting is all about Planning, Control and Decision Making.

Accounting for the production of inventory mirrors the cost flow from Raw Material accounts, wages control account, Production overhead control account to WIP account and then to finished goods and P&L account.

Integrated accounts combine both financial and cost accounts in one system of ledger accounts. Interlocking systems contain separate cost accounting and financial accounting ledgers.

1. ACCOUNTING FOR INVENTORY

There are two main methods of recording inventory.

- Periodic inventory method (period end system)
- Perpetual inventory system

Each method uses a ledger account for inventory but these have different roles.

Periodic inventory method

Opening inventory in the trial balance (a debit balance) and purchases (a debit balance) are both transferred to cost of sales thus clearing both accounts.

Closing inventory is recognized in the inventory account as an asset (a debit balance) and the other side of the entry is a credit to cost of sales. Cost of sales comprises purchase in the period adjusted for movements in inventory level from the start to the end of the period.

Perpetual inventory method

A single account is used to record all inventory movements. The inventory account is used to show the current cost of inventory in hand. In this type of accounting, a separate account for purchases is not maintained as part of double entry records. The account is also used to record all issues out of inventory. These issues constitute the cost of sales.

When the perpetual inventory method is used, a record is kept of all receipts of items into inventory (at cost) and all issues of inventory to cost of sales.

Each issue of inventory is assigned a cost, and the cost of the items issued is either the actual cost of the inventory (if it is practicable to establish the actual cost i.e. the inventory is individually identifiable) or a cost obtained using a valuation method.

Each receipt and issue of inventory is recorded in the inventory account. This means that a purchases account becomes unnecessary, because all purchases are recorded in the inventory account. Though a separate detail of purchases may be maintained for vendor documentation purposes.

All transactions involving the receipt or issue of inventory must be recorded, and at any time, the balance on the inventory account should be the value of inventory currently held. Though there is no need for inventory count but one at the end of each period is conducted to maintain control over the integrity of records.

1.1 Accounting for the production of inventory

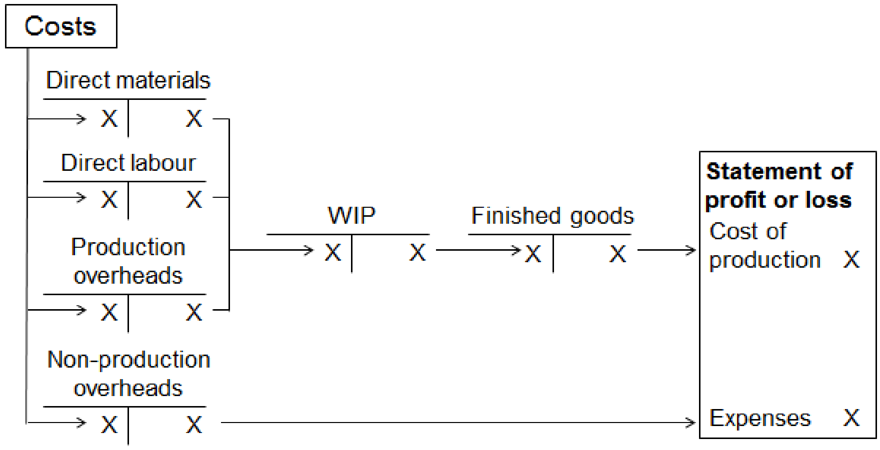
Costing systems

The above methods of accounting for inventory were previously explained for a company that buys and sells goods. This chapter explains how to account for goods that are manufactured instead of purchased.

As a simple starting point:

- For a retail company, the cost of goods sold is simply the purchase price of the goods.
- For a manufacturing company, the cost of goods sold is the total production cost including direct materials, direct labor and production overheads. The accounting systems must identify these costs and then transfer them into finished goods (usually via work-in-progress) and thus into cost of sales.

▶ *Illustration: Cost flow*



This diagram implies that cost accounting can be studied as a series of steps:

Step No.	Stage of inventory	Accounting treatment
1.	The inventory is purchased	Recognize costs in appropriate cost accounts
2.	The inventory is issued to the production process	Transfer costs from the cost accounts into work-in- progress
3.	Finished products are obtained at the end of manufacturing process	Transfer costs from work-in-progress into finished goods
4.	Finished goods are sold	Transfer costs from the finished goods account into the statement of profit or loss (income statement) to become part of cost of sales

1.2 Possible complications

Complex production processes

The above steps provide an overview to help you understand the accounting process. There might be variations from this in practice. For example, a complex production process might involve several different processes and this might be reflected in the transfer of costs along a chain of WIP accounts before a final transfer into finished goods.

Outsource Production:

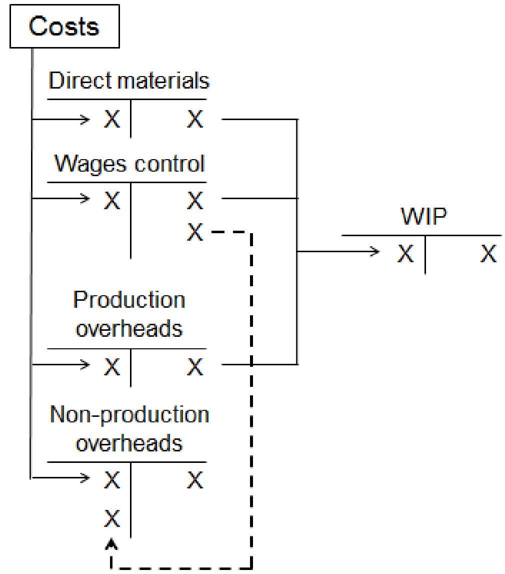
Most industries rely on outsourcing all or part of their production process. In many industries certain processes are outsourced e.g. in textile companies, the process of spinning may be done in-house then the thread be given to an outsourced vendor for knitting and then the knitted cloth be brought back after paying manufacturing charges to the outsourced party to make finished products.

Wages control account

A system will probably contain a wages control account. This will be used to recognize the total wages cost. Some of these might relate to indirect labor or non-production activities.

- Any amounts relating to indirect labor must be transferred to a production overhead account.
- Any amounts relating to non-production labor (e.g. sales or administration) should be transferred into one or more non-production overhead accounts
- The direct labor related to production is transferred to WIP

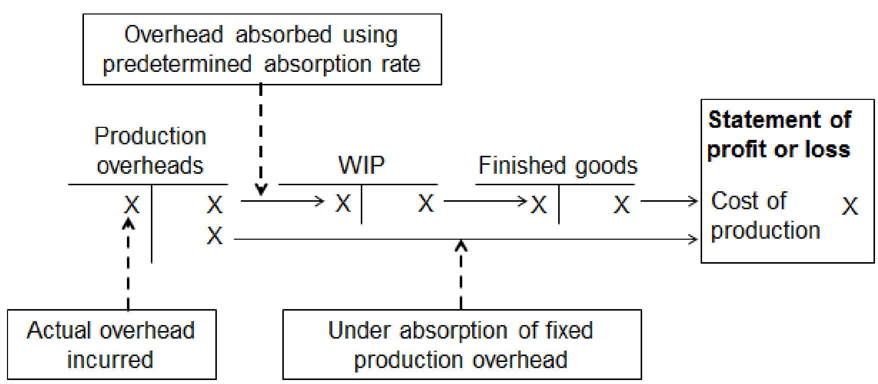
▶ *Illustration: Cost flows showing reclassification of non-production wages*



Over (under) absorption of fixed production overhead

The fixed production overheads account is debited with the actual fixed production overhead incurred in the period. Fixed production overheads are transferred into WIP using a pre-determined absorption rate. The difference between the absorbed overhead and the actual overhead is over (under) absorption. This must be adjusted in the statement of profit or loss.

▶ *Illustration:*



▶ *Example 01*

A company manufactures and sells a range of products in a single factory. Its budgeted production overheads for Year 6 were Rs.150,000, and budgeted direct labor hours were 50,000 hours.

Actual results in Year 6 were as follows:

	Rs.	
Direct materials costs	130,000	
Direct labor costs	160,000	
Fixed production overhead	140,000	(40,000 hours)

There was no opening or closing inventory at the beginning or end of Year 6.

The company uses an absorption costing system, and production overhead is absorbed using a direct labor hour rate.

The information would be accounted for as follows.

Recognition of costs	Debit	Credit
Direct materials	130,000	
Direct labor	160,000	
Fixed production overhead	140,000	
Cash/payables		430,000

Transfer of costs into work-in-progress

	Debit	Credit
WIP	130,000	
Direct materials		130,000
WIP	160,000	
Direct labor		160,000
WIP (see working below)	120,000	
Fixed production overhead		120,000

Working

The predetermined absorption rate is Rs.150,000/50,000 hours = Rs.3 per direct labor hour.

Therefore, the amount transferred = Rs. 120,000 (40,000 hrs × Rs. 3)

Transfer of costs from work-in-progress into finished goods

	Debit	Credit
Finished goods	410,000	
WIP		410,000

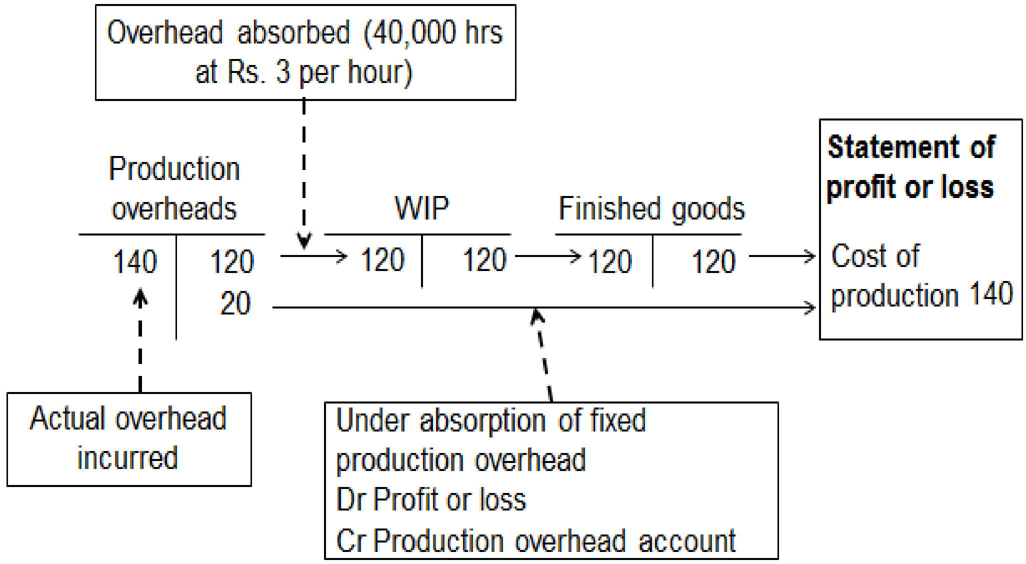
Accounting for under-absorption of fixed production overhead

	Debit	Credit
Statement of profit or loss (see working below)	20,000	
Fixed production overhead		20,000

Working: Under absorption

	Rs.
Overhead absorbed (40,000 hours @ RS. 3 per hour)	120,000
Overhead incurred (actual cost)	(140,000)
Under absorption	(20,000)

This can be represented (in part) by the following diagram (figures in Rs. 000)



1.3 Accounting entries in the cost accounting system

The following suite of journals describes the typical accounting entries that might be posted within a cost accounting system that uses perpetual inventory system.

Journals to recognize expenses as incurred

Illustration: Costing journals – recognition of expenses as incurred

	Debit	Credit
Purchase of raw materials		
Inventory (raw materials)	X	
Payables (or cash)		X
Payment of wages		
Wages control a/c	X	
Cash		X
Recognition of production overhead		
Overhead control a/c	X	
Cash		X
Record production depreciation within overheads		
Overhead control a/c	X	
Accumulated depreciation (assets used in production)		X
Record non-production overheads		
Non-production overhead control a/c	X	
Payables (or cash)		X

Journals to adjust for possible complications

Illustration: Costing journals – Reclassifying production expense into overheads		
	Debit	**Credit**
Reclassification of indirect labor into overheads		
Overhead control a/c	X	
Wages control a/c		X
Issue of indirect materials		
Overhead control a/c	X	
Inventory (raw materials)		X

Journals to recognize use of resources in production

Illustration: Costing journals – Transfer of costs into WIP as production proceeds		
	Debit	**Credit**
Issue of direct materials to WIP		
Inventory (WIP)	X	
Inventory (raw materials)		X
Use of direct labor in production		
Inventory (WIP)	X	
Wages control account		X
Absorption of overheads into production		
Inventory (WIP)	X	
Overhead control a/c		X

Journal to recognize completion of production

Illustration: Costing journals – Transfer of costs from WIP into finished goods		
	Debit	**Credit**
Transfer of costs on completion of production		
Inventory (finished goods)	X	
Inventory (WIP)		X

Journal to recognize transfer of costs to statement of profit or loss when the goods are sold

Illustration: Costing journals – Transfer of costs into statement of profit or loss		
	Debit	**Credit**
Recognition of cost of sales in P&L control account		
P&L control a/c	X	
Inventory (finished goods)		X

Recognition of under-absorption of fixed production overhead		
P&L control a/c	X	
Overhead control a/c		X
Recognition of over-absorption of fixed production overhead		
Overhead control a/c	X	
P&L control a/c		X
Recognition of overheads in P&L control account		
P&L control a/c	X	
Overhead control a/c		X

1.4 Recognizing sales and the calculation of profit

So far this chapter has explained the flow of cost information. Goods are made to be sold. Any accounting system must be able to record sales and allow for the calculation of profit (or loss).

The accounting system would allow for the following journals.

Illustration: Journals to recognized revenue and allow the calculation of profit (or loss)

	Debit	Credit
Recognition of sales		
Receivables (or cash)	X	
Sales		X
Recognition of sales in P&L control account		
Sales	X	
P&L control a/c		X
Transfer from P&L control account to reserves		
Profit:		
P&L control a/c	X	
Retained earnings		X
or loss:		
Retained earnings	X	
P&L control a/c		X

2. COST BOOKKEEPING SYSTEMS

Cost book-keeping systems can be categorized into two types in terms of how the cost accounts relate to other ledger accounts. These two systems are called:

- integrated accounts;
- interlocking accounts.

Interlocking accounts involve using separate ledgers for costing and for financial reporting purposes. Each of these ledgers includes an account (or accounts) to reflect the relationship with the other ledger (thus they are said to interlock). Interlocking systems can vary in the range of transactions reflected in the cost ledger.

- In some systems the cost ledger includes only costing information.
- In other systems the cost ledger recognizes sales and the subsequent calculation of profit. For ease of description we will describe this system as being fully interlocking.

Each of these systems will be explained and illustrated with an example.

2.1 Integrated accounts

Integrated accounts can be defined as

- A single set of accounting records that provide financial and cost accounts using a common input of data.
- A system where all information (both financial and costing) is kept in a single set of books.

As the name suggests, the cost accounts are integrated into the entity's bookkeeping system. There is a single general ledger which includes the cost accounts.

Double entry is simply the normal double entry associated with maintaining a set of accounts including the entries described above.

In practice most companies and ERP solutions available in the market use integrated accounting system.

Advantages of integrated accounts

- Avoids duplication of effort between cost and financial accounting systems.
- Removes the need to reconcile two different systems.
- A single consistent profit figure is available.

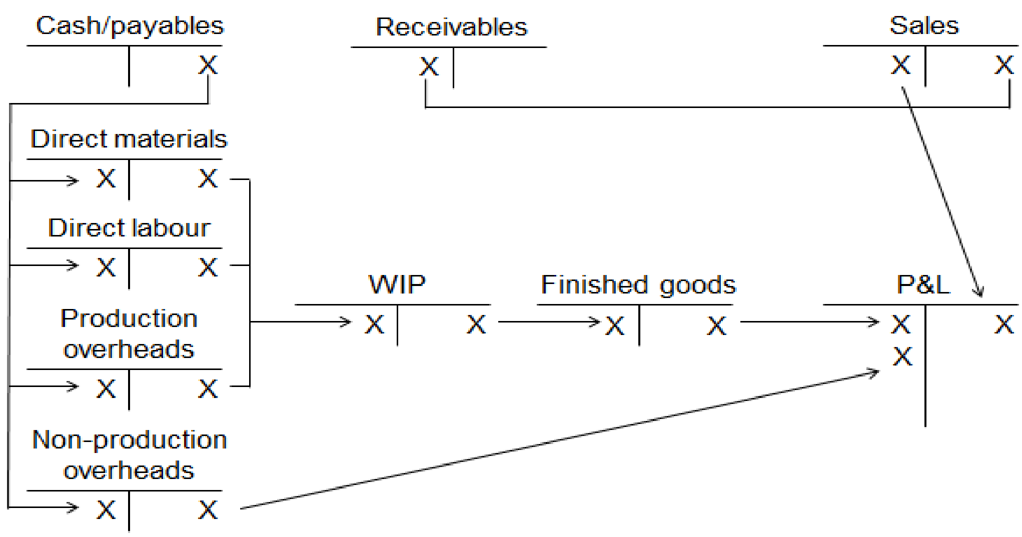
Disadvantages of integrated accounts

- Using a single system for external reporting and the provision of management information reduces flexibility. For example, inventory must be valued at full absorption cost for external reporting purposes (in accordance with IAS 2: *Inventories*) but management might require marginal cost information for decision making.

▶ *Illustration:*

This diagram shows the various ledger accounts and accounting entries used within integrated accounts.

Chart of accounting flow in an integrated accounts system



The direct materials account above might be named differently, for example, raw materials a/c, inventory (raw materials) a/c, stores etc. Similarly, the WIP account might be described as inventory (WIP) a/c and the finished goods account as inventory (finished goods) a/c.

The above diagram does not show it but there may well be a need for an entry to account for Over (under) absorption of fixed production overhead as explained earlier in this chapter (section 1.5).

Profit or loss is calculated in the usual way as the balance on the P&L account. The balance would be transferred to the accumulated profit account (retained earnings account).

2.2 Integrated accounts: Comprehensive illustration

The following illustration applies the accounting entries to ledger accounts for a comprehensive example.

The following balances and transactions relate to a manufacturing company.

Opening inventories	raw materials	10,000kg	Rs.25,000
	work in progress	nil	
	finished goods	1,000 units	Rs.100,000
Materials	purchases	28,000 kg	Rs.77,000
	issues to production	30,000kg	FIFO
Labor	paid	16,000 hours	Rs.96,000
	production	15,000 hours	
Production overhead			Rs.250,000
Standard overhead rate per hour			Rs.20
Completed production		4,000 units	
Closing inventories	raw materials	see above	
	work in progress	nil	
	finished goods	500 units	FIFO
Sales revenue		see above	Rs. 540,000

The balances and transactions would be recorded in the general ledger, as below.

Recognition of expenses as incurred

Purchase of raw materials	Debit	Credit
Inventory (raw materials)	77,000	
Payables		77,000
Payment of wages		
Wages control a/c	96,000	
Cash		96,000
Overhead incurred		
Overhead control a/c	250,000	
Cash		250,000

Reclassification of wages expense into overhead

	Debit	Credit
Overhead control a/c	6,000	
Wages control a/c		6,000

Working	
Number of hours: 16,000 – 15,000	1,000
Hourly rate: Rs. 96,000/16,000 hours	Rs.6
Transfer (Rs.)	6,000

Transfer of expenses into WIP as production proceeds

Raw materials used	Debit	Credit
Inventory (WIP)	80,000	
Inventory (raw materials)		80,000

Working: FIFO	Rs.
First 10,000 kgs (opening inventory)	25,000
Next 20,000 kgs (from purchases (20,000 kgs/28,000 kgs) × Rs.77,000	55,000
Transfer (Rs.)	80,000

Use of direct labor	Debit	Credit
Inventory (WIP)	90,000	
Wages control a/c (96,000 – 6,000)		90,000

Overhead absorbed		
Inventory (WIP)	300,000	
Overhead control a/c		300,000

Working	Rs.
15,000 hours @ Rs. 20 per hour (given)	Rs. 300,000

Transfer of costs from WIP into finished goods	Debit	Credit
Inventory (finished goods)	470,000	
Inventory (WIP)		470,000

Working: Balance in WIP before transfer	Rs.
Opening WIP	–
Raw materials	80,000
Direct labor	90,000
Overhead absorbed	300,000
	470,000
Less: Closing WIP	–
	470,000

Note:

Cost per unit = Rs. 470,000 /4,000 units Rs. 117.5

Transfer of costs to costing P&L a/c

Transfer of finished goods to cost of sales	Debit	Credit
P&L control account	511,250	
Inventory (finished goods)		511,250

Working	Units	Rs.
Opening inventory of finished goods	1,000	100,000
Production	4,000	470,000
	5,000	570,000
Closing inventory of finished goods (@ Rs. 117.5)	(500)	(58,750)
	4,500	511,250
Over-absorption of overhead		
Overhead control a/c	44,000	
P&L control a/c		44,000

Working:	Rs.
Overhead incurred	250,000
Transfer from wages control a/c	6,000
	256,000
Overhead absorbed	300,000
Over absorption	44,000

Recognition of sales and calculation of profit

Recognition of sales	Debit	Credit
Receivables	540,000	
Sales		540,000
Sales	540,000	
P&L control a/c		540,000

Recognition of sales	Debit	Credit
Transfer of profit to accumulated profit		
P&L control a/c	72,750	
Accumulated profit		72,750

Working: Profit for the period	Rs.
Sales	540,000
Cost of sales	
Opening inventory	
Raw materials	25,000
Finished goods	100,000
	125,000
Production costs	
Raw materials	77,000
Wages	96,000
Overheads	250,000
	423,000
Closing inventory	
Raw materials	22,000
Finished goods	58,750
	(80,750)
	(467,250)
Profit	72,750

The general ledger T accounts after the double entries are as follows:

Raw materials

	Rs. '000		Rs. '000
B/f	25,000		
Payables (not shown)	77,000	To WIP	80,000
		C/f	22,000
	102,000		102,000

Wages control

	Rs. '000		Rs. '000
Cash (not shown)	96,000	Overhead control	6,000
		To WIP	90,000
	96,000		96,000

Overhead control

	Rs. '000		Rs. '000
Cash (not shown)	250,000	To WIP	300,000
Wages control	6,000		
P&L control a/c (over abs.)	44,000		
	300,000		300,000

Work in progress (WIP)

	Rs. '000		Rs. '000
Raw materials	80,000	Finished goods	470,000
Wages control	90,000		
Overhead control	300,000		
	470,000		470,000

Finished goods

	Rs. '000		Rs. '000
B/f	100,000	P&L control a/c	511,250
WIP	470,000	C/f	58,750
	570,000		570,000

Sales

	Rs. '000		Rs. '000
P&L control a/c	540,000		
		Receivables (not shown)	540,000
	540,000		540,000

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P&L control a/c			
	Rs. '000		Rs. '000
		Sales	540,000
Finished goods	511,250	Over absorption	44,000
Profit for the period	72,750		
	588,000		588,000

2.3 Interlocking accounts

Interlocking accounts can be defined as

- A system in which the books are divided into two ledgers.
- Cost accounts are maintained in a cost ledger (also known as the factory ledger) and the other accounts are maintained in the general ledger.

There are separate records but these are kept in agreement or are readily reconcilable.

It is convenient to think of a business split into two entities (but remember that this is not necessarily the case):

- The head office maintains the general ledger which is used to generate external reports; and
- A factory maintains the cost ledger (or factory ledger) which is used to record manufacturing.

Each ledger contains an account which reflects each entity's relationship with the other entity. Thus:

- The general ledger contains a **Factory Ledger Control Account (FLC a/c)**. This is a receivable and shows the assets that the head office owns that are held by the factory.
- The factory ledger contains a **General Ledger Control Account (GLC a/c)**. This is a payable that shows the assets that the factory is holding on behalf of the head office. At each period end this would be the sum of raw materials, WIP and finished goods not yet sold.

The balances on these accounts are a mirror image of each other and should agree.

Raw materials are purchased by the head office for the factory. Similarly, the head office pays wages for the production staff and pays the factory overheads. The general ledger reflects this with the following double entries.

Illustration: Expenses incurred by the head office for the factory

General ledger	Debit	Credit
Purchase of direct materials		
Factory ledger control a/c	X	
Payables		X
Payment for direct labor		
Factory ledger control a/c	X	
Cash		X
Production overhead incurred		
Factory ledger control a/c	X	
Cash/payables		X

The result of the above is that the factory ledger control account in the general ledger shows that the factory "owes" these amounts to the head office. They are amounts the head office has invested in the factory.

The amounts are entered in the factory ledger as follows.

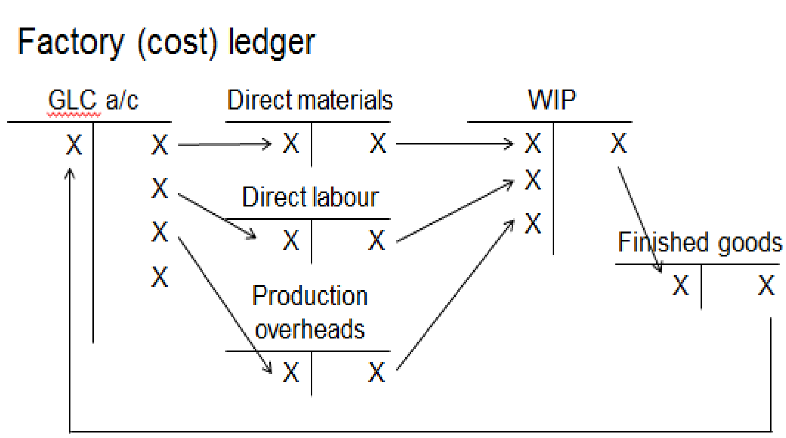
Illustration: Expenses incurred by the head office for the factory		
Factory ledger	**Debit**	**Credit**
Purchase of direct materials		
Inventory (raw materials)	X	
General ledger control a/c		X
Payment for direct labor		
Direct labor	X	
General ledger control a/c		X
Production overhead incurred		
Production overheads	X	
General ledger control a/c		X

In the factory ledger, costs are transferred from the cost accounts into WIP and hence on to finished goods as previously described. The finished goods are the output the head office receives from the factory for onwards sale. The following entries are then made to reflect the completion and transfer of production. The goods may not be physically moved from factory to head office but become available for sale.

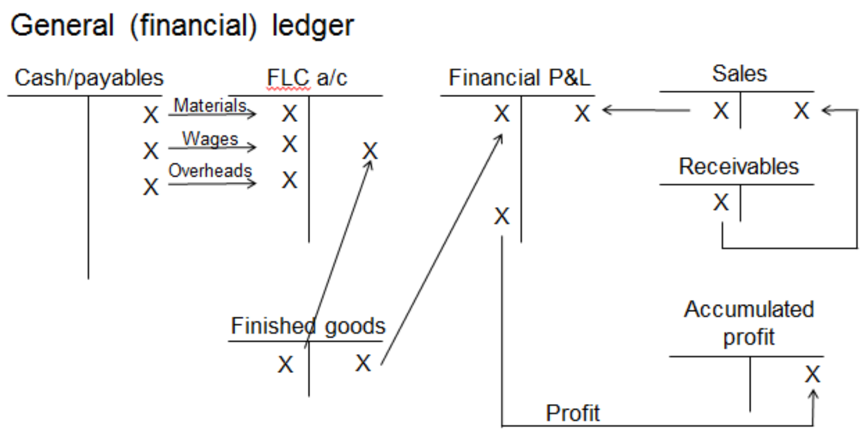
Illustration: Completion of production	Debit	Credit
Completion of production: Factory ledger		
General ledger control a/c	X	
Inventory (finished goods)		X
Completion of production: Financial ledger		
Inventory (finished goods)	X	
Factory ledger control a/c		X

- *Illustration:*

The following diagram provides an overview of the various ledger accounts and the flow of information represented by the accounting entries used within interlocking accounts.



General ledger control account



FLC a/c = Factory ledger control account

2.4 Interlocking accounts: Comprehensive illustration

The following illustration applies the accounting entries to ledger accounts for a comprehensive example.

The following balances and transactions relate to a manufacturing company.

Opening inventories	raw materials	10,000kg	Rs.25,000
(held by factory)	work in progress	nil	
	finished goods	1,000 units	Rs.100,000
			Rs.125,000
Materials	purchases	28,000 kg	Rs.77,000
	issues to production	30,000kg	FIFO
Labor	paid	16,000 hours	Rs.96,000
	production	15,000 hours	
Production overhead			Rs.250,000
Standard overhead rate per hour			Rs.20
Completed production		4,000 units	
Closing inventories	raw materials	see above	
	work in progress	nil	
	finished goods	500 units	FIFO

Opening balance on general ledger control account in factory ledger (and factory ledger control account in general ledger).			Rs. 125,000
(Note that this represents the inventory held by the factory)			
Sales revenue		see above	Rs.540,000

The following pages will show how the balances and transactions would be recorded in the cost ledger and the financial ledger.

Factory ledger

Recognition of expenses as incurred

Purchase of raw materials	Debit	Credit
Inventory (raw materials)	77,000	
General ledger control a/c		77,000
Payment of wages		
Wages control a/c	90,000	
General ledger control a/c		90,000
Overhead incurred		
Overhead control a/c	250,000	
General ledger control a/c		250,000

Transfer of expenses into WIP as production proceeds

Raw materials used	Debit	Credit
Inventory (WIP)	80,000	
Inventory (raw materials)		80,000

Working: FIFO	Rs.	
First 10,000 kgs (opening inventory)	25,000	
Next 20,000 kgs (from purchases (20,000 kgs/28,000 kgs) × Rs.77,000	55,000	
Transfer (Rs.)	80,000	

Use of direct labor	Debit	Credit
Inventory (WIP)	90,000	
Wages control a/c		90,000
Overhead absorbed		
Inventory (WIP)	300,000	
Overhead control a/c		300,000

Working

15,000 hours @ Rs. 20 per hour (given) Rs. 300,000

Transfer of costs from WIP into finished goods

	Debit	Credit
Inventory (finished goods)	470,000	
Inventory (WIP)		470,000

Working: Balance in WIP before transfer	Rs.
Opening WIP	–
Raw materials	80,000
Direct labor	90,000
Overhead absorbed	300,000
	470,000
Less: Closing WIP	–
	470,000

Note:

Cost per unit = Rs. 470,000 /4,000 units Rs. 117.5

Transfer of costs in respect of finished goods

Over-absorption of overhead	Debit	Credit
Overhead control a/c	50,000	
Inventory (finished goods)		50,000

Working:	Rs.
Overhead incurred	250,000
Overhead absorbed	300,000
Over absorption	50,000

Transfer of finished goods to cost of sales	Debit	Credit
General ledger control a/c	461,250	
Inventory (finished goods)		461,250

Working	Units	Rs.
Opening inventory of finished goods	1,000	100,000
Production	4,000	470,000
	5,000	570,000
Closing inventory of finished goods (@ Rs. 117.5)	(500)	(58,750)
	4,500	511,250
		(50,000)
		461,250

The Factory Ledger T accounts after the double entries are as follows:

Raw materials

	Rs. '000		Rs. '000
B/f	25,000		
GLC a/c	77,000	To WIP	80,000
		C/f	22,000
	102,000		102,000

Wages control

	Rs. '000		Rs. '000
GLC a/c	90,000	To WIP	90,000
	96,000		96,000

Overhead control

	Rs. '000		Rs. '000
GLC a/c	250,000	To WIP	300,000
Finished goods	50,000		
	300,000		300,000

Work in progress (WIP)

	Rs. '000		Rs. '000
Raw materials	80,000	Finished goods	470,000
Wages control	90,000		
Overhead control	300,000		
	470,000		470,000

Finished goods

	Rs. '000		Rs. '000
B/f	100,000	GLC a/c	461,250
		Over absorption	50,000
WIP	470,000	C/f	58,750
	570,000		570,000

General Ledger Control Account (GLC a/c)			
	Rs. '000		Rs. '000
		B/f	125,000
		Raw materials	77,000
Finished goods	461,250	Direct labor	90,000
C/f	80,750	Overheads	250,000
	542,000		542,000

General ledger

Recognition of expenses as incurred	Debit	Credit
Purchase of raw materials		
Factory ledger control a/c	77,000	
Payables		77,000
Payment of wages		
Factory ledger control a/c	90,000	
Non-production wages	6,000	
Cash		96,000
Overhead incurred		
Factory ledger control a/c	250,000	
Cash		250,000
Inventory (finished goods)	461,250	
Factory ledger control a/c		461,250

Recognition of sales	Debit	Credit
Receivables	540,000	
Sales		540,000
Sales	540,000	
P&L control a/c		540,000
P&L control a/c (cost of sales)	461,250	
Inventory (finished goods)		461,250
P&L control a/c (cost of sales)	6,000	
Non-production wages		6,000
Transfer of profit to accumulated profit		
P&L control a/c	72,750	
Accumulated profit		72,750

Working: Profit for the period	Rs.
Sales	540,000
Cost of sales	(461,250)
Non-production wages	(6,000)
Profit	72,750

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The general ledger T accounts after the double entries are as follows:

Payables			
	Rs. '000		Rs. '000
C/f	77,000	FLC a/c	77,000
	77,000		77,000

Cash			
	Rs. '000		Rs. '000
b/f	X	FLC a/c	90,000
		Non-production wages (not shown)	6,000
		FLC a/c	250,000
		c/f	X
	X		X

Inventory (finished goods)			
	Rs. '000		Rs. '000
FLC a/c	461,250	P&L control a/c	461,250
	461,250		461,250

Sales			
	Rs. '000		Rs. '000
P&L control a/c	540,000	Receivables (not shown)	540,000
	540,000		540,000

Profit & Loss Control Account			
	Rs. '000		Rs. '000
Finished goods	461,250	Sales	540,000
Non-production wages	6,000		
Profit for the year	72,750		
	540,000		540,000

Factory Ledger Control Account (FLC a/c)			
	Rs. '000		Rs. '000
B/f	125,000		
Raw materials	77,000		
Direct labor	90,000	Finished goods	461,250
Overheads	250,000	C/f	80,750
	542,000		542,000

Points to note

The opening balance in the ***General Ledger Control Account*** in the factory ledger is a payable of Rs. 125,000. This is balanced by the sum of the inventory of raw materials (Rs. 25,000) and finished goods (Rs. 100,000) brought forward at the start of the period.

The opening balance in the ***Factory Ledger Control Account*** in the general ledger is a receivable of Rs. 125,000.

The closing balance in the ***General Ledger Control Account*** in the factory ledger is a payable of Rs. 80,750. This is balanced by the sum of the inventory of raw materials (Rs. 22,000) and finished goods (Rs. 58,750) carried forward at the end of the period.

The opening balance in the ***Factory Ledger Control Account*** in the general ledger is a receivable of Rs. 80,750.

The profit for the year (Rs. 72,750) is not affected by the costing system. This figure is the same as that in the earlier example on integrated accounts.

2.5 Fully interlocking accounts

This version of interlocking accounts involves the recognition of sales and the calculation of profit in the cost ledger as well as in the general ledger.

Many double entries need to be made in both records though some transactions do not affect the cost ledger. For example:

- receipts from customers,
- payments to suppliers;
- interest received and paid;
- dividend payments;
- share issues.

Cost ledger

Double entry in the cost system is maintained through a "Cost ledger control account (CLCA)". The balance on this account is akin to the capital account in the general ledger. Typically, at a period end it balances out to the sum of the cost account inventories (raw materials + WIP + finished goods). These figures should agree with those found in the general ledger but profit and inventory figures in cost and financial accounts might need to be reconciled due to timing differences.

The CLCA is close to be being a mirror image of the P&L control account in the main ledger with the vast majority of entries being the same but on the different side to each other.

Advantages of interlocking accounts

- Allows greater flexibility

Disadvantages of interlocking accounts

- Duplication of effort as entries need processing in both sets of ledgers
- Different profit figures may emerge
- Inventory valuations will be different between the two systems
- Reconciliation may be necessary (which takes time and effort)

Cost ledger control account (CLC)

This account is used for 'the other side' of cost accounting double entries within interlocking accounts to replace accounts that are not included (as being of no interest for costing purposes). This account is sometimes called 'the dustbin account'.

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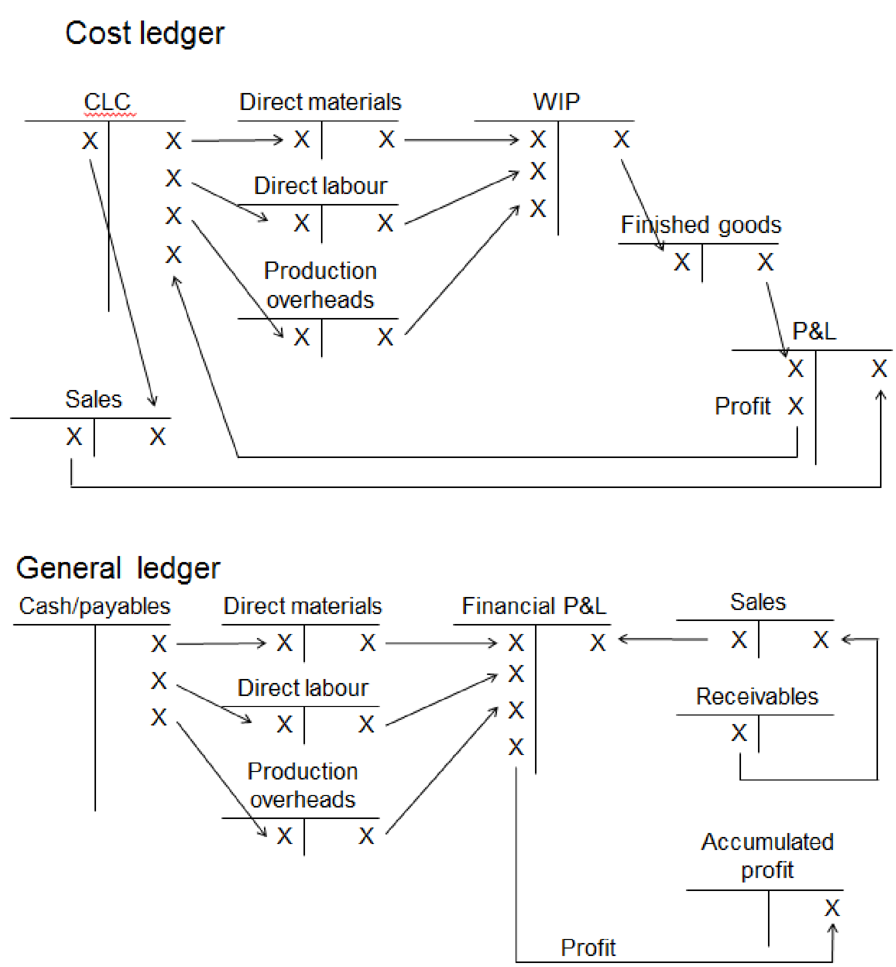
Examples of such accounts include:

- Cash
- Bank
- Trade receivables
- Trade payables

▶ *Illustration:*

The following diagram provides an overview of the various ledger accounts and the flow of information represented by the accounting entries used within fully interlocking accounts.



2.6 Fully interlocking accounts: Comprehensive illustration

The following illustration applies the accounting entries to ledger accounts for a comprehensive example.

The following balances and transactions relate to a manufacturing company.

Opening inventories	raw materials	10,000kg	Rs.25,000
	work in progress	nil	
	finished goods	1,000 units	Rs.100,000

Materials	purchases	28,000 kg	Rs.77,000
	issues to production	30,000kg	FIFO
Labor	paid	16,000 hours	Rs.96,000
	production	15,000 hours	
Production overhead			Rs.250,000
Standard overhead rate per hour			Rs.20
Completed production		4,000 units	
Closing inventories	raw materials	see above	
	work in progress	nil	
	finished goods	500 units	FIFO
Sales revenue		see above	Rs.540,000

Note that the opening cost ledger trial balance is as follows:

	Debit	Credit
Raw materials	25,000	
Finished goods	100,000	
Cost ledger control a/c		125,000

The following pages will show how the balances and transactions would be recorded in the cost ledger and the financial ledger.

Cost ledger

Recognition of expenses as incurred

Purchase of raw materials	Debit	Credit
Inventory (raw materials)	77,000	
Cost ledger control a/c		77,000
Payment of wages		
Wages control a/c	96,000	
Cost ledger control a/c		96,000
Overhead incurred		
Overhead control a/c	250,000	
Cost ledger control a/c		250,000

Reclassification of wages expense into overhead

	Debit	Credit
Overhead control a/c	6,000	
Wages control a/c		6,000

Working	
Number of hours: 16,000 – 15,000	1,000
Hourly rate: Rs. 96,000/16,000 hours	Rs.6
Transfer (Rs.)	6,000

Transfer of expenses into WIP as production proceeds

Raw materials used	Debit	Credit
Inventory (WIP)	80,000	
Inventory (raw materials)		80,000

Working: FIFO	Rs.
First 10,000 kgs (opening inventory)	25,000
Next 20,000 kgs (from purchases (20,000 kgs/28,000 kgs) × Rs.77,000	55,000
Transfer (Rs.)	80,000

Use of direct labor	Debit	Credit
Inventory (WIP)	90,000	
Wages control a/c (96,000 – 6,000)		90,000
Overhead absorbed		
Inventory (WIP)	300,000	
Overhead control a/c		300,000

Working	
15,000 hours @ Rs. 20 per hour (given)	Rs. 300,000

Transfer of costs from WIP into finished goods	Debit	Credit
Inventory (finished goods)	470,000	
Inventory (WIP)		470,000

Working: Balance in WIP before transfer	Rs.
Opening WIP	–
Raw materials	80,000
Direct labor	90,000
Overhead absorbed	300,000
	470,000
Less: Closing WIP	–
	470,000

Note:	
Cost per unit = Rs. 470,000 /4,000 units	Rs. 117.5

Transfer of costs to costing P&L a/c

Transfer of finished goods to cost of sales	Debit	Credit
P&L control account	511,250	
Inventory (finished goods)		511,250

Working	Units	Rs.
Opening inventory of finished goods	1,000	100,000
Production	4,000	470,000
	5,000	570,000
Closing inventory of finished goods (@ Rs. 117.5)	(500)	(58,750)
	4,500	511,250

Over-absorption of overhead	Debit	Credit
Overhead control a/c	44,000	
P&L control a/c		44,000

Working:	Rs.
Overhead incurred	250,000
Transfer from wages control a/c	6,000
	256,000
Overhead absorbed	300,000
Over absorption	44,000

Recognition of sales and calculation of profit

Recognition of sales	Debit	Credit
Cost ledger control a/c	540,000	
Sales		540,000
Transfer of sales to P&L control a/c		
Sales	540,000	
P&L control a/c		540,000
Transfer of profit to cost ledger control a/c		
P&L control a/c	72,750	
Cost ledger control a/c		72,750

Working: Proof of profit	Rs.
Sales	540,000
Cost of sales	
Finished goods	511,250
Over-absorption of overhead	(44,000)
	(467,250)
Profit	72,750

The cost ledger T accounts after the double entries are as follows:

Raw materials			
	Rs. '000		Rs. '000
B/f	25,000		
CLC a/c	77,000	To WIP	80,000
		C/f	22,000
	102,000		102,000

Wages control			
	Rs. '000		Rs. '000
CLC a/c	96,000	Overhead control	6,000
		To WIP	90,000
	96,000		96,000

Overhead control			
	Rs. '000		Rs. '000
CLC a/c	250,000	To WIP	300,000
Wages control	6,000		
P&L control a/c (over abs.)	44,000		
	300,000		300,000

Work in progress (WIP)			
	Rs. '000		Rs. '000
Raw materials	80,000	Finished goods	470,000
Wages control	90,000		
Overhead control	300,000		
	470,000		470,000

Finished goods			
	Rs. '000		Rs. '000
B/f	100,000	P&L control a/c	511,250
WIP	470,000	C/f	58,750
	570,000		570,000

Sales			
	Rs. '000		Rs. '000
P&L control a/c	540,000	CLC a/c	540,000
	540,000		540,000

Costing Profit & Loss Account (CPL)			
	Rs. '000		Rs. '000
Finished goods	511,250	Sales	540,000
CLC a/c (profit)	72,750	Overhead control	44,000
	584,000		584,000

Cost Ledger Control Account (CLC a/c)			
	Rs. '000		Rs. '000
		B/f	125,000
		Raw materials	77,000
		Direct labor	96,000
		Overheads	300,000
Sales	540,000		
		P&L control a/c	72,750
C/f	80,750		
	620,750		620,750

Note that the closing cost ledger trial balance is as follows:

	Debit	Credit
Raw materials	22,000	
Finished goods	58,750	
Cost ledger control a/c		80,750

General ledger

	Recognition of expenses as incurred	Debit	Credit
	Purchase of raw materials		
	Inventory (raw materials)	77,000	
	Payables		77,000
	Payment of wages		
	Wages control a/c	96,000	
	Cash		96,000
	Overhead incurred		
	Overhead control a/c	250,000	
	Cash		250,000
Transfer of expenses to P&L control a/c			
	P&L control a/c	77,000	
	Purchases		77,000
	P&L control a/c	96,000	
	Wages control a/c		96,000
	P&L control a/c	250,000	
	Overhead control a/c		250,000
Transfer of opening inventory to P&L control a/c			
	Raw materials		
	P&L control a/c	25,000	
	Inventory (raw materials)		25,000
	Finished goods		
	P&L control a/c	100,000	
	Inventory (finished goods)		100,000
Recognition of closing inventory			
	Raw materials		
	Inventory (raw materials)	22,000	
	P&L control a/c		22,000
	Finished goods		
	Inventory (finished goods)	58,750	
	P&L control a/c		58,750

Recognition of sales and calculation of profit			
	Recognition of sales	**Debit**	**Credit**
	Receivables	540,000	
	Sales		540,000
	Sales	540,000	
	P&L control a/c		540,000
	Transfer of profit to accumulated profit		
	P&L control a/c	72,750	
	Accumulated profit		72,750

Working: Profit for the period	Rs.
Sales	540,000
Cost of sales	
Opening inventory	
Raw materials	25,000
Finished goods	100,000
	125,000
Production costs	
Raw materials	77,000
Wages	96,000
Overheads	250,000
	423,000
Closing inventory	
Raw materials	22,000
Finished goods	58,750
	(80,750)
	(467,250)
Profit	72,750

The general ledger T accounts after the double entries are as follows:

Purchases			
	Rs. '000		**Rs. '000**
Payables (not shown)	77,000	P&L control a/c	77,000
	77,000		77,000

Wages control

	Rs. '000		Rs. '000
Cash (not shown)	96,000	P&L control a/c	96,000
	96,000		96,000

Overhead control

	Rs. '000		Rs. '000
Cash (not shown)	250,000	P&L control a/c	250,000
	250,000		250,000

Inventory (raw materials)

	Rs. '000		Rs. '000
B/f	25,000	P&L control a/c	25,000
P&L control a/c	22,000	C/f	22,000
	47,000		47,000

Inventory (finished goods)

	Rs. '000		Rs. '000
B/f	100,000	P&L control a/c	100,000
P&L control a/c	58,750	C/f	58,750
	158,750		158,750

Sales

	Rs. '000		Rs. '000
P&L control a/c	540,000	Receivables (not shown)	540,000
	540,000		540,000

Profit & Loss Control Account			
	Rs. '000		**Rs. '000**
Purchases	77,000	Sales	540,000
Wages control a/c	96,000		
Overhead control a/c	250,000		
Opening inventory		Closing inventory	
Raw materials	25,000	Raw materials	22,000
Finished goods	100,000	Finished goods	58,750
Profit for the year	72,750		
	620,750		620,750

3. COMPREHENSIVE EXAMPLES

- *Example 01:*

At 1 July a manufacturing company had the following balances in the general ledger adjustment account in its cost ledger:

	Rs.
Balance brought forward (credit)	5,625
Stores ledger control account	2,125
Finished goods stock control account	1,500
Work in progress control account	2,000

Open ledger accounts for the above items in the cost ledger, post the following items which occurred in the four-month period up to 31 October and open up other accounts as considered necessary, including a costing profit and loss account.

Stock material purchased	12,000
Stock materials issued to production	12,500
Stock materials issued to maintenance department	1,000
Wages – direct	10,830
Included in direct wages is indirect work	600
Factory overheads incurred	4,200
Factory overheads absorbed into production	5,800
Work transferred to finished stock, at cost	24,000
Factory cost of sales	22,500
Sales at selling price	28,750
Administrative and selling costs (to be written off against profits)	4,250

General ledger control a/c

	Rs.		Rs.
		Balance b/d	5,625
Sales account	28,750	Stores	12,000
		Wages	10,830
		Production overhead	4,200
		Administration and selling expenses	4,250
Balance c/d	10,155	Profit and loss a/c	2,000
	38,905		38,905
		Balance b/d	10,155

Stores ledger control a/c

	Rs.		Rs.
Balance b/d	2,125	Work in progress	12,500
General ledger control	12,000	Production overhead	1,000
		Balance c/d	625
	14,125		14,125
Balance b/d	625		

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Wages control a/c			
	Rs.		Rs.
General ledger control	10,830	Production overhead	600
		Work in progress	10,230
	10,830		10,830

Production overhead control a/c			
	Rs.		Rs.
Stores ledger control	1,000	Work in progress	5,800
Wages control	600		
General ledger control	4,200		
	5,800		5,800

Administration and selling expenses control a/c			
	Rs.		Rs.
General ledger control	4,250	Profit and loss a/c	4,250
	4,250		4,250

Sales a/c			
	Rs.		Rs.
Profit and loss a/c	28,750	General ledger control	28,750
	28,750		28,750

Work in progress control a/c			
	Rs.		Rs.
Balance b/d	2,000	Finished goods control	24,000
Stores	12,500		
Wages	10,230		
Production overhead	5,800	Balance c/d	6,530
	30,530		30,530
Balance b/d	6,530		

Finished goods control a/c			
	Rs.		Rs.
Balance b/d	1,500	Cost of sales	22,500
Work in progress	24,000		
		Balance c/d	3,000
	25,500		25,500
Balance b/d	3,000		

Cost of goods sold			
	Rs.		Rs.
Finished goods stock	22,500	Profit and loss a/c	22,500
	22,500		22,500

Profit and loss a/c			
	Rs.		Rs.
Cost of goods sold	22,500	Sales	28,750
Administration and selling expenses	4,250		
Profit (to general ledger control)	2,000		
	28,750		28,750

► *Example 02:*

Kaat Ltd operates separate cost accounting and financial accounting systems. The following manufacturing and trading statement has been prepared from the financial accounts for the quarter ended 31 March.

	Rs.	Rs.
Raw materials		
Opening stock	48,000	
Purchases	108,800	
	156,800	
Closing stock	(52,000)	
Raw materials consumed		104,800
Direct wages		40,200
Production overhead		60,900
Production cost incurred		205,900
Work in progress		
Opening stock	64,000	
Closing stock	(58,000)	6,000
Cost of goods produced carried down		211,900
Sales		440,000
Cost of goods sold		
Finished goods opening stock	120,000	
Cost of goods produced brought down	211,900	
	331,900	
Finished goods closing stock	(121,900)	(210,000)
Gross profit		230,000

The following information has been extracted from the cost accounts:

Control account balances at 1 January

	Rs.
Raw material stores	49,500
Work in progress	60,100
Finished goods	115,400

AT A GLANCE SPOTLIGHT STIKCY NOTES

Transactions for the quarter

	Rs.
Raw materials issued	104,800
Cost of goods produced	222,500
Cost of goods sold	212,100
Loss of materials damaged by flood (insurance claim pending)	2,400

A notional rent of Rs.4,000 per month has been charged in the cost accounts. Production overhead was absorbed at the rate of 185% of direct wages. Profit at the end of the period is shown as Rs.238,970.

a) Preparation of the relevant control accounts in the cost ledger, would be as follows

Raw materials stores a/c

	Rs.		Rs.
Balance b/f	49,500	Work in progress	104,800
Purchases	108,800	Loss due to flood	2,400
		Balance c/f	51,100
	158,300		158,300
Balance b/f	51,100		

Work in progress control a/c

	Rs.		Rs.
Balance b/f	60,100	Finished goods	222,500
Raw materials	104,800	Balance c/f	56,970
Direct wages	40,200		
Production overhead	74,370		
	279,470		279,470
Balance b/f	56,970		

Finished goods control a/c

	Rs.		Rs.
Balance b/f	115,400	Cost of sales	212,100
Work in progress	222,500	Balance c/f	125,800
	337,900		337,900
Balance b/f	125,800		

Production overhead

	Rs.		Rs.
General ledger control	60,900	Work in progress	74,370
Notional rent	12,000		
Overhead overabsorbed	1,470		
	74,370		74,370

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b) Prepare a statement reconciling the gross profit as per the cost accounts and the financial accounts.

Reconciliation statement

	Rs.	Rs.	Rs.
Profit as per financial accounts		230,000	
Difference in stock values			
Work in progress opening stock	3,900		
Finished goods opening stock	4,600		
Finished goods closing stock	3,900		
	———	12,400	
Raw materials opening stock	1,500		
Raw materials closing stock	900		
Work in progress closing stock	1,030		
		(3,430)	
			8,970
Profit as per cost accounts			238,970

Cost accounting profit and loss	Rs.	Rs.	Rs.
Sales			440,000
Cost of sales		212,100	
Loss of stores		2,400	
		214,500	
Overhead over-absorbed	1,470		
Notional rent	12,000		
		(13,470)	
			(201,030)
			238,970

▶ *Example 03:*

Mirza Limited is engaged in the manufacturing of spare parts for automobile industry. The company records the purchase and issue of materials in a store ledger which is not integrated with the financial ledger. It is the policy of the company to value inventories on weighted average basis. The valuation is carried out by the Finance Department using stores memorandum record. A physical stock count is carried out after every six months. Any shortage/excess is then adjusted in the financial as well as stores ledger.

On December 31, 20X3, physical stock count was conducted by the Internal Auditor of the company. He submitted the following statement to the Finance Department:

Item Code	Balance (in units)			Cost per unit (Rs.)	
	Store Ledger	Financial Records	Physical	Average	Current
010-09	20,500	20,500	20,000	2.00	2.25
013-25	10,000	10,000	10,000	4.00	1.50
017-10	5,500	5,500	5,000	1.00	1.10
022-05	4,000	4,500	5,500	2.00	2.00
028-35	1,200	1,200	1,000	2.75	2.50
035-15	640	600	600	3.00	3.50

On scrutinizing the details, Finance Department was able to ascertain the following reasons:

Item Code	Reasons
010-09	500 units were defective and therefore the Internal Auditor excluded them while taking the physical count.
013-25	This item is not in use and is considered obsolete. The net realizable value is Rs. 0.60 per unit.
017-10	Shortage is due to theft.
022-05	A receipt of 1,000 units was not recorded. The remaining difference is due to errors in recording the quantity issued.
028-35	200 units returned to a supplier were not recorded. The invoiced cost was Rs. 3 per unit.
035-15	Discrepancy is due to incorrect recording of a Goods Receipt Note.

a) Necessary Journal entries to record the adjustments in the financial ledger would be prepared as follows

Journal Entries in Financial Ledger

		Dr.	Cr.
		Rupees	Rupees
(i)	Cost of sales/ FOH/ Abnormal loss	1,000	
	Stores Ledger A/c		1,000
	(Record the normal loss of item # 010-09		
(ii)	Cost of sales/ FOH	34,000	
	Provision for obsolescence		34,000
	(Record the provision for obsolescence against item # 013-25)		
(iii)	Cost of sales/ FOH/ Abnormal loss	500	
	Stores Ledger A/c		500
	(Record the theft of item # 017-10)		

		Dr.	Cr.
		Rupees	Rupees
(iv)	(a) Stores Ledger A/c	2,000	
	Creditors / Cash		2,000
	(Record the purchase of items # 022-05)		
	(b) No adjustment		
(v)	Creditors/ Cash	600	
	Stores Ledger A/c		600
	(Record the return of item # 028-35)		
(vi)	No adjustment		

b) In order to make necessary adjustments in the stores, following need to be noted

i. The quantity should be shown as issued in the stores ledger.

ii. No adjustment.

iii. 500 units should be shown in the issue column and adjust the balance accordingly.

iv. a) 1,000 units should be recorded on the receipt side of individual stores ledger account.

b) The issue column of the individual stores ledger account should be reduced by 500 units.

v. 200 units should be reduced from the receipt and accordingly adjust the balance columns of the individual stores ledger account.

vi. The postings of incorrectly recorded Goods Receipt Note should be corrected.

▶ *Example 04*

Sapphire limited (SL) fabricates parts for auto manufacturers and follows job order costing. The company's head office is situated in Lahore but the factory is in Karachi. A separate set of records is kept at the head office and at the factory. Following details were extracted from SL's records for the month of February 20X4.

	Jobs		
	A	B	C
Materials issued to production (units)			
• Material X	40,000	-	10,000
• Material Y	-	75,000	25,000
Direct labor hours worked (hours)	6,000	9,000	15,000
Labor rate per hour (Rs.)	75	60	65

The other related information is as follows:

i. Materials purchased on account:

- 100,000 units of material X at Rs. 25 per unit
- 150,000 units of material Y at Rs. 35 per unit

ii. The head office prepared the payroll and deducted 8% for payroll taxes. The payroll amounted to Rs. 3.0 million out of which Rs. 1.0 million pertained to selling and administrative staff salaries. After charging direct labor cost to each job the balance amount of payroll cost was attributed to general factory overhead.

iii. Factory overhead was applied to the jobs at Rs. 25 per direct labor hour.

iv. Actual factory overheads amounted to Rs. 700,000 including depreciation on machinery amounting to Rs. 400,000. All payments were made by head office.

v. Over or under-applied factory overheads are closed to cost of goods sold account.

vi. Jobs A and B were completed during the month. Job A was sold for Rs. 2.0 million to one of the auto manufacturer on credit. The customer however, agreed to settle the transaction at 2% cash discount.

vii. Selling and administrative expenses, other than salaries paid during the month were Rs. 500,000.

Journal entries to record all the above transactions in SL's factory ledger and general ledger for the month of February 20X4, would be prepared as follows.

General Journal entries					
Particulars	Factory Ledger		Particulars	General Ledger	
	Debit	Credit		Debit	Credit
Material X	2,500,000		Factory Ledger	7,750,000	
Material Y	5,250,000		Trade Creditors		7,750,000
General Ledger		7,750,000			
(Purchase of material)					
Payroll	2,000,000		Factory Ledger	2,000,000	
General Ledger		2,000,000	Selling and administrative expenses	1,000,000	
			Accrued Payroll		2,760,000
(Payroll accrual)			Payroll taxes		240,000
No Entry			Accrued payroll	2,760,000	
			Payroll Taxes	240,000	
			Bank		3,000,000
			(Payment of payroll & taxes)		
Work in process A	1,000,000				
Work in process B	2,625,000				
Work in process C	1,125,000		No Entry		
Material X		1,250,000			
Material Y		3,500,000			

General Journal entries					
Particulars	Factory Ledger		Particulars	General Ledger	
	Debit	Credit		Debit	Credit
(Issuance of raw material to WIP)					
Work in process A	450,000				
Work in process B	540,000				
Work in process C	975,000		No Entry		
Factory overheads	35,000				
Payroll		2,000,000			
(Direct labor cost allocated to WIP)					
Work in process A	150,000				
Work in process B	225,000				
Work in process C	375,000		No Entry		
Factory overheads - applied		750,000			
(Factory overheads applied to WIP)					
Factory overheads	700,000		Factory Ledger	700,000	
General Ledger		700,000	Bank		300,000
			Accumulated Depreciation		400,000
			(Actual factory overheads transferred)		
Factory overheads - applied	15,000		Factory Ledger	15,000	
General Ledger		15,000	Cost of goods sold		15,000
(Over applied overheads transferred to cost of goods sold)					
Finished goods A	1,600,000				
Finished goods B	3,390,000		No Entry		
Work in process A		1,600,000			
Work in process B		3,390,000			
(Jobs A and B completed and transferred to finished goods)					
General Ledger	1,600,000		Cost of goods sold	1,600,000	
Finished goods A		1,600,000	Factory Ledger		1,600,000
(Job A delivered and transferred to cost of goods sold)					
No Entry			Trade Debtors	2,000,000	
			Sales		2,000,000

General Journal entries					
Particulars	Factory Ledger		Particulars	General Ledger	
	Debit	Credit		Debit	Credit
			(Job A sold to customer)		
No Entry			Bank	1,960,000	
			Cash discount	40,000	
			Trade debtors		2,000,000
			(Amount realized from customer)		
No Entry			Selling and administrative expenses	500,000	
			Bank		500,000
			(Payment of Selling and admin. Expenses)		

AT A GLANCE

SPOTLIGHT

STIKCY NOTES

STICKY NOTES

The objective of accounting for production of inventory is to record and mirror the cost throughout the production process.

The cost flows from:

- **material account, wages control account, production overhead account to WIP account;**
- **then to finished goods accounts; and**
- **ultimately to Profit and loss account.**

Cost book-keeping systems can be categorized into two types in terms of how the cost accounts relate to other ledger accounts:

- **integrated accounts;**
- **interlocking accounts.**

Integrated accounts combine both financial and cost accounts in one system of ledger accounts. A reconciliation between cost and financial profits is not necessary with an integrated system.

Interlocking accounts are recorded in factory ledger for cost accounts and general ledger for other accounts, which are readily reconcilable.

CHAPTER 7

JOB AND SERVICE COSTING

IN THIS CHAPTER

AT A GLANCE

A costing method is one which is designed to suit the way goods are processed or manufactured or the way that services are provided.

A job is a cost unit which consists of a single order or contract. Job costing is a basic cost accounting method applicable where work consists of separate contracts, jobs or batches.

The cost of a job consists of direct material cost, direct labor cost, direct expenses, production overheads and administrative, selling and distribution overheads.

Service organizations do not make or sell tangible goods. Service costing differs from other costing methods. With many services the cost of direct materials consumed will be relatively small compared to labor, direct expenses and overheads cost.

The output of most service organizations is often intangible and difficult to define. A unit cost is therefore difficult to calculate.

Specific characteristics of services are intangibility, simultaneity, perishability and heterogeneity.

1. JOB COSTING

1.1 The nature of job costing

Job costing is used when a business entity carries out tasks or jobs to meet specific customer orders. Although each job might involve similar work, they are all different and are carried out to the customer's specific instructions or requirements.

Examples of 'jobs' include work done for customers by builders or electricians, audit work done for clients by a firm of auditors, and repair work on motor vehicles by a repair firm.

Job costing is similar to contract costing, in the sense that each job is usually different and carried out to the customer's specification or particular requirements. However, jobs are short-term and the work is usually carried out in a fairly short period of time. Contracts are usually long-term and might take several months or even years to complete.

1.2 The cost of a job

A cost is calculated for each individual job, and this cost can be used to establish the profit or loss from doing the job.

Job costing differs from most other types of costing system because every job is a cost unit which consists of a single order or contract and the costing is being done for every job separately. The expected cost of a job has to be estimated so that a price for the job can be quoted to a customer.

The features of Job costing are as follows:

- Work is undertaken to customer's special attention
- Each order is of short duration
- Jobs move through processes and operations as a continuously identifiable unit.
- Each job usually differs in one or more respects from every other job and therefore a separate record must be maintained to show the details of a particular job.
- Job costs are allocated on a job cost sheet or job cost card.
- Rectification work is the cost of rectifying substandard work. it is to be charged as direct cost of the job concerned if not a frequent occurrence and can be directly attributable to a job. It is to be treated as production overhead if regarded as normal part of the work and it is of recurring nature.

A job costing system is usually based on absorption costing principles, and in addition a cost is included for non-production overheads, as follows.

Illustration: Job cost	Rs.
Direct materials	500
Direct labor	300
Direct expenses	200
Prime cost	1,000
Production overhead absorbed	750
Production cost of the job	1,750
Non-production overheads	400
Total job cost	2,150

In many cases, job costs include not just direct materials costs and direct labor costs, but also **direct expenses**, such as:

- the rental cost of equipment hired for the job
- the cost of work done for the job by sub-contractors
- the depreciation cost of equipment used exclusively on the job.

Production overheads might be absorbed on a direct labor hour basis, or on any other suitable basis.

Non-production overheads might be added to the cost of the job:

- as a percentage of the prime cost of the job, or
- as a percentage of the production cost of the job.

▶ *Example 01:*

The following cost information has been gathered about Job number 453.

The direct materials cost is Rs.100, the direct labor cost is Rs.60 and direct expenses are Rs.40. Direct labor costs Rs.20 per hour. Production overheads are charged at the rate of Rs.30 per direct labor hour and non-production overheads are charged at the rate of 40% of prime cost.

The job cost for Job 453 is calculated as follows:

Job cost: Job 453	**Rs.**
Direct materials	100
Direct labor (3 hours at Rs.20)	60
Direct expenses	40
Prime cost	200
Production overhead (3 hours at Rs.30)	90
Production cost of the job	290
Non-production overheads (40% of prime cost)	80
Total job cost	270

▶ *Example 02:*

A company operates a job costing system. Job number 6789 will require Rs.345 of direct materials and Rs.210 of direct labor, which is paid Rs.14 per hour. Production overheads are absorbed at the rate of Rs.30 per direct labor hour and non-production overheads are absorbed at the rate of 40% of prime cost.

The total expected cost of the job would require following calculations

	Rs.
Direct materials	345
Direct labor (15 hours)	210
Prime cost	555
Production overheads (15 hours × Rs.30)	450
Full production cost	1,005
Non-production overheads (40% × Rs.555)	222
Full cost of sale for the job	1,227

1.3 Cost records and accounts for job costing

In order to establish the cost of each individual job in a costing system, it is necessary to have procedures for recording direct costs in such a way that they can be allocated to specific jobs. Production overheads and non-production overheads can be charged using overhead absorption rates within a system of absorption costing.

Each job is given a unique identity number, or job number. The costs for individual jobs are recorded as follows.

- The direct materials for a job are issued directly from stores to the job. The materials requisition note should specify the job number and the costs of the materials are charged to the job.
- The labor time spent on a job is recorded on time sheets or job sheets. The time sheets for each individual employee identify the jobs he has worked on and the time that he spent on each job. These can be converted into a cost for the job at the employee's hourly rate.
- A system is needed for recording direct expenses to specific jobs. Costs might be obtained from purchase invoices from suppliers, and recorded in the job cost record (the 'job sheet') for the job.
- Production overheads are charged to the job (absorbed, in an absorption costing system) at the appropriate absorption rate, when the job has been completed.
- Similarly, non-production overheads can be charged when the job has been finished by charging them at the appropriate absorption rate.

Direct costs and overheads are recorded on a job sheet or job card for the job. At one time, a job card used to be an actual card or sheet of paper, although job costing systems are now likely to be computerized.

In a costing system, a job account is similar to a work in progress account, except that it is for one job only. In a company that specializes in jobs, the work in progress account is the total of all the individual job accounts.

Illustration: Job cost account

Job account: Job 12345			
	Rs.		Rs.
Direct materials	1,800	Cost of sales	7,800
Direct wages	2,500		
Direct expenses	500		
Production overhead	3,000		
	7,800		7,800

When the job is finished, the total cost of the job is transferred to the cost of sales.

► *Example 03:*

The following information relates to job activity in the month of June.

	Job 0503	Job 0402	Job 0607
Contract price	Rs. 500,000	Rs. 980,000	Rs. 600,000
Commenced	3 May	2 April	7 June
Completed	25 June	Not completed	19 June
Opening WIP comprised:			na
Direct materials (all material X)	Rs. 5,000	Rs. 10,000	
Direct labor (all grade A)	Rs. 10,000	Rs. 18,000	
Variable production o'head	Rs. 12,000	Rs. 21,600	
Fixed production overhead	Rs. 12,800	Rs. 23,040	
	Rs. 39,800	Rs. 72,640	
Material issues from stores:			
Material X	200 kgs	800 kgs	900 kgs
Material Y	400 kgs	600 kgs	
Labor			
Grade A	60 hours	120 hours	150 hours
Grade B	25 hours	100 hours	20 hours

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Costs:	
Material X	Rs. 220 per kg
Material Y	Rs. 500 per kg
Grade A	Rs. 250 per hour
Grade B	Rs. 400 per hour
Variable overhead recovery rate	Rs. 300 per hour
Fixed production overhead is absorbed using direct labor hours	
Budgeted fixed production overhead	Rs. 160,000
Budgeted labor hours	500 hours
Actual fixed production overhead expenditure in the period	Rs. 161,000

The company needed to hire a special machine for job 0402 at a cost of Rs. 5,000 in the current month.

20 kgs of raw material were returned to stores on completion of job 0607.

For internal profit reporting purposes administration and marketing expenses are added to cost of sales at 20% at the time of completion of the job. Actual administration and marketing expense in the period was Rs. 130,000.

(Note: The system suggested is the similar to that for the receivables control account backed up by the receivables ledger. In this case there is a WIP control account backed up by the job costing ledger).

Task 1 – Schedule of resources used in month

Material X	Kgs	Cost per kg	Rs.
Job 0503:	200	220	44,000
Job 0402	800	220	176,000
Job 0607	900	220	198,000
Less returns	(20)	220	(4,400)
	880	220	193,600
	1,880	220	413,600

Material Y	Kgs	Cost per kg	Rs.
Job 0503:	400	500	200,000
Job 0402	600	500	300,000
	1,000	500	500,000

Labor grade A	Hours	Cost per hour	Rs.
Job 0503:	60	250	15,000
Job 0402:	120	250	30,000
Job 0607:	150	250	37,500
	330	250	82,500

Labor grade B	Hours	Cost per hour	Rs.
Job 0503:	25	400	10,000
Job 0402:	100	400	40,000
Job 0607:	20	400	8,000
	145	400	58,000

Variable overhead		Hours	Cost per hour	Rs.
Job 0503:	60 + 25 =	85	300	25,500
Job 0402:	120 + 100 =	220	300	66,000
Job 0607:	150 + 20 =	170	300	51,000
		475	300	142,500

Fixed overhead	Hours	Cost per hour	Rs.
Job 0503:	85	320	27,200
Job 0402:	220	320	70,400
Job 0607	170	320	54,400
	475	320	152,000

Task 2 – Journal entries to record costs in the job accounts

	Debit	Credit
Issues of Material X		
Job 0503 account	44,000	
Job 0402 account	176,000	
Job 0607 account	198,000	
Material X inventory account		418,000
Returns of Material X		
Material X inventory account	4,400	
Job 0607 account		4,400
Issues of Material Y		
Job 0503 account	200,000	
Job 0402 account	300,000	
Material Y inventory account		500,000
Grade A labor		
Job 0503 account	15,000	
Job 0402 account	30,000	
Job 0607 account	37,500	
Grade A labor account		82,500
Grade B labor		
Job 0503 account	10,000	
Job 0402 account	40,000	
Job 0607 account	8,000	
Grade B labor account		58,000
Variable overhead		
Job 0503 account	25,500	
Job 0402 account	66,000	
Job 0607 account	51,000	
Variable overhead account		142,500

	Debit	Credit
Fixed overhead		
Job 0503 account	27,200	
Job 0402 account	70,400	
Job 0607 account	54,400	
Fixed production overhead account		152,000
Hire cost		
Job 0402 account	5,000	
Cash		5,000

Task 3 – Job cost accounts

Job 0503			
	Rs.		Rs.
Balance b/d	39,800		
Issues from stores:			
Material X	44,000		
Material Y	200,000		
Labor:			
Grade A	15,000		
Grade B	10,000		
Variable overhead	25,500		
Fixed overhead	27,200	Cost of sales	361,500
	361,500		361,500

Job 0402			
	Rs.		Rs.
Balance b/d	72,640		
Issues from stores:			
Material X	176,000		
Material Y	300,000		
Labor:			
Grade A	30,000		
Grade B	40,000		
Variable overhead	66,000		
Fixed overhead	70,400		
Machine hire	5,000	Balance c/d	760,040
	760,040		760,040

Job 0607			
	Rs.		Rs.
Issues from stores:		Returns to stores	
Material X	198,000	Material X	4,400
Labor:			
Grade A	37,500		
Grade B	8,000		
Variable overhead	51,000		
Fixed overhead	54,400	Cost of sales	344,500
	348,900		348,900

Task 4–Job cost cards (showing the resources allocated to the jobs and the allocation of administration and marketing expenses for the jobs completed in the period. Also incorporate the revenue for the period and show the profit or loss on those jobs completed)

	Job 0503	Job 0402	Job 0607
Material X			
In opening WIP	5,000	10,000	na
In period	44,000	176,000	193,600
	49,000	186,000	193,600
Material Y (in period)	200,000	300,000	
Grade A labor			
In opening WIP	10,000	18,000	na
In period	15,000	30,000	37,500
	25,000	48,000	37,500
Grade B labor	10,000	40,000	8,000
Variable overhead			
In opening WIP	12,000	21,600	
In period	25,500	66,000	51,000
	37,500	87,600	51,000
Fixed overhead			
In opening WIP	12,800	23,040	
In period	27,200	70,400	54,400
	40,000	93,440	54,400
Machine hire		5,000	
Factory cost	361,500	760,040	344,500
Administration and marketing @ 20%	72,300		68,900
Cost of sale	433,800		413,400
Contract price	500,000		600,000
Profit	66,200		186,600

Task 5– Journal entries to record costs in the general ledger (Assuming that the company operates a system using a control account in its general ledger for jobs show the double entry (as T-accounts) to account for job activity in the period)

The following journals were not asked for but they are included to help you to understand the double entry in the general ledger.

		Debit	Credit
a	**Issues of Material X**		
	WIP control account	418,000	
	Inventory control account		418,000
b	**Returns of Material X**		
	Inventory control account	4,400	
	WIP control account		4,400
c	**Issues of Material Y**		
	WIP control account	500,000	
	Inventory control account		500,000
d	**Grade A labor**		
	WIP control account	82,500	
	Payroll control account		82,500
e	**Grade B labor**		
	WIP control account	58,000	
	Payroll control account		58,000
f	**Variable overhead**		
	WIP control account	142,500	
	Variable overhead account		142,500
g	**Fixed overhead**		
	WIP control account	152,000	
	Fixed production overhead account		152,000
h	**Hire cost**		
	WIP control account	5,000	
	Cash		5,000
i	**Transfer of costs on completed sales**		
	Cost of sales account		
	Job 0503	361,500	
	Job 0607	344,500	
		706,000	
	WIP control account		706,000

WIP control					
		Rs.			Rs.
Balance b/d					
Job 0503		39,800			
Job 0402		72,640			
		112,440			
a)	Inventory control	418,000	b)	Inventory control	4,400
c)	Inventory control	500,000			
d)	Payroll control	82,500			
e)	Payroll control	58,000			
f)	Var. overhead	142,500			
g)	Fixed overhead	152,000			
h)	Hire cost	5,000	i)	Cost of sales	706,000
			Balance c/d		760,040
		1,470,440			1,470,440
Balance b/d		760,040			

Cost of sales					
		Rs.			Rs.
i)	WIP control a/c	706,000			

Fixed production overhead					
		Rs.			Rs.
Balance b/d		161,000	g)	WIP control a/c	152,000
(Actual spend)					

We now need to recognize the following entries. Once again journals are provided for your convenience.

		Debit	Credit
j	**Administration and marketing mark-up (20% of cost of sales figure)**		
	Cost of sales account (20% of 706,000)	141,200	
	Administration and marketing control a/c		141,200
	Note that this is the same sum of the two figures shown on the job cost card in task 4 (72,300 + 68,900)		
k	**Transfer of balance on cost of sales to the income statement**		
	Income statement	847,200	
	Cost of sales account		847,200
l	**Under recovery of fixed production overhead**		
	Income statement (161,000 – 152,000)	9,000	
	Fixed production overhead account		9,000

		Debit	Credit
m	**Over recovery of administration and marketing overhead**		
	Administration and marketing control a/c	11,200	
	Income statement (141,200 – 130,000)		11,200
n	**Recognition of revenue on finished jobs**		
	Receivables (500,000 + 600,000)	1,100,000	
	Income statement		1,100,000

WIP control

	Rs.		Rs.
Balance b/d	760,040		

Cost of sales

		Rs.			Rs.
i)	WIP control a/c	706,000			
j)	Admin and marketing	141,200	k)	Income statement	847,200
		847,200			847,200

Fixed production overhead

		Rs.			Rs.
Balance b/d (actual)		161,000	g)	WIP control a/c	152,000
			i)	Income statement	9,000
		161,000			161,000

Administration and marketing

		Rs.			Rs.
Balance b/d (actual)		130,000	j)	Cost of sales	141,200
m)	Income statement	11,200			
		141,200			141,200
Balance b/d					

Income statement

		Rs.			Rs.
k)	Cost of sales	847,200	j)	Cost of sales	
i)	Fixed production OH	9,000	m)	Admin and mkt.	11,200
			n)	Receivables	1,100,000
Profit (Balancing figure)		255,000			
		1,111,200			1,111,200

▶ *Example-04:*

Ahmer and Company is engaged in production of engineering parts. It receives bulk orders from bicycle manufacturers and follows job order costing. On July 1, 20X3 two jobs were in progress whereas two jobs were opened during the year. The details are as follows:

	JOBS			
	A	B	C	D
Work in process – opening (Rs.)	1,400,000	2,500,000	-	-
Raw material issued from stores (Rs.)	800,000	1,200,000	1,500,000	600,000
Direct labor hours worked (Hours)	20,000	30,000	15,000	18,000
Rate of direct labor per hour (Rs.)	20	18	16	15

Other related information is as follows:

i. Factory overhead is applied to the jobs at Rs. 10 per labor hour.

ii. Actual factory overheads for the year amounted to Rs. 900,000.

iii. Under/over applied factory overheads are charged to profit and loss account.

iv. Job A was completed during the year. All the goods were shipped to the customers.

v. Job B was also completed during the year. However, about 10% of the goods were rejected during inspection. These were transferred to Job C where they will be used after necessary adjustments.

Journal entries to record all the above transactions can be prepared as follows:

General Journal entries				
Date	**Particulars**	**Ledger folio**	**Debit**	**Credit**
1	Work in process A		800,000	
	Work in process B		1,200,000	
	Work in process C		1,500,000	
	Work in process D		600,000	
	Raw material			4,100,000
	(Issuance of raw material to WIP)			
2	Work in process A (20,000*20)		400,000	
	Work in process B (30,000*18)		540,000	
	Work in process C (15,000*16)		240,000	
	Work in process D (18,000*15)		270,000	
	Payroll			1,450,000
	(Direct labor cost allocated to WIP)			
3	Work in process A (20,000*10)		200,000	
	Work in process B (30,000*10)		300,000	
	Work in process C (15,000*10)		150,000	
	Work in process D (18,000*10)		180,000	

General Journal entries				
Date	**Particulars**	**Ledger folio**	**Debit**	**Credit**
	Factory overheads applied			830,000
	(Factory overheads applied to WIP @ Rs. 10 per direct labor hours)			
4	Factory overheads applied		830,000	
	Profit and loss account (900,000-830,000)		70,000	
	Factory overheads Control			900,000
	(Factory overheads applied transferred to overheads control a/c and under applied overheads charged to P&L account)			
5	Finished goods A		2,800,000	
	(1,400,000+800,000+400,000+200,000)			
	Work in process A			2,800,000
	(Job A completed and transferred to finished goods)			
6	Finished goods – B		4,086,000	
	90% of (2,500,000+1,200,000+540,000+300,000)			
	Work in process C		454,000	
	10% of (2,500,000+1,200,000+540,000+300,000)			
	Work in process B			4,540,000
	(Job B completed and transferred to finished goods, 10% rejected items transferred to Job C)			
7	Cost of goods sold		6,886,000	
	Finished goods A			2,800,000
	Finished goods B			4,086,000
	(Jobs A and B delivered and transferred to cost of goods sold.)			
		Rs.	21,506,000	21,506,000

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STIKCY NOTES

2. SERVICE COSTING

2.1 The nature of services and operations

It is usual to explain costing in terms of how to calculate and record the costs of manufactured products. However, many business entities do not make and sell products; they provide services.

Service organization do not make or sell tangible goods. Services are any activity carried out by a party to the benefit of another that is essentially intangible and does not result in the ownership of anything.

Examples include hotel services, consultancy services, legal and accounting services, providers of telephone services (telecommunications companies), providers of television and radio channels, entertainment services, postal services, medical services, and so on.

Characteristics of services

These are major characteristics of services:

- **Intangibility**: They do not have a physical substance unlike goods. They cannot be held or seen.
- **Inseparability**: Consumption and creation of a service cannot be separated. Services are consumed as they are created. A service does not exist until it is consumed by the person being served.
- **Variability**: Services face the problem of maintaining consistency in the standard of output. Goods can usually be supplied to a standard specification. This is more difficult to achieve for services.
- **Perishability**: Services cannot be stored. They do not have a shelf life.
- **Lack of ownership**: Services do not result in the transfer of property in anything. The purchase of a service only confers on the customer a temporary benefit.
- **Heterogeneous**: a haircut is heterogeneous and so the exact service received will vary each time, not only will two hairdressers cut hair differently, but a hairdresser will not consistently deliver the same standard of haircut.

Operations

Operations are activities. Like services, they do not result in a finished product to sell to customers. Examples of operations include a customer service center taking telephone calls and e-mails from customers, and the staff canteen providing meals to employees.

2.2 Service costing, product costing and job costing compared

Costs can be established for services, such as hotel accommodation, telephone calls, auditing work, holidays and travel, and so on. The costs of a service are the sum of direct materials, direct labor, direct expenses (if any) and a share of operational overheads.

Costs can also be established for operations, in a similar way.

Service costing differs from costing in manufacturing industries in several ways.

- There is no production system; therefore, there are no production overheads.
- Direct materials costs are often a fairly small proportion of total costs (for example, the direct materials costs to a telecommunications company of providing telephone services are very small).
- In some service industries, direct labor costs are high (for example, in the film-making industry, accountancy and investment banking).
- General overhead costs can be a very high proportion of total costs.
- Inventory is usually very small; therefore, absorption costing is usually of little or no value for management information purposes.

Not all entities that provide services will use service costing. The purpose of service costing is to provide information to management about the costs of different services that the entity provides, and the profitability of each of the different services. Each service should be fairly standard. If they are not standard services, it is more sensible to use job costing to calculate the cost of each 'job' of service. For example:

- Service costing might be used by a hospital to record or calculate the cost of each of the different services provided by the hospital, such as the cost of treating a patient for a particular condition such as cardiac arrests etc.
- Job costing might be used by a professional firm such as a firm of accountants or solicitors, where the cost of each job depends largely on the amount of time spent on each job by the professional staff.

2.3 Cost units in service costing: composite cost units

One of the main problems with service costing is that it can be difficult to identify a suitable cost unit for the service. It is often appropriate to use a composite cost unit in service costing. This is a cost that is made up from two variables, such as a cost per man per day (a cost per 'man/day'). Here, the two variables are 'men' (the number of employees) and 'days'.

Examples of composite **cost units used in service costing** are as follows:

- The cost per room per day. This is a useful unit cost in the hotel services industry.
- The cost per passenger mile or the cost per passenger kilometer (= the average cost of transporting a passenger for one mile or one kilometer). This unit measure of cost is used by transport companies that provide bus or train services.
- The cost per ton mile delivered (= the average cost of transporting one ton of goods for one mile). This unit cost is commonly used for costing freight services and delivery operations.
- The cost per patient/day (= the average cost of treating one patient for one day) or the cost per hospital bed/day (= the cost of maintaining one hospital bed in a hospital for one day). These costs are used by health service providers.
- The cost per man day. This unit cost is widely used in professional services, such as auditing, legal services and consultancy services.

Composite cost units can be used in addition to a 'job costing' type of service costing system. For example, a firm of accountants might calculate the cost of each job performed for a client. In addition, it might calculate the average cost per man day for the professional services such as taxation, auditing, consultancy etc. that it provides.

- The cost of each service 'job' enables management to monitor costs and profits on individual jobs for a customer.
- The composite cost, which is an average cost for all 'jobs' allows management to monitor the general level of costs.

2.4 Calculating the cost per unit of service (or operation)

The cost of a service unit (or composite cost unit) is calculated as follows.

▶ *Formula*

$$\text{Cost per unit of service} \quad \frac{\text{Total costs of the service}}{\text{Number of units of service}}$$

Total costs are the costs of direct materials, direct labor, direct expenses and variable overheads plus a charge for fixed overheads (unless marginal costing is used to cost the services).

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The total number of service units might be a bit more difficult to calculate. Here are a few examples.

- *Example 05:*

A hotel has 80 standard twin-bedded rooms. The hotel is fully-occupied for each of the 350 days in each year that it is open. The total costs of running the hotel each year are Rs. 3,360,000.

What would be a useful measure of the cost of providing the hotel services?

A useful unit cost is the cost per room/day. This is the average cost of maintaining one room in the hotel for one day.

Room available in a year = 80 rooms × 350 days = 28,000

Cost per room/day = Rs. 3,360,000/28,000 = Rs 120.

- *Example 06:*

A train company operates a service between two cities, Southtown and Northtown. The distance between the cities is 400 miles. During the previous year, the company transported 200,000 passengers from Southtown to Northtown and 175,000 passengers from Northtown to Southtown. The total costs of operating the service were Rs.60 million.

What would be a useful measure of the cost of providing the train service between the two cities?

A useful unit cost is the cost per passenger/mile. This is the average cost of transporting one passenger for one mile.

Passenger/miles per year = (200,000 × 400) + (175,000 × 400) = 150 million.

Mile = Rs. 60,000,000/150,000,000 = Rs.0.40.

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3. COMPREHENSIVE EXAMPLES

- *Example 01:*

RI Limited (RIL) is engaged in the manufacturing of spare parts for industrial machines. RIL receives bulk orders from its customers and follows job order costing. Following data pertains to two of the jobs which were started in the month of February 2018:

	Job F01	Job F02
Size of job order (Units)	5,400	3,600
Labor hours used	27,500	21,600
Labor rate per hour	Rs. 360	Rs. 400

i. Each unit of both jobs require 24 kg of raw material S40. Purchase price of S40 was Rs. 30 per kg.

ii. The inventory of S40 at beginning and end of the month was Rs. 2,940,000 and Rs. 1,740,000 respectively.

iii. Wages were paid on 28 February 2018. Income tax withheld from the wages amounted to Rs. 500,000 which would be deposited in government treasury in the following month.

iv. Job F01 was in process at month-end. However, Job F02 was completed during the month of February and finished goods were sent to warehouse. During the delivery to the customer, 500 units were damaged badly and their realizable value is 50% of the cost.

Total labor hours utilized during the month were 100,000. Factory overheads are applied at Rs. 120 per direct labor hour. Under/over applied factory overheads are charged to cost of sales at month-end. Total actual factory overheads amounted to Rs. 11,000,000, out of which 40% were fixed.

Journal entries to record the transactions for the month of February 2018 can be prepared as follows:

Journal entries

Date	Particulars		Debit	Credit
			----- Rs. in '000 -----	
1	Purchases - Raw material	(W-1)	5,280	
	Supplier/cash			5,280
	(Purchased raw material)			
2	Work in process (F01)	(W-1)	3,888	
	Work in process (F02)	(W-1)	2,592	
	Raw material			6,480
	(Allocated raw material consumed to the jobs)			
3	Work in process (F01)	(27,500×360)	9,900	
	Work in process (F02)	(21,600×400)	8,640	
	Payroll			18,540
	(Allocated direct labor to the jobs)			

Date	Particulars		Debit	Credit
			----- Rs. in '000 -----	
4	Payroll		18,540	
	Accrued payroll tax			500
	Bank/Cash			18,040
	(Paid of payroll)			
5	Work in process (F01)	(27,500×120)	3,300	
	Work in process (F02)	(21,600×120)	2,592	
	Factory overheads applied			5,892
	(Applied factory overheads to the jobs @ Rs. 120 per direct labor hour)			
6	Finished goods	(2,592+8,640+2,592)	13,824	
	Work in process (F02)			13,824
	(Transferred WIP of job F02 to finished goods)			
7	Damaged goods (at NRV) (13,824/3,600×500×50%) Abnormal loss - P&L (13,824/3,600×500×50%)		960 960	
	Finished goods			1,920
	(Recorded 500 damaged units)			
8	Cost of sales	(13,824–1,920)	11,904	
	Finished goods			11,904
	(Transferred total finished goods to cost of sales)			
9	Factory overheads applied	(100,000×120)	12,000	
	Cost of sales (overhead over applied)			1,000
	Factory overheads control			11,000
	(Transferred applied factory overheads to control a/c and charged under applied overheads to cost of sales)			
10	Factory overheads control		11,000	
	Cash/suppliers			11,000
	(Recorded actual factory overheads incurred)			

W-1:		Rs. In 000
Material consumption - F01	(5,400×24×30)	3.888.00
Material consumption - F02	(3,600×24×30)	2,592.00
Add: Closing stock of raw material	*Given*	1,740.00
Less: Opening stock of raw material	*Given*	(2,940.00)
Purchases - Raw material		5,280.00

▶ *Example 02:*

Modern Engineering Workshop (MEW) is engaged in production of customized spare parts of textile machinery. The following information pertains to the jobs worked by MEW during the month of June 2014:

	Job 101	Job 202
Size of job order	4,000 units	5,000 units
	----------- Rs. in '000 -----------	
Opening work in process	15,000	-
Raw material consumed	10,000	31,000
Direct labor used (Rs. 100 per hour)	5,000	8,000

i. Overheads are applied to jobs at Rs. 25 per direct labor hour. Under/over applied overheads are transferred to cost of sales.

ii. Job 101 was completed during the month and the goods were sent to the warehouse for delivery to the customer. During the transfer to the warehouse, 160 units were damaged. Net realizable value of the damaged units was Rs. 500,000. Remaining units were transferred to the customer.

iii. Job 202 is in process; however, 2,000 units are fully complete and were transferred to the warehouse during the month while 3,000 units are 70% complete as at 30 June 2014.

iv. Actual overheads for the month of June 2014 amounted to Rs. 4,000,000.

In order to prepare journal entries to record the above transactions, please see below:

Journal entries			
Date	Particulars	Debit	Credit
		Rs. in '000	
1	Work in process Job # 101	10,000	
	Work in process Job # 202	31,000	
	Raw material		41,000
	(Raw material consumed for jobs)		
2	Work in process Job # 101	5,000	
	Work in process Job # 202	8,000	
	Payroll		13,000
	(Direct labor cost allocated to jobs)		
3	Work in process Job # 101 5,000/100*25	1,250	
	Work in process Job # 202 8,000/100*25	2,000	
	Factory overheads applied		3,250
	(Overheads applied to the jobs @ Rs. 25 per direct labor hour)		

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Journal entries			
Date	**Particulars**	**Debit**	**Credit**
		Rs. in '000	
4	Factory overheads applied	3,250	
	Cost of sales – overhead under applied (4,000–3,250)	750	
	Factory overheads control		4,000
	(Transfer of applied factory overheads to control a/c and under applied overheads charged to cost of sales)		
5	Finished goods (Job # 101) (15,000+10,000+5,000+1,250)*3,840/4,000	30,000	
	Damaged goods (at NRV)	500	
	Profit and loss account (damaged goods cost exceeding NRV) (31,250×160/4,000)-500	750	
	Work in process Job # 101		31,250
	(WIP of Job order # 101 transferred to finished goods)		
6	Cost of sales	30,000	
	Finished goods		30,000
	(Finished goods of Jobs # 101 transferred to cost of sales)		
7	Finished goods (31,000+8,000+2,000)/(2,000+3,000*0.7)*2,000	20,000	
	Work in process Job # 202		20,000
	(Units fully completed for Job # 202 transferred to finished goods)		

STICKY NOTES

Job costing is a costing method used where each cost unit is separately identifiable. The work is undertaken to customer's specific requirements and the job is of short duration. The main focus of Job costing is to calculate cost of a specific job or batch.

Costs for each job are collected on a job cost card. Costs includes Material, labor and overheads. Overheads are absorbed in to the cost of jobs using pre-determined overhead absorption rates.

Service costing can be used by companies operating in a service industry often by companies wishing to establish the cost of services carried out by some of their departments

Service costing differs from the other costing methods. With many services the cost of direct materials consumed will be relatively small compared to the labor, direct expenses and overheads cost.

CHAPTER 8

PROCESS COSTING

IN THIS CHAPTER

AT A GLANCE

Process Costing is used where production is a continuous process and it is not possible to identify separate units of Production.

The output of one process is the input to a subsequent process until a completed product is produced.

There is often a loss in process which is called normal loss due to spoilage, wastage, evaporation etc.

If actual loss is greater than normal loss the difference is called abnormal loss and if actual loss is less than normal loss, we treat the difference as abnormal gain.

Losses and Gain can occur at different stages in the process

Loss or spoilage may have a scrap value; the scrap value of normal loss will probably be deducted from the cost of material in the process.

The scrap value of abnormal loss (or abnormal Gain) will probably be set off against its cost, in an abnormal loss and abnormal gain account, and only the balance on the account will be written to the P & L account at the end of the period.

Process account may have closing and opening WIP, there are two methods to deal with opening WIP – FIFO and Weighted Average.

Output from production may be a single product but there may be joint products or by Products

1. INTRODUCTION TO PROCESS COSTING

1.1 Process costing

Process costing is used when output is produced in a continuous process system, and it is difficult to separate individual units of output. The output of one process is the input to a subsequent process until a completed product is produced. There is often a loss in the process which is called expected or normal loss.

Examples of manufacturing where process costing is used are:

- chemicals manufacturing;
- petroleum refining
- the manufacture of liquids; and
- the continuous processing of high volumes of low-cost food items such as tins of peas or beans, or bottles of tomato ketchup.

In these types of production process, losses in process might occur and there are often problems in measuring exactly the amount of unfinished work-in-process at the end of a period.

The basic principle of costing is the same as for other types of costing. The cost of a unit of output from a process is measured as the total cost of resources consumed by the process divided by the total units produced.

1.2 Features of Process Costing

Process costing provides a system of costing where any or all of these characteristics occur.

- The output of one process is the input to a subsequent process until a completed product is produced.
- Output is normally measured in total quantities, such as tones or liters produced, or in very large quantities of small units (such as the number of cans or tins).
- Materials might be added in full at the start of a process or might be added gradually throughout the process. The materials are processed to produce the final output. In a process costing system, it is usual to distinguish between:
  - direct materials; and
  - conversion costs, which are direct labor costs and production overheads.
- There might be losses in the process (due to evaporation, spoilage, wastage or chemical reaction) so the quantity of output might therefore be less than the quantity of materials input. Process costing provides a system of costing that allows for expected losses in the manufacturing process.
- When there is a continuous production process there will usually be closing work in process and it is difficult to measure the quantity of work-in-process (incomplete production) at the end of a financial period. Process costing provides a method of measuring and costing incomplete WIP.
- Output from production might be a single product, but there may be joint products and by products.
- Depending on the relative value of product, process costing offers methods of costing for each of the different products.
- In some process manufacturing systems, there is a series of sequential processes. For example, a manufacturing system might consist of three consecutive processes: raw materials are input to Process 1, then the output from Process 1 goes onto the next process (Process 2) and the output from Process 2 then goes into a final process, Process 3. The output from Process 3 is the final product. Each process is different and all these characteristics do not occur in all processes.

1.3 The basics of Process Costing

Where a series of separate processes is required to manufacture the finished product the output of one process becomes the input to the next until the final output is made in the final process. For example, if two processes are required the accounts would be like this.

▶ *Illustration:*

Simple process account

Process 1 Account					
	Units	**Rs.**		**Units**	**Rs.**
Materials	100	1,000			
Conversion cost		500	Output to Process 2	100	1,500
	100	1,500		100	1,500

Process 2 Account					
	Units	**Rs.**		**Units**	**Rs.**
Material from process 1	100	1,500			
Added materials	50	500			
Direct labor		700			
Production overhead		400	Output to Finished Goods	150	3,100
	150	3,100		150	3,100

Note that direct labor and production overhead may be treated together as conversion cost

Added material, labor and production overheads in process 2 are added gradually throughout the process. Materials from process 1 is introduced in full at the start of Process 2.

1.4 Addition of Materials in Subsequent Process

Many industries that utilize process costing have more than one processes through which the units pass through before being turned into finished goods e.g. In oil refining the crude oil passes through distillation, reforming, isomerization etc. before turning into a final finished product.

As the production passes through different products, the finished goods output of one process becomes the raw materials input of the next process, in addition to the units from the previous process, new materials may also be added in the next process. In order to separately distinguish the costs incurred in different processes or department the cost from the previous process are labelled as "Direct Materials – Process 1".

▶ *Illustration*

Descriptions	Process X	Process Y
Materials Added (KGs)	**10,000**	**2,000**
Materials (Rs.)	30,000	3,000
Direct Wages (Rs.)	16,000	40,000
Production OH as % of Direct Wages	25%	30%
Normal Loss%	5%	5%
Materials Output (KGs)	**9,500**	**10,925**

Process 1 A/c					
	KGs	**Rs.**		**KGs**	**Rs.**
Direct Materials	10,000	30,000	Normal Loss	500	
Direct Wages		16,000	Output to Process 2	9,500	50,000
Production OH		4,000			
	10,000	**50,000**		**10,000**	**50,000**

Process 2 A/c					
	KGs	**Rs.**		**KGs**	**Rs.**
Direct Materials - process 1	9,500	50,000	Normal Loss	575	
Direct Materials	2,000	3,000	Output	10,925	105,000
Direct Wages		140,000			
Production OH		12,000			
	11,500	**105,000**		**11,500**	**105,000**

2. LOSSES

2.1. Normal loss

A feature of process manufacturing is that there is often some loss or wastage in production and output quantities are less than input quantities of materials.

Normal loss is the expected loss in the process due to evaporation of liquids, wastage or rejected units.

- *Formula: Normal loss*

Normal loss = Quantity of material input – Expected output	OR
Quantity of material input = Normal loss + Expected output	OR
Expected output = Quantity of material input – Normal loss	

Normal loss is usually expressed as a percentage of the input units of materials.

- *Example 01:*

Normal loss of a process is 10%.

A company puts 5,000 liters into the process.

Normal loss is 10% of 5,000 = 500.

Expected output from the process would be 90% of 5,000 liters = 4,500 liters

Normal loss is unavoidable in the normal course of events. It is inherent in the physical and chemical reactions that take place in a process.

- *Example 02:*

A person buys a one liter tin of soup.

The soup must be heated but heating will cause evaporation.

When the soup is ready to eat there will be less than a liter left.

Normal loss is how much evaporation would normally be expected.

2.1.1. Normal loss with no recovery value

- *Example 03:*

A person buys a one liter tin of soup for Rs. 500.

Normal evaporation during cooking is 10%.

When the soup is ready to eat there is 0.9 liters left.

The person has paid Rs. 500 for 0.9 liters and this is unavoidable.

The implication of this simple example is as follows. The normal loss is something that is unavoidable in order to get the good output. The cost of the lost units is part of the cost of obtaining the good output.

All of the cost should be assigned to the good output and none to the normal loss.

If the normal loss has no scrap value it is given a nil value. This means that all of the costs of input must be recognized as part of good output.

- *Formula: Cost of good output*

$$\text{Per unit Cost of good output} = \frac{\text{Total process costs}}{\text{Expected units of output}}$$

- *Example 04:*

The following information relates to a production process:

Input quantities	2,000 liters
Normal loss	10%
Therefore expected output	1,800 liters
Actual output	1,800 liters
Direct materials cost	Rs. 3,600
Direct labor cost	Rs. 300
Production overhead absorbed	Rs. 600
Solution	

The cost per unit produced can be calculated as follows:

	Rs.
Direct materials	3,600
Direct labour	300
Production overheads	600
Total production cost	4,500
Expected output (90% of 2,000)	÷1,800 litres
Cost per litre	Rs.2.50

Process account in the cost ledger

The process cost account (shown below) is a work-in-progress account for the process. The debit side of the account records direct materials, direct labor costs and production overheads absorbed. The credit side of the WIP account records the cost of the finished output.

The account also includes memorandum columns for the quantities of direct materials input and the quantities of output and loss. Normal loss is shown so that the quantities columns add up to the same amount on the debit or credit sides, but the normal loss has no cost (as it's cost is built into the cost of output).

Process account with normal loss (no scrap recovery)

The following information relates to a production process X.

The process account can be completed as follows

Process X					
	Liters	Rs.		Liters	Rs.
Materials	2,000	3,600	Output (actual) at Rs. 2.5 each	1,800	4,500
Direct labor		300			
Prod. overhead		600	Normal loss	200	–
	2,000	4,500		2,000	4,500

Note that it is always useful to draft a process account at the start of an answer as it focuses the mind on what needs to be done.

2.1.2.Normal loss with recovery value

In some cases, losses in a process have a scrap value. The normal loss quantity might not be physically lost but is changed in some way, so that it is not the same as good output. For example, there might be some kind of chemical separation with a substance scraped off the top of the liquid in the process and whatever is scraped off might have a scrap value.

If normal loss has a scrap value, the company is able to recover some of the input costs to the process. The scrap value reduces the cost of the process.

To reflect this in the process account the normal loss is measured at its scrap value and the calculation of the cost of good output becomes:

- *Formula:*

$$\text{Per unit Cost of good output} = \frac{\text{Total process costs} - \text{Scrap value of the normal loss}}{\text{Expected units of output}}$$

- *Example 05:*

The following information relates to a production process X.

Input quantities	2,000 liters
Normal loss	10%
Therefore expected output	1,800 liters
Actual output	1,800 liters
Scrap value of normal loss	Rs. 0.9 per liter
Direct materials cost	Rs. 3,600
Direct labor cost	Rs. 300
Production overhead absorbed	Rs. 600

The cost per unit produced can be calculated as follows:	**Rs.**
Direct materials	3,600
Direct labour	300
Production overheads	600
Total production cost	4,500
Less scrap value of normal loss (200 litres × 0,9)	(180)
	4,320
Expected output (90% of 2,000)	÷1,800 litres
Cost per litre	Rs.2.40

The process account can be completed as follows

Process X					
	Liters	**Rs.**		**Liters**	**Rs.**
Materials	2,000	3,600	Output (actual) at Rs. 2.4 each	1,800	4,320
Direct labor		300			
Prod. O'hd		600	Normal loss	200	180
	2,000	4,500		2,000	4,500

2.1.3. Normal loss with cost of disposal

In other cases, a company might have to pay to dispose of losses in a process. The substance scraped off the top of the liquid in the process might be toxic and has to be disposed of safely.

The cost of disposal represents an additional cost to the process.

To reflect this in the process account the normal loss is measured at zero but the expected costs of disposal are debited to the process account.

- *Formula:*

$$\text{Per unit Cost of good output} = \frac{\text{Total process costs + Disposal costs of the normal loss}}{\text{Expected units of output}}$$

- *Example 06:*

The following information relates to a production process X

Input quantities	2,000 liters
Normal loss	10%
Therefore expected output	1,800 liters
Actual output	1,800 liters
Disposal cost of normal loss	Rs. 1 per liter

The cost per unit produced can be calculated as follows:	Rs.
Direct materials	3,600
Direct labour	300
Production overheads	600
Total production cost	4,500
Disposal costs of normal loss (200 litres × 1)	200
	4,700
Expected output (90% of 2,000)	÷1,800 litres
Cost per litre	Rs. 2.6111

The process account can be completed as follows

Process X					
	Liters	Rs.		Liters	Rs.
Materials	2,000	3,600	Output (actual) at Rs. 2.6111 each	1,800	4,700
Direct labor		300			
Prod. overhead		600			
Disposal cost of normal loss		200	Normal loss	200	–
	2,000	4,700		2,000	4,700

2.2. Abnormal Loss

Normal loss is the expected amount of loss in a process. Actual loss might be more than the expected or normal loss. When actual loss exceeds normal loss, there is abnormal loss. The difference between total actual loss and normal loss is abnormal loss.

- *Formula:*

Abnormal loss = Actual loss – Expected (normal) loss

From earlier:

Quantity of material input = Normal loss + Expected output

But:

Expected output = Actual output + Abnormal loss

Therefore:

Quantity of material input = Normal loss + Actual output + Abnormal loss

Total loss = Normal loss + Abnormal loss.

Abnormal loss is not expected and should not happen. It therefore makes sense to give it a cost. By giving a cost to abnormal loss, management information about the loss can be provided, and management can be made aware of the extent of any problem that might exist with excessive losses in process.

2.2.1. Accounting for abnormal loss

If it is assumed that all losses in process occur at the end of the process, units of abnormal loss are cost in exactly the same way in the as units of finished output. This might seem a little strange but the idea is to highlight the impact of the loss.

The cost per unit of abnormal loss is therefore the same as the cost of units of good output. This is exactly the same as before.

- *Formula:*

$$\text{Per unit Cost of good output} = \frac{\text{Total process costs – Scrap value of the normal loss}}{\text{Expected units of output}}$$

The cost of units of abnormal loss is treated as an expense for the period, and charged as an expense in the income statement for the period.

- *Example 07:*

The following information relates to a production process X.

Input quantities	2,000 liters
Normal loss	10%
Therefore expected output	1,800 liters
Actual output	1,700 liters
Therefore abnormal loss	100 liters

The cost per unit produced can be calculated as follows:	Rs.
Direct materials	3,600
Direct labour	300
Production overheads	600
Total production cost	4,500
Expected output (90% of 2,000)	÷1,800 litres
Cost per litre	Rs. 2.5

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Costing:

Cost of finished output = 1,700 units × Rs.2.50 = Rs.4,250.

Cost of abnormal loss = 100 units × Rs.2.50 = Rs.250.

The process account can be completed as follows

Process X					
	Liters	Rs.		Liters	Rs.
Materials	2,000	3,600	Output (actual) at Rs. 2.5 each	1,700	4,250
Direct labor		300	Abnormal loss	100	250
Production overheads		600			
			Normal loss	200	–
	2,000	4,500		2,000	4,500

Note that the abnormal loss is included in the credit side of the account, in the same way that normal loss is shown on the credit side. However, whereas normal loss has no value/cost, abnormal loss has a cost.

The appropriate abnormal loss double entry in the cost ledger is:

	Debit	Credit
Abnormal loss account	X	
Process accounts		X

hence,

Abnormal loss account					
	Liters	Rs.		Liters	Rs.
Process X account	100	250			

At the end of the financial period, the balance on the abnormal loss account is written off as a cost in the costing income statement. Unlike normal loss the cost of abnormal loss is not built into inventory, however, the cost of abnormal loss is treated as a period cost rather than a product cost.

2.2.2. Abnormal loss with recovery value

When loss has a scrap value, the scrap value of normal loss is deducted from the process cost, as explained earlier.

Abnormal loss will also have a scrap value but this is treated differently to the scrap value of normal loss.

- The cost of expected units of output is calculated in the usual way.
- The scrap value of normal loss is normal loss units × scrap value per unit (as usual).
- In the process account the cost of abnormal loss is measured at the cost of expected units (just as before).
- Periodically the units in the normal loss account are transferred to a scrap account at scrap value.
- The balance on the abnormal loss account is an expense for the period (measured at the cost of the units less the scrap value of abnormal loss).
- This means that scrap value of abnormal loss is set off against the cost of abnormal loss in the abnormal loss account, not the process account.

- *Illustration:*

	Debit	Credit
Cash (money from the sale of scrapped units)	X	
Abnormal loss account		X

The net cost of abnormal loss (cost of abnormal loss minus its scrap value) is then transferred as a expense to the cost accounting income statement at the end of the accounting period.

- *Example: 08:*

The following information relates to a production process X.

Input quantities	2,000 liters
Normal loss	10%
Therefore expected output	1,800 liters
Actual output	1,700 liters
Therefore abnormal loss	100 liters
Scrap value of normal loss	Rs. 0.9 per liter

The cost per unit produced can be calculated as follows:	Rs.
Direct materials	3,600
Direct labour	300
Production overheads	600
Scrap value of normal loss (200 × Rs.0.90)	(180)
Total production cost	4,320
Expected output (90% of 2,000)	÷1,800 liters
Cost per litre	Rs. 2.4

Costing:

Cost of finished output = 1,700 units × Rs. 2.40 = Rs. 4,080.

Cost of abnormal loss = 100 units × Rs. 2.40 = Rs. 240.

Normal loss = 200 units × Rs. 0.9 = Rs. 180

The process account can be completed as follows

Process X					
	Liters	Rs.		Liters	Rs.
Materials	2,000	3,600	Output	1,700	4,080
Direct labor		300	Abnormal loss	100	240
Prod. overhead		600	Normal loss	200	180
	2,000	4,500		2,000	4,500

Accounting for the losses

The double entry to account for the losses can be completed as follows

Abnormal loss account					
	Liters	Rs.		Liters	Rs.
Process X account	100	240	Scrap account	100	90
			Income statement		150
	100	240		100	240

Normal Loss /Scrap account					
	Liters	Rs.		Liters	Rs.
Proces1s X account (normal loss)	200	180	Cash	300	270
Abnormal loss account	100	90			
	300	270		300	270

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3. ABNORMAL GAIN

Abnormal loss occurs when actual loss is more than the expected (normal) loss. Abnormal gain occurs when the actual loss is less than normal loss. Abnormal gain is the difference between the expected normal loss and the actual loss. It might be due to enhanced efficiency of the manufacturing process, if the gain is expected to be permanent then the expected loss ratio should be revised.

- *Formula: Abnormal gain*

Abnormal gain = Expected (normal) loss – Actual loss

From earlier:

Expected output = Actual output + Abnormal loss

Gain is opposite in sign so goes to the other side of the expression:

Expected output + Abnormal gain = Actual output

Actual loss = Normal loss – Abnormal gain

3.1. Accounting for abnormal gain: no scrap value for loss

The method of costing for abnormal gain is the same in principle as for abnormal loss. If it is assumed that all losses occur at the end of the process, the cost per unit of finished output and the value/cost of abnormal gain are calculated as the cost per expected unit of output. (i.e. the cost of good output)

The cost per unit of abnormal loss is therefore the same as the cost of units of good output. This is exactly the same as before.

- *Formula: Cost of good output*

$$\text{Per unit Cost of good output} = \frac{\text{Total process costs – Scrap value of the normal loss}}{\text{Expected units of output}}$$

The differences between costing for abnormal loss and costing for abnormal gain are that:

- Abnormal gain is a benefit rather than an expense. Whereas abnormal loss is written off as a cost at the end of the financial period, abnormal gain is an adjustment that increases the profit for the period.
- Abnormal gain is recorded as a debit entry in the process account, because it is a benefit.
- The other side of the double entry is recorded in an abnormal gain account. At the end of the period, the balance on the abnormal gain account is then transferred to the income statement as a benefit for the period, adding to profit.

- *Example 09:*

The following information relates to a production process X.

Input quantities	2,000 liters
Normal loss	10%
Therefore expected output	1,800 liters
Actual output	1,850 liters
Therefore abnormal gain	50 liters

The cost per unit produced can be calculated as follows:	Rs.
Direct materials	3,600
Conversion costs (direct labour + production overheads)	900
Total production cost	4,500
Expected output (90% of 2,000)	÷1,800 litres
Cost per litre	Rs. 2.5

Costing:

Cost of finished output = 1,850 units × Rs. 2.50 = Rs. 4,625.

Cost of abnormal gain = 50 units × Rs. 2.50 = Rs. 125.

Normal loss = zero (as there is no scrap value).

The process account can be completed as follows

Process X					
	Liters	Rs.		Liters	Rs.
Materials	2,000	3,600	Output	1,850	4,625
Conversion cost		900			
Abnormal gain	50	125	Normal loss	200	nil
	2,050	4,625		2,050	4,625

Accounting for abnormal gain: ledger entries

The abnormal gain is shown on the debit side of the process account, and the total number of units in the memorandum column for quantities (2,050) is larger than the actual quantity of units input to the process (2,000).

The appropriate double entry in the cost ledger is:

▶ *Illustration:*

	Debit	Credit
Process account	X	
Abnormal gain account		X

Continuing from the previous example:

Abnormal gain account					
	Liters	Rs.		Liters	Rs.
Income Statement		125	Process X account	50	125

The balance on this account is taken to the costing income statement at the end of the period, and added to the reported profit.

3.2. Abnormal gain where loss has a scrap value

When loss has a scrap value, the value of abnormal gain is actually less than the amount shown in the process account. The process has been more efficient and produced more good output than expected but there are less normal loss units so the revenue from scrap is less than expected.

Accounting for the scrap value of abnormal gain is similar to accounting for the scrap value of abnormal loss.

- In the process account (WIP), abnormal gain is valued at the cost per expected unit of output.
- The scrap value of normal loss is normal loss units × scrap value per unit (as usual).
- The scrap value of abnormal gain is recorded as a debit entry in the abnormal gain account (in a similar way to recoding the scrap value of abnormal loss as a credit entry in the abnormal loss account).
- The scrap value of the abnormal gain is set off against the value of the abnormal gain in the abnormal gain account, not the process account.
- The balance on the abnormal gain account is the net value of abnormal gain (value of abnormal gain minus the scrap value not earned from the normal loss). This balance is transferred as a net benefit to the cost accounting income statement at the end of the accounting period.

▶ *Example 10:*

Abnormal gain where loss has recovery value

The following information relates to a production process X.

Input quantities	2,000 liters
Normal loss	10%
Therefore expected output	1,800 liters
Actual output	1,850 liters
Therefore abnormal gain	50 liters
Scrap value of normal loss	Rs. 0.9 per liter

The cost per unit produced can be calculated as follows:	**Rs.**
Direct materials	3,600
Direct labour	300
Production overheads	600
Scrap value of **normal loss** (200 × Rs.0.90)	(180)
Total production cost	4,320
Expected output (90% of 2,000)	÷1,800 liters
Cost per litre	Rs. 2.4

Costing:

Cost of finished output = 1,850 units × Rs. 2.40 = Rs. 4,440.

Cost of abnormal gain = 50 units × Rs. 2.40 = Rs. 120.

Normal loss = 200 units × Rs. 0.90 = Rs. 180.

The process account can be completed as follows

Process X					
	Liters	**Rs.**		**Liters**	**Rs.**
Materials	2,000	3,600	Output	1,850	4,440
Conversion cost		900			
Abnormal gain	50	120	Normal loss	200	180
	2,050	4,620		2,050	4,620

Accounting for the abnormal gain and the normal loss

The double entry to account for the losses can be completed as follows

Abnormal gain account					
	Liters	**Rs.**		**Liters**	**Rs.**
Scrap account	50	45	Process X account	50	120
Income statement		75			
	50	120		50	120

The balance on this account is Rs.75. This is treated as an addition to profit in the cost accounting income statement for the period.

Normal Loss /Scrap account					
	Liters	**Rs.**		**Liters**	**Rs.**
Process X a/c (normal loss)	200	180	Abnormal gain account	50	45
			Cash	150	135
	200	270		200	180

The company expected to be able to sell 200 liters of scrap product. The abnormal gain means that they only have 150 liters to sell.

- *Example 11:*

500 liters of a liquid were input to a process at a cost of Rs. 7,200. Normal loss is 20% of the input quantity. Actual loss was equal to the normal loss.

In order to calculate (a) the cost of completed output from the process, and (b)if there is any, the cost of any abnormal loss or the value of any abnormal gain; please see below:

	litres
Input	1,500
Normal loss (20%)	300
Expected output	1,200

Cost per unit of expected output = Rs. 7,200/1,200 liters = Rs.6 per liter.

Actual output = 1,200 liters.

Cost of actual output = 1,200 liters × Rs.6 = Rs. 7,200.

There is no abnormal loss or abnormal gain.

▶ *Example 12:*

1,500 liters of liquid were input to a process at a cost of Rs. 7,200. A normal loss of 20% of the input is expected. The actual output for the period was only 1,100 liters.

For the above example, calculate

a) the cost of completed output from the process, and

b) if there is any, the cost of any abnormal loss or the value of any abnormal gain

	litres
Input	1,500
Normal loss (20%)	300
Expected output	1,200
Actual output	1,100
Abnormal loss	100

Cost per unit = same as in Example 1, Rs.6 per liter.

Cost of actual output = 1,100 liters × Rs.6 = Rs. 6,600.

Cost of abnormal loss = 100 liters × Rs.6 = Rs.600.

▶ *Example 13:*

1,500 liters of liquid were input to a process at a cost of Rs. 7,200. A normal loss of 20% of the input is expected. Loss is sold as scrap, for a net sales price of Rs.0.40 per liter. The actual output from the process was 1,200 liters.

For the above example, calculate:

a) the cost of completed output from the process, and

b) if there is any, the cost of any abnormal loss or the value of any abnormal gain

	Rs.
Input cost	7,200
Scrap value of normal loss (300 × Rs.0.40)	120
Net cost of the process	7,080

Cost per unit of expected output = Rs. 7,080/1,200 liters = Rs.5.90 per liter.

Actual output = 1,200 liters.

Cost of actual output= 1,200 liters × Rs.5.90 = Rs. 7,080.

There is no abnormal loss or abnormal gain.

▶ *Example 14:*

1,500 liters of liquid were input to a process at a cost of Rs. 7,200. The output from the process was 1,100 liters. Normal loss is 20% of the input quantity. Any lost units have a scrap value of Rs.0.40 per liter.

For each of this example, calculate:

a) the cost of completed output from the process, and

b) if there is any, the cost of any abnormal loss or the value of any abnormal gain

Cost per unit = same as in Exercise 3, Rs.5.90 per liter.

Cost of actual output = 1,100 liters × Rs.5.90 = Rs. 6,490.

Cost of abnormal loss = 100 liters × Rs.5.90 = Rs.590.

This cost of abnormal loss is the amount recorded in the process account.

The net cost of abnormal loss is reduced (in the abnormal loss account) by the scrap value of the lost units.

	Rs.
Cost of abnormal loss in the process account	590
Scrap value of abnormal loss (100 × Rs.0.40)	(40)
Net cost of abnormal loss (= expense in the income statement)	550

- *Example 15:*

1,500 liters of liquid were input to a process at a cost of Rs. 7,200. Normal loss is 20% of the input quantity but the actual output for the period was 1,250 liters. Loss has no scrap value.

Calculate:

a) the cost of completed output from the process, and

b) if there is any, the cost of any abnormal loss or the value of any abnormal gain

	litres
Input	1,500
Normal loss (20%)	300
Expected output	1,200
Actual output	1,250
Abnormal gain	50

Cost per unit = same as in Example 1, Rs.6 per liter.

Cost of actual output = 1,250 liters × Rs.6 = Rs. 7,500.

Value of abnormal gain = 50 liters × Rs.6 = Rs.300 (= debit entry in the process account)

- *Example 16:*

1,500 liters of liquid were input to a process at a cost of Rs. 7,200. The output from the process was 1,250 units. Normal loss is 20% of the input quantity. Any lost units have a scrap value of Rs.0.40 per liter. Calculation of the following is given in this example:

a) the cost of completed output from the process, and

b) if there is any, the cost of any abnormal loss or the value of any abnormal gain

	litres
Input	1,500
Normal loss (20%)	300
Expected output	1,200
Actual output	1,250
Abnormal gain	50

Cost per unit = same as in Exercise 3, Rs.5.90 per liter.

Cost of actual output = 1,250 liters × Rs. 5.90 = Rs. 7,375.

Value of abnormal gain = 50 liters × Rs.5.90 = Rs.295.

This value of abnormal gain is the amount recorded in the process account (as a debit entry).

The value cost of abnormal gain is reduced (in the abnormal gain account) by the scrap value of the units that have not been lost.

	Rs.
Value of abnormal gain in the process account	295
Scrap value forgone: (50 × Rs.0.40)	(20)
Net value of abnormal gain (= income in the income statement)	275

4. PROCESS COSTING WITH CLOSING WORK IN PROGRESS

4.1. Sharing out process costs between finished units and unfinished inventory

When manufacturing is a continuous process, there may be unfinished work-in-progress (WIP) at the start and end of a period. This section looks at closing WIP. In all the examples in this section it is assumed that there is no opening WIP. Also note that the examples in this section assume that there are no losses.

This means that some units have been started and finished in the year and others have been started but not finished.

It stands to reason that the cost or value of an unfinished unit is less than the cost of a completed unit. The costs of the process must be shared between finished output and unfinished work-in-process on a fair basis.

Previous sections have explained that costs are allocated to output by calculating a cost per unit. This involves dividing a cost figure by the number of units of expected output.

In order to do this when there is closing work in progress, we use the concept of equivalent units.

4.2. Equivalent units

An equivalent unit means 'equal to one finished unit of output'. This is quite a simple idea. A number of partially complete units is the equivalent of a number of complete units depending on their degree of completion. It is assumed that the costs are added uniformly throughout the process, unless otherwise mentioned.

- *Illustration:*

  200 units that are 50% complete are equivalent to 100 (50% × 200) complete units

  400 units that are 20% complete are equivalent to 80 (20% × 400) complete units

Costs are shared between finished units and inventory by calculating a cost per equivalent unit.

Complication

In all of the previous examples a cost per unit was calculated by dividing the total process costs (perhaps adjusting for expected normal loss or cost of disposal) by the expected number of units.

The existence of work in progress complicates this because the work in progress might be complete to different degrees in respect of different cost inputs. For example, a unit in the closing work in progress might be 80% complete with respect to material but only 50% complete with respect to labor.

In this case, the number of equivalent units of direct materials cost in a period will therefore differ from the number of equivalent units of labor.

A cost per unit is calculated for each type of cost using the equivalent units for that cost. The cost of output is then based on these individual costs.

Costs for finished output and closing inventory can be calculated from the number of equivalent units and the cost per equivalent unit.

4.3. A three-stage calculation

We recommend a three-stage calculation:

- Prepare a statement of equivalent units to calculate the equivalent units for each type of cost in the output from the process and for closing WIP
- Next, prepare a statement of cost per equivalent unit for each type of cost.
- Third, prepare a statement to calculate the cost of finished output and closing WIP from the statement of equivalent units and statement of cost per equivalent unit.

▶ *Example 17:*

The following information relates to a production process X.

Input quantities	4,000 units
Completed output	3,500 units
Closing WIP	500 units

All the direct materials are added to production at the beginning of the process.

Closing inventory of 500 units is therefore 100% complete for materials but is only 40% complete for conversion

The costs incurred in the period were:	Rs.
Direct materials	24,000
Conversion costs:	7,400

Statement of equivalent units would require be as follows:

			Equivalent units	
Output	**Total units**	**Percentage complete**	**Direct materials**	**Conversion costs**
Finished output	3,500	100%	3,500	3,500
Closing WIP:				
Materials	500	100%	500	
Conversion		40%		200
	4,000		4,000	3,700

Statement of cost per equivalent unit

	Direct materials	Conversion costs
Total costs	Rs.24,000	Rs.7,400
Equivalent units	÷ 4,000	÷ 3,700
Cost per equivalent unit	Rs.6	Rs.2

Statement of evaluation

	Rs.
Cost of finished goods (3,500 × (Rs. 6 + Rs. 2))	28,000
Cost of closing WIP	
Materials (500 units × Rs. 6)	3,000
Conversion (200 units × Rs. 2)	400
	3,400

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	**Rs.**		**units**	**Rs.**
Direct materials	4,000	24,000	Finished goods	3,500	28,000
Conversion costs	-	7,400	Closing WIP	500	3,400
	4,000	31,400		4,000	31,400

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- *Example 18:*

A manufacturing company operates two processes. Output from Process 1 is transferred as input to Process 2. Output from Process 2 is the finished product.

Data for the two processes in January are as follows:

Process 1	
Opening work in process	Nil
Units introduced into the process	14,000
Units completed and transferred to the next process (Process 2)	10,000
Closing work-in-progress	4,000
Material cost added during the period	Rs.70,000
Conversion cost added during the period	Rs.48,000

Materials are input into Process 1 at the start of the process and conversion costs are incurred at a constant rate throughout processing. The closing work-in-progress in Process 1 at the end of January is estimated to be 50% complete for the conversion work.

Process 2	
Opening work-in-process	Nil
Units transferred into the process from Process 1	10,000
Closing work-in-progress	1,000
Units completed and transferred to finished goods inventory	9,000
Costs for the period:	
Cost of production transferred from Process 1	Rs.90,000
Conversion cost added during the period	Rs.57,000
Added materials during Process 2	Rs.36,000

The materials from Process 1 are introduced at the start of processing in Process 2, but the added materials are introduced at the end of the process. Conversion costs are incurred at a constant rate throughout processing. The closing work-in-progress in Process 2 at the end of January is estimated to be 50% complete.

It is required to

a) Calculate the cost of completed output from Process 1 and Process 2

b) Calculate the cost of the closing work-in-process in each process at the end of January.

c) Prepare the Process 1 account and the Process 2 account for January.

There is no opening inventory in either process; therefore, there is no difference between the weighted average cost and FIFO valuation methods.

Process 1

Equivalent units	Total	Direct materials		Conversion costs
	Total units	Equivalent units		Equivalent units
Completed units	10,000	10,000		10,000
Closing inventory	4,000	4,000	(4,000 × 50%)	2,000
Total equivalent units	14,000	14,000		12,000
Cost		Rs.70,000		Rs.48,000
Cost per equivalent unit		Rs.5		Rs.4

Statement of evaluation		Direct materials		Conversion costs	Total cost
		Rs.		Rs.	Rs.
Completed units	(10,000 × Rs.5)	50,000	(10,000 × Rs.4)	40,000	90,000
Closing inventory	(4,000 × Rs.5)	20,000	(2,000 × Rs.4)	8,000	28,000
		70,000		48,000	118,000

The process account is prepared as follows:

Process 1 account					
	units	Rs.		units	Rs.
Direct materials	14,000	70,000	Process 2 account	10,000	90,000
Conversion costs		48,000	Closing inventory c/f	4,000	28,000
	14,000	118,000		14,000	118,000

Process 2

Equivalent units	Total	Materials from Process 1	Conversion costs	Added materials
	Total units	Equivalent units	Equivalent units	Equivalent units
Completed units	9,000	9,000	9,000	9,000
Closing inventory	1,000	1,000	500	0
Total equivalent units	10,000	10,000	9,500	9,000
Cost		Rs.90,000	Rs.57,000	Rs.36,000
		Rs.9	Rs.6	Rs.4

Note: The added materials are added at the end of the process, which means that there are no added materials in the (unfinished) closing inventory.

Statement of evaluation	Materials from Process 1	Conversion costs	Added materials	Total cost
	Rs.	Rs.	Rs.	Rs.
Completed units	81,000	54,000	36,000	171,000
Closing inventory	9,000	3,000	0	12,000
	90,000	57,000	36,000	183,000

The process account is prepared as follows:

Process 2 account					
	units	Rs.		units	Rs.
Materials from Process 1	10,000	90,000	Finished goods	9,000	171,000
Conversion costs		57,000			
Added materials		36,000	Closing inventory c/f	1,000	12,000
	10,000	183,000		10,000	183,000

5. OPENING WORK IN PROGRESS

5.1. Introduction to opening work in progress

Opening work in progress adds another level of complexity.

When there is opening work in progress there are two types of cost on the debit side of the account. These are the costs that were incurred last period and brought forward as work in progress and the costs that were incurred in the current period. The issue is whether they should be treated together or separately. This question is addressed in the accounting policy adopted for opening work in progress.

- weighted average cost method treats all costs on the debit side of the account in the same way.
- first-in, first-out (FIFO) method allocates the costs in opening WIP to the finished goods and then spreads the remaining costs elsewhere.

5.2. Opening Work In Progress: Weighted Average Cost Method

5.2.1.The underlying principle

When the weighted average cost method is used, the assumption is that all units produced during the period and all units of closing inventory should be valued at the same cost per equivalent unit for materials and the same cost per equivalent unit for conversion costs.

An average cost per equivalent unit is calculated for all units of output and closing inventory. This includes the units that were partly-completed at the beginning of the period (and which were therefore valued as closing WIP at the end of the previous period).

The calculation of equivalent units is based on the number of units finished in the period (it does not matter when they were started) and the number of units in closing WIP.

5.2.2.The three-stage calculation

The costs are worked out in a similar way to the previous example (where there was no opening WIP).

- **Statement of equivalent units.** Prepare a statement of equivalent units for finished output and for closing WIP.
- **Statement of cost per equivalent unit**. Calculate the cost per equivalent unit for direct materials and the cost per equivalent unit for conversion costs. However, remember to include the cost of the opening WIP. The materials cost of the opening WIP should be included in the total direct materials cost, and the conversion costs in the opening WIP should be added to the conversion costs for the current period.

  You will normally have to calculate a separate cost per equivalent units for materials and for conversion costs. This is because the equivalent units of closing inventory will be different for materials and conversion costs.
- **Statement of evaluation**. Having calculated the equivalent units and a cost per equivalent unit, prepare a statement of evaluation.

► *Example 19:*

The following information relates to a production process X.

Opening inventory	3,000 units
Material cost in opening WIP (100% complete)	Rs. 12,600
Conversion costs in opening WIP (30% complete)	Rs. 970
During the month	
Input quantities	7,000 units
Completed output	8,000 units
Closing WIP (100% complete for direct materials and 60% complete for conversion costs).	2,000 units

All the direct materials are added to production at the beginning of the process.

Closing inventory of 2,000 units is therefore 100% complete for materials but is only 60% complete for conversion.

The costs incurred in the period were:	Rs.
Direct materials	28,000
Converison costs:	17,430

Statement of equivalent units

			Equivalent units	
Output	**Total units**	**Percentage complete**	**Direct materials**	**Conversion costs**
Finished output	8,000	100%	8,000	8,000
Closing WIP:				
Materials	2,000	100%	2,000	
Conversion		60%		1,200
	10,000		10,000	9,200

And the Statement of cost per equivalent unit, would be as follows

	Direct materials	Conversion costs
Total costs		
Costs in opening WIP	Rs. 12,600	Rs. 970
Costs in the period	Rs. 28,000	Rs.17,430
	Rs. 40,600	Rs.18,400
Equivalent units	÷ 10,000	÷ 9,200
Cost per equivalent unit	Rs. 4.06	Rs. 2

Statement of evaluation

	Rs.
Cost of finished goods (8,000 × (Rs. 4.06 + Rs. 2))	48,480
Cost of closing WIP	
Materials (2,000 units × Rs. 4.06)	8,120
Conversion (1,200 units × Rs. 2)	2,400
	10,520

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	Rs.		units	Rs.
Opening WIP	3,000	13,570			
Direct materials	7,000	28,000	Finished goods	8,000	48,480
Conversion costs	-	17,430	Closing WIP	2,000	10,520
	10,000	59,000		10,000	59,000

5.2.3. Weighted average cost method: summary

The weighted average cost method for process costing with opening WIP can be summarized as follows.

- All output and closing inventory is valued at the same cost per equivalent unit
- Cost of opening inventory + Costs in the period = Total costs
- Units of closing inventory + Units of output in the period = Total equivalent units
- Cost per equivalent unit = Total costs/Total equivalent units

Illustration for the summary of weighted average calculation of cost per unit, is below

	Direct materials	Conversion costs
Cost of opening inventory	X	X
Costs incurred in the period	X	X
Total costs	X_m	X_{cc}
Number of units output	Y	Y
Equivalent units of closing inventory	Y	Y
Total equivalent units	Y_m	Y_{cc}
Cost per equivalent unit	(X_m/Y_m)	(X_{cc}/Y_{cc})

5.3. Opening Work In Progress: FIFO Method

5.3.1. FIFO method in process costing

The first-in, first-out (FIFO) method of process costing is based on the assumption that the opening units of work-in-process at the beginning of the month will be the first units completed. The cost of these units is their value at the beginning of the period plus the cost to complete them in the current period.

It is necessary to calculate the number of equivalent units of work done in the period. This consists of:

- The equivalent units of direct materials and conversion costs required to complete the opening WIP. These are the first units completed in the period.
- The equivalent units of finished output in the period that was started as well as finished in the period. These have one equivalent unit of direct materials and one equivalent unit of conversion costs. The total number of these units is:
  - the total finished output in the period
  - minus the quantity of opening WIP (which are completed first)
- The equivalent units of closing WIP (calculated in the normal way).

5.3.2. The three-stage calculation

The three-stage calculation with the FIFO method is similar to the calculation method previously described, with the exception that in the statement of evaluation, the cost of finished output consists of:

- The finished cost of opening WIP which is the sum of:
  - the costs in the opening WIP value at the start of the period; plus
  - the costs in the current period to complete these units; plus
- the cost of finished output started as well as finished in the period.

Study the following example carefully.

► *Example 20:*

The following information relates to a production process X.

Opening inventory	3,000 units
Material cost in opening WIP (100% complete – therefore 0% is needed in this period)	Rs. 12,600
Conversion costs in opening WIP (30% complete – therefore 70% is needed in this period)	Rs. 970
	Rs. 13,570

During the month	
Input quantities	7,000 units
Completed output	8,000 units
Closing WIP (100% complete for direct materials and 60% complete for conversion costs).	2,000 units

All the direct materials are added to production at the beginning of the process.

Closing inventory of 2,000 units is therefore 100% complete for materials but is only 60% complete for conversion.

The costs incurred in the period were:	Rs.
Direct materials	28,000
Converison costs:	17,430

In solving for Statement of equivalent units, please see below:

			Equivalent units	
Output	**Total units**	**Percentage complete**	**Direct materials**	**Conversion costs**
Started last period				
Opening WIP	3,000			
Materials		0%	nil	
Conversion		70%		2,100
Started and finished in the period	5,000	100%	5,000	5,000
Finished in period	8,000		5,000	7,100
Closing WIP:				
Materials	2,000	100%	2,000	
Conversion		60%		1,200
	10,000		7,000	8,300

Statement of cost per equivalent unit

Total costs in current period	Rs. 28,000	Rs.17,430
Equivalent units	÷ 7,000	÷ 8,300
Cost per equivalent unit	Rs. 4	Rs. 2.1

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Statement of evaluation

	Rs.
Cost of goods finished in the period (8,000 units)	
Started in previous period but finished in this period	
Opening WIP (3,000 units)	13,570
Conversion cost to finish opening WIP (2,100 × Rs. 2.1)	4,410
	17,980
Started and finished in this period (5,000 × Rs. 4 + Rs. 2.1)	30,500
	48,480
Cost of closing WIP	
Materials (2,000 units × Rs. 4)	8,000
Conversion (1,200 units × Rs. 2.1)	2,520
	10,520

These costs would be recorded in the process account as follows

Process (WIP) account					
	units	Rs.		units	Rs.
Opening WIP	3,000	13,570			
Direct materials	7,000	28,000	Finished goods	8,000	48,480
Conversion costs	-	17,430	Closing WIP	2,000	10,520
	10,000	59,000		10,000	59,000

(**Tutorial note:** If you compare this example using FIFO with the previous example using the weighted average cost method, you will see that the cost of finished output and value of closing WIP is the same in each case. This is a coincidence. Normally, the two methods provide different costs for finished output and different closing WIP valuations.)

5.3.3. FIFO method: summary

The first-in, first-out method for process costing with opening WIP can be summarized as follows.

- The cost of the opening units completed in the current period is calculated separately from the cost of the units that are started and finished in the current period.
- A cost per equivalent unit is calculated **for the current period**, as follows:

► *Illustration for the summary of weighted average calculation of cost per unit, is given below*

	Direct materials	Conversion costs
Costs incurred in the current period	TC_m	TC_c
Equivalent units of work in the current period:		
to complete opening WIP	X	Y
to start and finish units	X	Y
to make closing WIP	X	Y
Total equivalent units of work in this period	X_m	Y_{cc}
Cost per equivalent unit in the current period	TC_m / X_m	TC_c / Y_{cc}

- These costs are used to apportion the process costs in the current period between:
  - the cost of completing the opening WIP
  - the cost of units started and finished in the current period
  - the value of closing inventory.
- Having calculated costs for the current period, the valuation of output from the process is calculated as follows:

and illustration for the summary of evaluation of outputs under the FIFO method, is given below:

	Rs.
Cost of Items started in the previous period and finished in this period	
Opening WIP	X
Cost of finishing the opening WIP	
To complete material	X
To complete other costs	X
	X
Cost of items started and finished in this period	X
Cost of items finished in the period	X
Cost of items started in this period	
Material	X
Other costs	X
	X
Total process costs	X

6. WORK IN PROGRESS AND LOSSES

6.1. Introduction

Earlier in the chapter, we explained that normal loss is measured at zero or its scrap value if it has one. This recognized that the scrap recovery reduces the overall cost of the process.

When a question requires the calculation of cost per unit by components of cost, the question arises as to at what cost the expected scrap recovery should be set off against. After all, the value of the scrapped unit would lay partly in its material cost but also partly in its conversion costs. The usual approach is to employ a convention that ignores the complication, and offset the expected scrap recovery against the material cost only.

We saw that abnormal loss is measured in the same way as good production. The number of abnormal loss units are included in the expected good output used in the cost per unit calculation.

The same principles are followed when a question requires the calculation of cost per unit by component through the calculation of equivalent units. The number of equivalent units taken to build the abnormal loss must be included in the total number of equivalent units.

▶ *Example 21:*

The following information relates to a production process X

Input quantities	4,000 units
Normal loss (all units having a scrap recovery of Rs. 1)	10% of input
Completed output	3,000 units
Closing WIP	500 units

All the direct materials are added to production at the beginning of the process.

Inspection of the units occurs when they are 50% complete. (Note that this must relate to conversion as they are 100% complete for material).

Closing inventory of 500 units is therefore 100% complete for materials but is 60% complete for conversion.

The costs incurred in the period were:	**Rs.**
Direct materials	24,000
Converison costs:	7,400

It is useful to construct an extra working with these questions to show the physical number of units.

Closing work in progress and losses – (Preliminary working)

	Units
Opening WIP	0
Input	4,000
Total possible units	4,000
Normal loss (10% of input)	(400)
Expected good output	3,600
Actual good output	(3,000)
Closing WIP	(500)
Abnormal loss	100

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Closing work in progress and losses

Statement of equivalent units

			Equivalent units	
Output	**Total units**	**Percentage complete**	**Direct materials**	**Conversion costs**
Finished output	3,000	100%	3,000	3,000
Closing WIP:				
Materials	500	100%	500	
Conversion		60%		300
Abnormal loss				
Materials	100	100%	100	
Conversion		50%		50
	3,600		3,600	3,350

Statement of cost per equivalent unit

Total costs	Rs.24,000	Rs.7,400
Expected scrap recovery of normal loss (10% × 4,000 units × Rs. 1)	Rs. (400)	
	Rs.23,600	Rs.7,400
Equivalent units	÷ 3,600	÷ 3,350
Cost per equivalent unit	Rs.6.56	Rs.2.21

Statement of evaluation

Note that the costs per unit above have been rounded to two decimal places. However, the calculations below are based on unrounded figures ($^{23,600}/_{3,600}$ and $^{7,400}/_{3,350}$)

	Rs.
Cost of finished goods (3,000 × (Rs. 6.56 + Rs. 2.21))	26,294
Cost of closing WIP	
Materials (500 units × Rs. 6.56)	3,278
Conversion (300 units × Rs. 2.21)	662
	3,940
Cost of closing abnormal loss	
Materials (100 units × Rs. 6.56)	656
Conversion (50 units × Rs. 2.21)	110
	766

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	**Rs.**		**units**	**Rs.**
Direct materials	4,000	24,000	Finished goods	3,000	26,294
			Normal loss	400	400
Conversion costs	-	7,400	Abnormal loss	100	766
			Closing WIP	500	3,940
	4,000	31,400		4,000	31,400

6.2. Opening WIP and losses (Weighted average)

- *Example 22:*

The following information relates to a production process X

Opening inventory	3,000 units
Material cost in opening WIP (100% complete)	Rs. 12,600
Conversion costs in opening WIP (30% complete)	Rs. 970
During the month	
Input quantities	7,000 units
Normal loss (all units having a scrap recovery of Rs. 1)	5% of Current input
Completed output	7,500 units
Closing WIP (100% complete for direct materials and 60% complete for conversion costs).	2,000 units

All the direct materials are added to production at the beginning of the process.

Inspection of the units occurs when they are 50% complete. (Note that this must relate to conversion as they are 100% complete for material).

Closing inventory of 2,000 units is therefore 100% complete for materials but is 60% complete for conversion.

The costs incurred in the period were:	Rs.
Direct materials	28,000
Conversion costs:	17,430

Opening work in progress and losses – Weighted average method – Preliminary working)

	Units
Opening WIP	3,000
Input	7,000
Total possible units	10,000
Normal loss (5% of input)	(350)
Expected good output	9,650
Actual good output	(7,500)
Closing WIP	(2,000)
Abnormal loss	150

Opening work in progress and losses – Weighted average method

Statement of equivalent units

			Equivalent units	
Output	**Total units**	**Percentage complete**	**Direct materials**	**Conversion costs**
Finished output	7,500	100%	7,500	7,500
Closing WIP:				
Materials	2,000	100%	2,000	
Conversion		60%		1,200
Abnormal loss				
Materials	150	100%	150	
Conversion		50%		75
	9,650		9,650	8,775

Statement of cost per equivalent unit

	Direct materials	Conversion costs
Total costs	**Rs.**	**Rs.**
Costs in opening WIP	12,600	970
Costs in the period	28,000	17,430
Expected scrap recovery of normal loss (5% × 7,000 units × Rs. 1)	(350)	
	40,250	18,400
Equivalent units	÷ 9,650	÷ 8,775
Cost per equivalent unit	4.17	2.10

Statement of evaluation

Note that in costs per unit above have been rounded to two decimal places. However, the calculations below are based on unrounded figures (40,250/9,650 and 18,400/8,775)

	Rs.
Cost of finished goods (7,500 × (Rs. 4.17 + Rs. 2.1))	47,009
Cost of closing WIP	
Materials (2,000 units × Rs. 4.17)	8,342
Conversion (1,200 units × Rs. 2.1	2,516
	10,858
Abnormal loss	
Materials (150 units × Rs. 4.17)	626
Conversion (75 units × Rs. 2.1	157
	783

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	Rs.		units	Rs.
Opening WIP	3,000	13,570	Finished goods	7,500	47,009
Direct materials	7,000	28,000	Normal loss	350	350
Conversion costs	-	17,430	Abnormal loss	150	783
			Closing WIP	2,000	10,858
	10,000	59,000		10,000	59,000

8.3 Opening WIP and losses (FIFO)

▶ *Example 23:*

The following information relates to a production process X.

Opening inventory	3,000 units
Material cost in opening WIP (100% complete	Rs. 12,600
Conversion costs in opening WIP (30% complete –	Rs. 970
	Rs. 13,570

During the month	
Input quantities	7,000 units
Normal loss (all units having a scrap recovery of Rs. 1)	5% of current input
Completed output	7,500 units
Closing WIP (100% complete for direct materials and 60% complete for conversion costs).	2,000 units

All the direct materials are added to production at the beginning of the process.

Inspection of the units occurs when they are 50% complete. (Note that this must relate to conversion as they are 100% complete for material).

Closing inventory of 2,000 units is therefore 100% complete for materials but is 60% complete for conversion.

The costs incurred in the period were:	**Rs.**
Direct materials	28,000
Conversion costs:	17,430

Opening work in progress and losses – FIFO method – Preliminary working

	Units
Opening WIP	3,000
Input	7,000
Total possible units	10,000
Normal loss (5% of input)	(350)
Expected good output	9,650
Actual good output:	
Started in the previous period but finished in this period	(3,000)
Started and finished in this period	(4,500)
Output in this period	(7,500)
Closing WIP	(2,000)
Abnormal loss	150

Opening work in progress and losses – FIFO method

Statement of equivalent units

			Equivalent units	
Output	**Total units**	**Percentage complete**	**Direct materials**	**Conversion costs**
Started last period				
Opening WIP	3,000			
Materials		0%	nil	
Conversion		70%		2,100
Started and finished in the period	4,500	100%	4,500	4,500
Finished in period	7,500		4,500	6,600

Closing WIP:				
Materials	2,000	100%	2,000	
Conversion		60%		1,200
Abnormal loss				
Materials	150	100%	150	
Conversion		50%		75
	9,650		6,650	7,875

Statement of cost per equivalent unit

	Direct materials	Conversion costs
Total costs in current period	28,000	17,430
Expected scrap recovery of normal loss (5% × 3,500 units × Rs. 1)	(350)	
	27,650	17,430
Equivalent units	÷ 6,650	÷ 7,875
Cost per equivalent unit	Rs. 4.16	Rs. 2.21

Opening work in progress and losses – FIFO method

Statement of evaluation

Note that the costs per unit above have been rounded to two decimal places. However, the calculations below are based on unrounded figures ($^{27,650}/_{6,650}$ and $^{17,430}/_{7,875}$)

	Rs.
Cost of goods finished in the period (7,500 units)	
Started in previous period but finished in this period	
Opening WIP (3,000 units)	13,570
Conversion cost to finish opening WIP (2,100 × Rs. 2.21)	4,648
	18,218
Started and finished in this period (4,500 × (Rs. 4.16 + Rs. 2.21))	28,671
	46,889

Cost of closing WIP	Rs.
Materials (2,000 units × Rs. 4.16)	8,316
Conversion (1,200 units × Rs. 2.21)	2,655
	10,971
Cost of abnormal loss	
Materials (150 units × Rs. 4.16)	624
Conversion (75 units × Rs. 2.21)	166
	790

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	Rs.		units	Rs.
Opening WIP	3,000	13,570			
Direct materials	7,000	28,000	Finished goods	7,500	46,889
Conversion costs	-	17,430	Normal loss	350	350
			Abnormal loss	150	790
			Closing WIP	2,000	10,971
	10,000	59,000		10,000	59,000

Tutorial note: FIFO stock valuation is more common than the weighted average method, and should be used unless an indication in given to the contrary. You may be presented with limited information about the opening stock which forces you to use either the FIFO or the weighted average method. The rules are as follows:

1. If you are given with degree of completion of each element of opening stock but not the value of each element, then you must use FIFO method.
2. If you are not given the degree of completion of each element in opening stock but you are given with value, then you must use weighted average method.

7. LOSSES AND GAINS AT DIFFERENT STAGES IN THE PROCESS

7.1. Assumptions about when loss occurs

In the earlier explanation of accounting for abnormal loss and abnormal gain, it was assumed that losses occur at the end of the production process. This assumption is not relevant for normal loss, but it is relevant for abnormal loss and abnormal gain, because these are given a value.

If it is assumed that losses occur at the end of a process, units of abnormal loss or gain are given a cost or value as if they are fully completed units – and so one equivalent unit each.

If losses occur at a different stage in the process, this assumption should not be applied. Instead, the concept of equivalent units should be used to decide the cost of the abnormal loss or the value of the abnormal gain. Equivalent units can be used provided that an estimate is made of the degree of completion of units at the time that loss occurs in the process. Differing degrees of completion might be used for direct materials and conversion costs.

7.2. Equivalent units and abnormal loss part-way through the process

When loss occurs part-way through a process, the cost of any abnormal loss should be calculated by:

- establishing the equivalent units of direct materials and conversion costs for the loss
- calculating a cost per equivalent units
- using the calculations of equivalent units and cost per equivalent unit to obtain a cost for finished output and abnormal loss in the period.

▶ *Example 24:*

Abnormal loss and loss part-way through a process

The following information relates to a production process X.

Input quantities	10,000 units
Normal loss	10%
Therefore expected output	9,000 units
Actual output	8,500 units
Therefore abnormal loss	500 units

Direct materials are added in full at the beginning of the process, and loss occurs 60% of the way through the process.

The costs incurred in the period were:	Rs.
Direct materials	27,000
Conversion costs:	13,200

Statement of equivalent units

			Equivalent units	
Output	**Total units**	**Percentage complete**	**Direct materials**	**Conversion costs**
Finished output	8,500	100%	8,500	8,500
Abnormal loss				
Materials	500	100%	500	
Conversion		60%		300
Expected output	9,000		9,000	8,800

Statement of cost per equivalent unit

	Direct materials	Conversion costs
	Rs. 27,000	Rs.13,200
Equivalent units	÷ 9,000	÷ 8,800
Cost per equivalent unit	Rs. 3	Rs. 1.5

Statement of evaluation

	Rs.
Cost of finished goods (8,500 × (Rs. 3 + Rs. 1.5))	38,250
Abnormal loss	
Materials (500 units × Rs. 3)	1,500
Conversion (300 units × Rs. 1.5)	450
	1,950

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	Rs.		units	Rs.
Direct materials	10,000	27,000	Finished goods	8,500	38,250
			Abnormal loss	500	1,950
Conversion costs	-	13,200	Normal loss	1,000	nil
	10,000	40,200		10,000	40,200

7.3. Equivalent units and abnormal gain part-way through the process

The same principles apply to the valuation of abnormal gain where the loss/gain occurs part-way through the process. However, there is one important difference. Equivalent units of abnormal gain are given a negative value and are subtracted from the total equivalent units of output in the period.

Perhaps the easiest way to think of the reason for this is that abnormal gain is on the opposite side of the process account (the debit side) from actual finished output (credit side) and abnormal gain equivalent units are subtracted because they offset the cost of the finished output.

► *Example 25:*

Abnormal gain part-way through a process

The following information relates to a production process X.

Input quantities	6,000 units
Normal loss	10%
Therefore expected output	5,400 units
Actual output	5,600 units
Therefore abnormal gain	200 units

Direct materials are added in full at the beginning of the process, and loss occurs 40% of the way through the process.

The costs incurred in the period were:	Rs.
Direct materials	27,000
Converison costs:	11,040

Statement of equivalent units

			Equivalent units	
Output	**Total units**	**Percentage complete**	**Direct materials**	**Conversion costs**
Finished output	5,600	100%	5,600	5,600
Abnormal gain	(200)			
Materials		100%	(200)	
Conversion		40%		(80)
Expected output	5,400		5,400	5,520

Statement of cost per equivalent unit

	Direct materials	Conversion costs
	Rs. 27,000	Rs.11,040
Equivalent units	÷ 5,400	÷ 5,520
Cost per equivalent unit	Rs. 5	Rs. 2

Statement of evaluation

Cost of finished goods (5,600 × (Rs. 5 + Rs. 2))	39,200
Cost of abnormal gain	
Materials (200 units × Rs. 5)	1,000
Conversion (80 units × Rs. 2)	160
	1,160

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	Rs.		units	Rs.
Direct materials	6,000	27,000	Finished goods	5,600	39,200
Conversion costs	-	11,040			
Abnormal gain	200	1,160	Normal loss	600	nil
	6,200	39,200		6,200	39,200

8. JOINT PRODUCTS AND BY-PRODUCTS

8.1. Definition of joint products

In some process manufacturing systems, two or more different products are produced. Joint product costs can be defined as:

- Joint products are two or more products generated simultaneously, by a single manufacturing process using common input, and being substantially equal in value

Until the joint products are produced in the manufacturing process, they cannot be distinguished from each other. The same input materials and processing operation produces all the joint products together.

Each joint product has a substantial sale value relative to each other joint product.

▶ *For example:*

The refining of crude oil produces a series of products fuel oil, gasoline, and kerosene. Domestic animals are grown for food and their hides are turned into leather.

8.2. Apportioning common processing costs between joint products

The costs of the common process that produces the joint products are common costs. In order to calculate a cost for each joint product, these common costs must be shared (apportioned) between the joint products. The common costs of the process must be apportioned between the joint products on a fair basis, in much the same way that overhead costs are apportioned between cost centers.

One of the following three methods of apportionment is normally used:

- **Units basis**: Common costs are apportioned on the basis of the total number of units produced. The cost per unit is the same for all the joint products. (This is also described as the physical quantities basis).
- **Sales value at the split-off point basis**: Common costs are apportioned on the basis of the sales value of the joint products produced, at the point where they are separated in the process (the 'split off point').
- **Net realizable value (sales value less further processing costs basis**: Common costs are apportioned on the basis of their eventual sales value after they have gone through further processing to get them ready for sale.

▶ *Example 26:*

Two joint products JP1 and JP2, are produced from a common process.

During March, 8,000 units of materials were input to the process. Total costs of processing (direct materials and conversion costs) were Rs. 135,880.

Output was 5,000 units of JP1 and 3,000 units of JP2.

JP1 has a sales value of Rs. 40 per unit when it is output from the process and can be sold for Rs.120 per unit after further processing costs of Rs.25 per unit.

JP2 has a sales value of Rs. 55 per unit when it is output from the process and can be sold for Rs.80 per unit after further processing costs of Rs.15 per unit.

Joint costs can be apportioned in one of the following ways.

Output	Units
JP1	5,000
JP2	3,000
	8,000

Costs:	Rs.
JP1: $^{5,000\text{ units}}/_{8,000\text{ units}}$ × Rs.135,880.	84,925
JP2: $^{3,000\text{ units}}/_{8,000\text{ units}}$ × Rs.135,880.	50,955
	135,880

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	Rs.		units	Rs.
Processing cost	8,000	135,880	JP1	5,000	84,925
			JP2	3,000	50,955
	8,000	135,880		8,000	135,880

Sales value at point of split off

Sales value	Rs.
JP1 (5,000 units × Rs. 40)	200,000
JP2 (3,000 units × Rs. 55)	165,000
	365,000
Costs:	**Rs.**
JP1: $^{\text{Rs. }200,000}/_{\text{Rs. }365,000}$ × Rs.135,880.	74,455
JP2: $^{\text{Rs. }165,000}/_{\text{Rs. }365,000}$ × Rs.135,880.	61,425
	135,880

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	Rs.		units	Rs.
Processing cost	8,000	135,880	JP1	5,000	74,455
			JP2	3,000	61,425
	8,000	135,880		8,000	135,880

Net realizable value at the point of split off

NRV value	Rs.
JP1 (5,000 units × Rs. 120 – Rs. 25)	475,000
JP2 (3,000 units × Rs. 80 – Rs. 15)	195,000
	670,000
Costs:	**Rs.**
JP1: $^{\text{Rs. }475,000}/_{\text{Rs. }670,000}$ × Rs.135,880.	96,333
JP2: $^{\text{Rs. }195,000}/_{\text{Rs. }670,000}$ × Rs.135,880.	39,547
	135,880

These costs would be recorded in the process account as follows.

Process account					
	units	Rs.		units	Rs.
Processing cost	8,000	135,880	JP1	5,000	96,333
			JP2	3,000	39,547
	8,000	135,880		8,000	135,880

▶ *Example 27:*

Physical unit basis

In a joint process, two joint products are made, Product A and Product B. There is no inventory of work-in-process. Information relating to last month's production is set out in the table below.

Joint product	Opening inventory	Closing inventory	Sales
	units	**units**	**units**
A	800	1,200	8,000
B	700	300	10,000

The costs of the joint process in the month were Rs. 144,000. These are apportioned between the joint products on the basis of units produced.

The joint processing costs for the month that are charged to each product can be calculated as follows

	Production
	units
Joint product A: (1,200 + 8,000 – 800)	8,400
Joint product B: (300 + 10,000 – 700)	9,600
Total production	18,000
Joint processing costs	Rs.144,000
Joint processing costs per unit	Rs.8

Apportionment of joint costs	Rs.
To Joint product A: (8,400 × Rs.8)	67,200
To Joint product B: (9,600 × Rs.8)	76,800
	144,000

8.3. By-products

When two or more different products are produced, any product that does not have a substantial sales value is called a by-product.

By products are outputs from a joint process that are relatively minor in quantity and/or value.

A by-product has a small value relative to the joint products but it may have some value.

The proceeds of sale of the by-product can be treated in a number of ways and the method chosen has an implication for how the by-product is measured in the joint process account.

Possible methods include:

Treatment of proceeds of sale	Measurement of by-product in joint process account
As revenue (adding it to the revenue from sales of other products).	No cost is allocated to the by product.
As other income	No cost is allocated to the by product.
As a deduction from joint process costs (this is the most commonly used method).	By-product is measured at scrap value (the accounting treatment is very similar to that used for normal loss).

Since a by-product does not have any substantial value, there is no sense in charging it with a share of the common processing costs.

Instead, the sales value of the by-product is usually deducted from the common processing costs (just as for normal loss). If there are joint products, the common processing costs are apportioned after deducting the sales value of the by-product from the total costs of the process.

▶ *Example 28:*

Two joint products JP1 and JP2, are produced from a common process.

During March, 9,000 units of materials were input to the process. Total costs of processing (direct materials and conversion costs) were Rs. 135,880.

Output was 5,000 units of JP1 and 3,000 units of JP2 and 1,000 units of by-product BP3.

JP1 has a sales value of Rs. 40 per unit when it is output from the process and can be sold for Rs.120 per unit after further processing costs of Rs.25 per unit.

JP2 has a sales value of Rs. 55 per unit when it is output from the process and can be sold for Rs.80 per unit after further processing costs of Rs.15 per unit.

BP3 has a sales value of Rs.1.58 per unit.

The company's policy is to treat the proceeds of sale of a by-product as a reduction of joint process costs

Apportionment of the process costs between the joint products on the basis of net realizable sales value at the split off point, would be as follows.

Net realizable value at the point of split off

Common process costs	Rs.
Total process costs	135,880
Deduct: Sales value of by-product (1,000 × Rs.1.58)	(1,580)
	134,300

NRV value	Rs.
JP1 (5,000 units × Rs. 120 – Rs. 25)	475,000
JP2 (3,000 units × Rs. 80 – Rs. 15)	195,000
	670,000

Costs:	Rs.
JP1: $^{\text{Rs. 475,000}}/_{\text{Rs. 670,000}}$ × Rs. 134,300.	95,213
JP2: $^{\text{Rs. 195,000}}/_{\text{Rs. 670,000}}$ × Rs. 134,300.	39,087
	134,300

These costs would be recorded in the process account as follows.

Process account					
	units	Rs.		units	Rs.
Processing cost	9,000	135,880	JP1	5,000	95,213
			JP2	3,000	39,087
			By product	1,000	1,580
	9,000	135,880		9,000	135,880

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▶ *Example 29:*

Two joint products XX and YY, are produced from a common process.

During July, 11,000 units of materials were input to the process. Total costs of processing (direct materials and conversion costs) were Rs. 100,000.

Output was 6,000 units of XX and 4,000 units of YY and 1,000 units of by-product Q.

XX has a sales value of Rs. 24 per unit when it is output from the process.

YY has a sales value of Rs. 12 per unit when it is output from the process.

Q has a sales value of Rs.1 per unit

The company's policy is to apportion joint costs based on sales value at the point of split off.

80% of the output of both XX and YY was sold by the month end.

The proceeds of sale of the by-product could be treated in one of the following ways.

Sales value at point of split off deducting proceeds of sale of the by-product from the joint process cost (as before)

Sales value	Rs.
XX (6,000 units × Rs. 24)	144,000
YY (4,000 units × Rs. 12)	48,000
	192,000

By-product deducted from cossts	Rs.
XX: Rs. 144,000/ Rs. 192,000 × (Rs.100,000 – Rs. 1,000)	74,250
YY: Rs. 48,000/ Rs. 192,000 × (Rs.100,000 – Rs. 1,000).	24,750
	99,000

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	Rs.		units	Rs.
Processing cost	11,000	100,000	XX	6,000	74,250
			YY	4,000	24,750
			Q	1,000	1,000
	11,000	100,000		11,000	100,000

The income statement would show the following:

	Rs.
Revenue:	
Sales of XX (80% × 6,000 units × Rs. 24)	115,200
Sales of YY (80% × 4,000 units × Rs. 12)	38,400
	153,600
Cost of sales:	
Production costs	99,000
Less: Closing inventory (20% × 99,000)	(19,800)
	(79,200)
Profit	74,400

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Sales value at point of split off treating proceeds of sale of the by-product as other income

Sales value	Rs.
XX (6,000 units × Rs. 24)	144,000
YY (4,000 units × Rs. 12)	48,000
	192,000

By-product deducted from costs	Rs.
XX: Rs. 144,000 / Rs. 192,000 × Rs.100,000	75,000
YY: Rs. 48,000 / Rs. 192,000 × Rs.100,000	25,000
	100,000

These costs would be recorded in the process account as follows.

Process (WIP) account					
	units	Rs.		units	Rs.
Processing cost	11,000	100,000	XX	6,000	75,000
			YY	4,000	25,000
			Q	1,000	nil
	11,000	100,000		11,000	100,000

The income statement would show the following:

Revenue:	
Sales of XX (80% × 6,000 units × Rs. 24)	115,200
Sales of YY (80% × 4,000 units × Rs. 12)	38,400
	153,600

Cost of sales:	
Production costs	100,000
Less: Closing inventory (20% × 100,000)	(20,000)
	(80,000)
Gross profit	73,600
Other income	1,000
Profit	74,600

The profit in the above example is higher than the profit in the previous example by Rs. 200.

This is because the whole sales proceeds from the sale of the by-product has been recognized as other income.

When the sales proceeds from the sale of the by-product are deducted from the joint process cost part of that deduction is carried forward to the next period in the valuation of closing inventory. The deduction in joint process costs was Rs. 1,000 and 80% of the inventory to which it relates has been sold leaving 20% (Rs. 200) to be carried forward to the next period.

9. COST OF REWORK

Sometimes the loss incurred in processing is not scrapped but is subject to a further rectification process, this extra processing cost is referred to as rework.

Rework might be performed on units that are either classified as normal or abnormal loss:

9.1. Normal Rework

The rework cost is charged to the normal processing cost. Rework may involve some material use, labor use etc. Hence the entry is:

	Debit	Credit
Process account	X	
Materials Account		X
Direct Labor Account		X

9.2. Abnormal Rework

Abnormal rework is not charged to process account so that that it will not appear in future estimates for similar jobs. It is recorded in a separate loss account:

	Debit	Credit
Loss from Abnormal Rework account	X	
Materials account		X
Direct Labor account		X

10. COMPREHENSIVE EXAMPLES

- *Example 01:*

XYZ operates several process production systems.

a) For Process 5, the FIFO method of valuing opening work-in-progress is used, and the following details relate to September Year 5.

Opening work-in-process was 600 units, each 80% processed as to materials and 60% processed as to conversion costs.

Finished output was 14,500 units. There were no abnormal losses or gains.

Closing work-in-process was 800 units, each 70% processed as to materials and 40% processed as to conversion costs.

Costs of processing during the current period were:

Materials: Rs. 36,450

Conversion costs: Rs. 17,352.

Calculation for the cost per equivalent unit of output produced during September (= one unit started and completed during the month), would be as follows

FIFO method

Equivalent units	Total	Direct materials		Conversion costs	
	Units	Equivalent units		Equivalent units	
Completion of opening WIP	600	(20%)	120	(40%)	240
Other completed units	13,900		13,900		13,900
	14,500		14,020		14,140
Closing inventory	800	(70%)	560	(40%)	320
Total equivalent units	15,300		14,580		14,460
Costs in the current period			Rs.36,450		Rs.17,352
Cost per equivalent unit			Rs.2.5		Rs.1.2

Cost per equivalent unit of fully completed units in the current period = Rs.2.50 + Rs.1.20 = Rs.3.70.

b) The following details relate to Process 16 in September Year 5:

Opening work-in-progress	2,000 litres, fully complete as to materials and 40% complete as to conversion. The cost of materials in the opening WIP was Rs.9,860 and conversion costs in the opening WIP were Rs.4,700.
Material input	24,000 litres, cost Rs.130,540
Conversion costs in the month	Rs.82,960
Output to process 2	23,000 litres
Closing work-in-progress	3,000 litres, fully complete as to materials and 45% complete as to conversion.

The weighted average cost system is used for inventory valuation in Process 16.

Calculation of the cost per unit of output from this process during September, would be as follows:

Weighted average cost

Equivalent units	Total	Direct materials		Conversion costs	
	Total units	Equivalent units		Equivalent units	
Completed units	23,000		23,000		23,000
Closing inventory	3,000	(100%)	3,000	(45%)	1,350
Total equivalent units	26,000		26,000		24,350
Costs:			Rs.		Rs.
Opening WIP			9,860		4,700
Current period costs			130,540		82,960
Total costs			140,400		87,660
Cost per equivalent unit			Rs.5.40		Rs.3.60

Cost per equivalent unit of fully completed units in the current period = Rs.5.40 + Rs.3.60 = Rs.9.00.

- *Example 02:*

Yahya Limited produces a single product that passes through three departments, A, B and C.

The company uses FIFO method for process costing. A review of department A's cost records for the month of January 20X4 shows the following details:

	Units	Material Rs.	Labor Rs.
Work in process inventory as at January 1, 20X4 (75% complete as to conversion costs)	16,000	64,000	28,000
Additional units started in January 20X4	110,000	-	-
Material costs incurred	-	430,500	-
Labor costs incurred	-	-	230,000
Work in process inventory as at January 31, 20X4 (50% complete as to conversion costs)	18,000	-	-
Units completed and transferred in January 20X4	100,000	-	-

Overhead is applied at the rate of 120% of direct labor. Normal spoilage is 5% of output. The spoiled units are sold in the market at Rs. 6 per unit.

The required computations for the month of January, are as follows:

a) Equivalent production units.

	Material Units	FOH/ Labor Units
Units completed and transferred out	100,000	100,000
Less: Beginning inventory (all units)	16,000	16,000
Started and completed in January	**84,000**	**84,000**

	Material Units	FOH/ Labor Units
Beginning inventory (completed in January)		
Labor and FOH (25%)		4,000
Closing inventory (completed in January)		
Material (100%)	18,000	
Labor and FOH (50%)	-	9,000
Normal loss (5% of output)	5,000	5,000
Abnormal loss	3,000	3,000
	110,000	**105,000**

b) Costs per unit for material, labor and factory overhead.

Material	**430,500-(6*5000)**	**= Rs 3.81**
	110,000 – 5,000	
Labor	230,000	= Rs 2.30
	105,000 - 5,000	
Factory Overhead	Rs. 2.30 x 120%	= Rs 2.76
		= Rs 8.87

c) Cost of abnormal loss (or gain), closing work in process and the units transferred to the next process.

	Rupees
Cost of abnormal loss	
3,000 units @ Rs.8.87	26,610
Closing work in process	
Material (18,000 x Rs. 3.81)	68,580
Labor (18,000 x Rs. 2.30 x 50%)	20,700
FOH (18,000 x Rs. 2.76 x 50%)	24,840
	114,120
Cost of units transferred to next process	
From beginning inventory	
Beginning Inventory-Already incurred costs	
Materials	64,000
Labor	28,000
Factory Overhead (Rs. 28,000 x 120%)	33,600
Beginning Inventory-Costs incurred in January	
Labor (16,000 x Rs. 2.30 x 25%)	9,200
FOH (16,000 x Rs. 2.76 x 25%	11,040
units fully produced during the current month (84,000 x Rs. 8.87)	745,080
	890,920

▶ *Example 03:*

A chemical is manufactured by passing through two processes X and Y using two types of direct material, A and B. In process Y, a by-product is also produced which is then transferred to process Z where it is completed. For the first week of a month, the actual data has been as follows:

		Process		
		X	Y	Z
Output of main product	(kgs)	9,400	8,000	
Output of by-product	(kgs)		1,400	1,250
Direct material - A (9,500 units)	(Rs.)	123,500		
Direct material - B added in process	(kgs)	500	300	20
Direct material - B added in process	(Rs.)	19,500	48,100	1,651
Direct wages	(Rs.)	15,000	10,000	500
Scrap value	(Rs. per unit)	5	10	6
Normal loss of units in process	(%)	4	5	5

The factory overheads are budgeted @ 240% of direct wages and are absorbed on the basis of direct wages. Actual factory overheads for the week amounted to Rs. 65,000. Estimated sales value of the by-product at the time of transfer to process Z was Rs. 22 per unit.

Preparation the required accounts for the given example are as follows

a) Process accounts for X, Y and Z.

Process X A/c					
	kgs	**Rs.**		**kgs**	**Rs.**
Direct materials – A	9,500	123,500	Normal loss A/c	400	2,000
Direct material – B	500	19,500	Abnormal loss A/c	200	4,000
Direct wages		15,000	Transfer to process Y	9,400	188,000
Production overheads @ 240% of direct wages		36,000			
	10,000	194,000		10,000	194,000

Working:	
Cost per unit of good units and abnormal loss units	**Rupees**
Total cost less scrap (194,000 – 2,000)	192,000
No. of units including abnormal losses (9,400 + 200)	9,600
Cost per unit (Rs.)	20

Process Y A/c					
	kgs	Rs.		kgs	Rs.
Transfer from process X	9,400	188,000	Normal loss A/c	485	4,850
Direct materials – B	300	48,100	Finished goods	8,000	240,000
Direct wages		10,000	Byproduct	1,400	30,800
Production overheads @ 240% of direct wages		24,000			
	9,700	270,100			
Abnormal gain A/c	185	5,550			
	9,885	275,650		9,885	275,650

Working:	
Cost per unit of good units and abnormal loss units	**Rupees**
Total cost less scrap and by-product cost (270,100 – 4,850 – 30,800)	234,450
Less: Total No. of units less normal losses and by-product (9700-485-1400)	7,815
Cost per unit (Rs.)	30

Process Z A/c					
	Units	Rs.		Units	Rs.
Input	1,400	30,800	Normal loss A/c	71	426
Direct materials – B	20	1,651	Abnormal loss A/c	99	2,475
Direct wages		500	Finished goods	1,250	31,250
Production overheads @ 240% of direct wages		1,200			
	1,420	34,151		1,420	34,151

Working: Cost per unit of good and abnormal loss units	Rupees
Total cost less scrap (34,151 – 426)	33,725
No. of units including abnormal losses (1,420 – 71)	1,349
Cost per unit (Rs.)	25

b) Abnormal loss and abnormal gain accounts.

Abnormal Loss A/c					
	Units	Rs.		Units	Rs.
Process X	200	4,000	Bank Account	200	1,000
Process Z	99	2,475	Bank account	99	594
			Costing P & L A/c		4,881
	299	6,475		299	6,475

Abnormal Gain A/c					
	Units	Rs.		Units	Rs.
Bank A/c / normal loss A/c	185	1,850	Process Y	185	5,550
Costing P & L A/c		3,700			
	185	5,550		185	5,550

c) Factory overhead account.

Factory overheads A/c			
	Rs.		Rs.
Cash/bank/payables (actual overheads)	65,000	Charged to process accounts:	
		Process X	36,000
		Process Y	24,000
		Process Z	1,200
		Cost of goods sold accounts:	
		Overheads under absorbed	3,800
	65,000		65,000

▶ *Example 04:*

Smart Processing Limited produces lubricants for industrial machines. Material COX is introduced at the start of the process in department A and subsequently transferred to department B. Normal loss in department A is 5% of the units transferred.

In department B, material COY is added just after inspection which takes place when the production is 60% complete. 10% of the units processed are evaporated before the inspection stage. However, no evaporation takes place after adding material COY. During the year, actual evaporation in department B was 10% higher than the estimated normal losses because of high level of sulphur contents in natural gas used for processing.

Other details for the year ended December 31, 20X3 are as under:

	Department A	Department B
	Rupees	
Opening work in process	2,184,000	2,080,000
Material input - 600,000 Liters	17,085,000	
- 500,000 Liters		9,693,000
Labor	8,821,000	6,389,000
Overheads	2,940,000	3,727,000

	Department A			Department B		
	Liters	Completion %		Liters	Completion %	
		Material	Conversion costs		Material	Conversion costs
Opening WIP	64,500	100	60	40,000	100	60
Closing WIP	24,000	100	70	50,000	100	80

Conversion costs are incurred evenly throughout the process in both departments. The company uses FIFO method for inventory valuation.

a) Calculations for the equivalent production units, would be

Quantity Schedule (in liters)	Dept. A	Dept. B
WIP opening	64,500	40,000
Started in process / material added	600,000	500,000
Received from preceding department	-	610,000
	664,500	1,150,000
Transferred out to B (664,500-24,000)x100/105	610,000	-
Transferred to finished goods (1,150,000-50,000-61,000-6,100)	-	1,032,900
WIP closing	24,000	50,000
Normal loss – A (664,500-24,000)x5/105)	30,500	-
Normal loss – B (10% x 610,000)	-	61,000
Abnormal loss – B (10% x 61,000)	-	6,100
	664,500	1,150,000

Equivalent production unit (in liters)				
	Department A		Department B	
	Material	Conversion	Material	Conversion
Units completed and transferred out	610,000	610,000	1,032,900	1,032,900
Opening Inventory (60% completed)	(64,500)	(38,700)	(40,000)	(24,000)
Abnormal loss (B: 6,100 x 60%)	-	-	-	3,660
Closing inventory (A: 70%, B: 80%)	24,000	16,800	50,000	40,000
	569,500	588,100	1,042,900	1,052,560

b) The cost of abnormal loss and closing WIP, would be calculated as:

Cost of abnormal loss (Department B)	Department A			Department B		
	Quantity	Rate	Amount	Quantity	Rate	Amount
	Units	Rs.	Rs.	Units	Rs.	Rs.
From department A (610,000 x 10% x 10%)				6,100	(W-2) 54.60	333,044
Labor (60%)				3,660	6.07	22,216
Overheads (60%)				3,660	3.54	12,956
			-			368,216
WIP-closing costs						
From department A	-	-	-	50,000	(W-2) 28.42	1,421,000
Material	24,000	30.00	720,000	50,000	9.29	464,500
Labor (70%, 80%)	16,800	15.00	252,000	40,000	6.07	242,800
Overheads (70%, 80%)	16,800	5.00	84,000	40,000	3.54	141,600
			1,056,000			2,269,900

c) For the cost of finished goods produced, calculations would be as follows

	Rupees
Total costs charged to department (W-1)	51,863,000
Less: WIP closing costs (Computed above)	(2,269,900)
Less: Cost of abnormal loss (Computed above)	(368,216)
Costs transferred to finished goods	49,224,884

W-1: Cost charged to department:						
	Department A			Department B		
	Equivalent Units	Cost (Rs.)	Unit cost (Rs.)	Equivalent Units	Cost (Rs.)	Unit cost (Rs.)
WIP - opening inventory		2,184,000			2,080,000	
Cost from department A					29,974,000	
Material	569,500	17,085,000	30.00	1,042,900	9,693,000	9.29
Labor	588,100	8,821,000	15.00	1,052,560	6,389,000	6.07
Overheads	588,100	2,940,000	5.00	1,052,560	3,727,000	3.54
Total cost to be accounted for		31,030,000	50.00		51,863,000	18.90

W-2: Allocation of cost received from department A:			
	Quantity	Amount (Rs.)	Unit cost (Rs.)
Units received from A	610,000		
Normal loss at 10%	(61,000)		
	549,000	*29,974,000	54.60
Abnormal loss at 1%	(6,100)	(333,044)	54.60
Units after inspection	542,900	29,640,956	54.60
Addition of material COY	500,000		
	1,042,900	29,640,956	28.42

**Rs. 31,030,000 (Total cost) – Rs. 1,056,000 (Closing WIP) = Rs. 29,974,000*

- *Example 05:*

Hornbill Limited (HL) produces certain chemicals for textile industry. The company has three production departments. All materials are introduced at the beginning of the process in Department-A and subsequently transferred to Department-B. Any loss in Department-B is considered as a normal loss.

The following information has been extracted from the records of HL for Department-B for the month of August 20X3:

	Department B
Opening work in process (Liters)	Nil
Closing work in process (Liters)	10,500
Units transferred from Department-A (Liters)	55,000
Units transferred to Department-C (Liters)	39,500
Labor (Rupees)	27,520
Factory overhead (Rupees)	15,480

Materials from Department-A were transferred at the cost of Rs. 1.80 per liter.
The degree of completion of work in process in terms of costs originating in Department-B was as follows:

WIP	Completion %
50% units	40%
20% units	30%
30% units	24.5%

(Tip: Treat the costs transferred from department A in the same way as material costs introduced at the start of the department B process and treat department B costs in the same way as conversion costs).

Preliminary working:	Units
Opening WIP	0
Input (previous process)	55,000
Total possible units	55,000
Actual good output	(39,500)
Closing WIP	(10,500)
Normal loss (as specified in the question)	5,000

a) For the given examples, Statement of equivalent units would be:

Statement of equivalent units				
			Equivalent units	
Output	Total units	Percentage complete	Materials (input from Dept. A)	Department B costs
Finished output	39,500	100%	39,500	39,500
Closing WIP:				
Materials	10,500	100%	10,500	
Dept. B costs		50% × 40%		2,100
Dept. B costs		20% × 30%		630
Dept. B costs		30% × 24.5%		770
				3,500
	55,000		50,000	43,000

b) Statement of Statement of cost per equivalent unit

	Materials (input from Dept. A)	Department B costs
Total costs:		
Input from department A (55,000 units × Rs. 1.8)	Rs.99,000	
Department B costs (27,520 + 15,480)		Rs. 43,000
Equivalent units (÷)	50,000	4,300
Cost per equivalent unit	Rs.1.98	Rs.1.00

c) Statement of evaluation of units would be

	Rs.
Cost of finished goods (39,500 × (Rs. 1.98 + Rs. 1.00))	117,710
Cost of closing WIP	
Materials (10,500 units × Rs. 1.98)	20,790
Conversion (3,500 units × Rs. 1.00)	3,500
	24,290

d) Process WIP would be accounted for as follows:

Process (WIP) account					
	units	Rs.		units	Rs.
Transfers from A	55,000	99,000	Finished goods (transfer to C)	39,500	117,710
Labour		27,520	Normal loss	5,000	–
Overhead		15,480	Closing WIP	10,500	24,290
	55,000	142,000		55,000	142,000

► *Example 06:*

Fowl Limited (FL) manufactures two joint products X and Y from a single production process.

Raw material Benz is added at the beginning of the process. Inspection is performed when the units are 50% complete. Expected loss from rejection is estimated at 10% of the tested units. Following details are available for the month of May 20X3:

	Units	Material (Rs.)	Conversion cost (Rs.)
Opening work in process	15,000	90,000	25,000
Transferred to finished goods:			
– Product- X	50,000	547,125	228,875
– Product- Y	25,000		
Loss due to rejection	12,500	-	-
Closing work in process	10,000	-	-

Additional information:

i. Opening and closing work in process are 75% complete.

ii. The normal loss is sold as scrap at the rate of Rs. 1.50 per unit.

iii. Production costs are allocated to joint products on the basis of weight of output.

iv. The company uses weighted average method for inventory valuation.

When required to prepare departmental statements for equivalent units and its cost, preliminary working for the month would be as follows:

Preliminary working)	Units
Opening WIP	15,000
Input	82,500
Expected good output	97,500
Actual good output	
Product X	(50,000)
Product Y	(25,000)
Closing WIP	(10,000)
Loss	12,500

Normal loss: Opening WIP is 75% complete and must have been tested in the previous period. Therefore, normal loss is on input units only (82,500 × 10%) = 8,250 units

Abnormal loss units (12,500 – 8,250) = 4,250 units

Statement of equivalent units				
Output	Total units	Percentage complete	Equivalent units	
			Direct materials	Conversion costs
Finished output				
Product X	50,000	100%	50,000	50,000
Product Y	25,000	100%	25,000	25,000
		100%		
Closing WIP:	10,000			
Materials		100%	10,000	
Conversion		75%		7,500
Abnormal loss	4,250			
Materials		100%	4,250	
Conversion		50%		2,125
	89,250		89,250	84,625

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Statement of cost per equivalent unit	Direct materials	Conversion costs
Total costs	Rs.	Rs.
Costs in opening WIP	90,000	25,000
Costs in the period	547,125	228,875
Expected scrap recovery of normal loss (8,250 units × Rs. 1.5)	(12,375)	
	624,750	253,875
Equivalent units	÷ 89,250	÷ 84,625
Cost per equivalent unit	7	3

Statement of evaluation	Rs.
Cost of finished goods	
Product X (50,000 × (Rs. 7 + Rs. 3))	500,000
Product Y (25,000 × (Rs. 7 + Rs. 3))	250,000
Cost of closing WIP	
Materials (10,000 units × Rs. 7)	70,000
Conversion (7,500 units × Rs. 3)	22,500
	92,500
Abnormal loss	
Materials (4,250 units × Rs. 7)	29,750
Conversion (2,125 units × Rs. 3)	6,375
	36,125

Process (WIP) account

	units	Rs.		units	Rs.
Opening WIP	15,000	115,000	Finished goods		
Direct materials	82,500	547,125	Product X	50,000	500,000
Conversion costs	-	228,875	Product Y	25,000	250,000
			Normal loss	8,250	12,375
			Abnormal loss	4,250	36,125
			Closing WIP	10,000	92,500
	97,500	891,000		97,500	891,000

▶ *Example 07:*

Platinum Limited (PL) manufactures two joint products Alpha and Beta and a by-product Zeta from a single production process. Following information is available from PL's records for the month of February 20X4:

Direct material	25,000 kg. @ Rs. 25 per kg.
Direct labor @ Rs. 15 per hour	Rs. 432,000
Normal process loss	20% of the material consumed

Overheads are allocated to the products at the rate of Rs. 10 per direct labor hour. The normal loss is sold as scrap at the rate of Rs. 8 per kg.

Following data relates to the output from the process:

Product	Output ratio	Selling price per kg. (Rs.)
Alpha	75%	95.0
Beta	15%	175.0
Zeta	10%	52.5

Alpha is further processed at a cost of Rs. 30 per unit, before being sold in the market. Joint costs are allocated on the basis of net realizable value.

a) Computation of the total manufacturing costs for February 20X4 would be as follows.

Total cost of output:	Kg.	Rupees
Direct material [25,000 x Rs. 25]	25,000	625,000
Direct Labor		432,000
Overheads [432,000 / Rs. 15 x Rs. 10]		288,000
		1,345,000
Less: Sale of scrap [25,000 x 20% x Rs. 8]	(5,000)	(40,000)
Total cost of products	20,000	1,305,000

b) And the calculation for the profit per kg for Alpha, Beta would be as follows:

Profit per kg of Alpha and Beta:	Rupees
Joint costs of products	1,305,000
Less: Sale of Zeta [20,000 x 10% x Rs. 52.5]	(105,000)
	1,200,000

Product	Kg.	Output %	NRV at split-off	Total NRV	Joint cost allocation	Total profit	Profit per Kg.
Alpha	15,000	75%	95-30=65	975,000	780,000	195,000	13
Beta	3,000	15%	175	525,000	420,000	105,000	35
	18,000			1,500,000	1,200,000		

- *Example 08:*

Oceanic Chemicals manufactures two joint products Sigma and Beta in a single process at its production department. Incidental to the production of these products, it produces a by-product known as ZEE. Sigma and ZEE are sold upon completion of processing in production department whereas Beta goes to refining department where it is converted into Theta.

Joint costs are allocated to Sigma and Beta on the basis of their net realizable values. Proceeds from sale of by-product are treated as reduction in joint costs. In both the departments, losses up to 5% of the input are considered as a normal loss.

Actual data for the month of June 2015:

	Department	
	Production	**Refining**
Cost	**------ Rs. in '000 ------**	
Material input at Rs. 50 per kg	3,000	-
Direct labor at Rs. 100 per hour	2,500	350
Production overheads	1,850	890

Output	**---------- Liters----------**	
Sigma	34,800	-
Beta	16,055	-
ZEE (by-product)	5,845	-
Theta	-	15,200

Sigma, Theta and by-product ZEE were sold at Rs. 300, Rs. 500 and Rs. 40 per liter respectively. There was no work in process at the beginning and the end of the month.

The cost per liter of Sigma and Theta, for the month of June 2015 would require following calculations:

Oceanic Chemicals **Product-wise cost of Sigma and Theta**		**Sigma**	**Theta**
		----------- Rs. in '000' -----------	
Joint costs of production	**W.2**	4,303.49	2770.98
Cost of refining	(350+890)	-	1,240.00
	(A)	4,303.49	4,010.98
No. of units produced	Liter. **(B)**	34,800	15,252
Cost per Liter	Rs. **(A÷B)**	**123.66**	**262.98**

W.1: Joint cost of production		**Rs. in '000'**
Joint cost of production	(3,000+2,500+1,850)	7,350.00
Sale proceeds from by-product ZEE	(5,845×40)	(233.80)
		7116.20
Cost of abnormal loss of production	[7,116.20÷(34,800+16,055+300)×300]	(41.73)
		7,074.47

W.2: Allocation of joint costs	NRV at split-off	Units produced	Total NRV	Joint cost allocation
	Rs.	Liters	-------- Rs. in '000 --------	
Sigma	300.00	34,800	10,440.00	4,303.49
Beta 500-[(350+890)÷15,252)]	418.70	16,055	6,722.23	2,770.98
			17,162.23	**7,074.47**

W.3: Abnormal loss quantity		Production	Refining
		---------- Liters ----------	
Input quantity	3,000,000÷50	60,000	16,055
Output quantity	(34,800+16,055+5,845)	(56,700)	(15,200)
Production losses		3,300	855
Normal losses up to 5% of input	(60,000×5%), (16,055×5%)	3,000	803
Abnormal loss		**300**	**52**

▶ *Example 09:*

Ababeel Foods produces and sells chicken nuggets. Boneless chicken is minced, spiced up, cut to standard size and semi-cooked in the cooking department. Semi-cooked pieces are then frozen and packed for shipping in the finishing department.

Inspection is carried out when the process in the cooking department is 80% complete. Normal loss is 5% of input and comprises of:

2% weight loss due to cooking; and

3% rejection of nuggets. The rejected nuggets are sold at Rs. 60 per kg.

Overheads are applied at the rate of 120% of direct labor cost. Inventory is valued using weighted average cost. Following information pertains to cooking department for the month of June 2014:

	Kg.	Material	Labor
		----- Rs. in '000 -----	
Opening work in progress (100% complete to material and 50% complete to conversion)	30,000	6,260	1,288
Costs for the month	420,000	50,000	20,000
Weight after cooking	440,000	-	-
Transferred to finishing department	362,000	-	-
Closing work in progress (100% complete to material and 65% complete to conversion)	65,000	-	-

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Preparation of the process account for cooking department for the month of June 2014 would be as follows.

Ababeel Foods					
Cooking department production and cost for June 2014					
Process account - Cooking department					
	Kg.	**Rs. in '000'**		**Kg.**	**Rs. in '000'**
Opening WIP	30,000	**(W-2)**9,094	**Normal loss:**		
Material	420,000	50,000	▪ weight loss **(W.1)**	7,700	-
Labor		20,000	▪ rejection **(W.1)**	11,550	693
Overheads (20,000*1.2)		24,000	**Abnormal loss:**		
			▪ weight loss **(W.1)**	2,300	
			▪ rejection **(W.1)**	1,450	
			(W.2)	3,750	829
			Transferred out **(W.2)**	362,000	88,328
			Closing WIP **(W.2)**	65,000	13,244
	450,000	**103,094**		**450,000**	**103,094**

W-1: Normal and abnormal losses:	**Total loss**	**Normal loss (Cooking loss at 2% & rejection loss at 3% of input)**		**Abnormal loss (Balancing)**
	Kg.			
Weight loss:				
Opening WIP	30,000			
Input for the month	420,000			
	450,000			
Transferred to finishing department	(362,000)			
Closing WIP	(65,000)			
Total loss	23,000			
Weight loss (450,000-440,000)	10,000	**(450,000-65,000)×2%**	7,700	2,300
Rejection loss (balancing)	13,000	**(450,000-65,000)×3%**	1,550	1,450
	23,000		**19,250**	**3,750**

W-2: Cost and equivalent quantity:		Material cost	Conv. cost	Total cost
		Rs. in '000'		
Opening WIP	1,288*2.2	6,260	2,834	9,094
Cost added	20,000*2.2	50,000	44,000	94,000
Normal rejection valued @ Rs. 60 per kg	11,550*60	(693)	-	(693)
Total cost	**(A)**	**55,567**	**46,834**	**102,401**
		Rupees		
Cost per kg.	(A×1,000)÷(B)	**129.0**	**115.0**	**244.0**

		Equivalent kg.		Total cost (Rs. in '000)
		Material	Conv.	
Finished goods		362,000	362,000	88,328
Closing WIP (100% to material and 65% to conv.)		65,000	42,250	13,244
Total abnormal loss (100% to material and 80% to conv.)		3,750	3,000	829
Total equivalent quantity and cost	**(B)**	**430,750**	**407,250**	**102,401**

► *Example 10:*

Cricket Chemicals Limited (CCL) is a manufacturing concern and has two production processes. Process I produces two joint products i.e. X-1 and X-2. Incidental to the production of joint products, it produces a by-product known as Zee. X-1 is further processed in process II and converted into 'X1-Plus'.

Following information has been extracted from the budget for the year ending 31 August 2019:

i. Process wise budgeted cost:

	Process I	Process II
	------------- Rupees -----------	
Direct material (500,000 liters)	98,750,000	-
Conversion cost	72,610,000	19,100,000

ii. Expected output ratio from process I and budgeted selling prices:

Products	Output ratio in process I	Selling price (Rs. per liter)
Joint product – X-1	55%	-
Joint product – X-2	40%	532
By-product – Zee	5%	120
X1-Plus	-	768

Additional information:

i. Material is added at the beginning of the process and CCL uses 'weighted average method' for inventory valuation.

ii. Joint costs are allocated on the basis of net realizable value of the joint products at the split-off point. Proceeds from the sale of by-product are treated as reduction in joint costs.

iii. Joint product X-2 is sold after incurring packing cost of Rs. 75 per liter.

iv. Normal production loss in process I is estimated at 5% of the input which occurs at beginning of the process. Loss of each liter results in a solid waste of 0.7 kg which is sold for Rs. 10 per kg. No loss occurs during process II.

v. Budgeted conversion cost of process I and process II include fixed factory overheads amounting to Rs. 7,261,000 and Rs. 3,820,000 respectively.

a) Preparation of product wise budgeted income statement for the year ending 31 August 2019, under marginal costing is given below

Cricket Chemicals Limited			
Product wise budgeted income statement - (Marginal costing)		**X1 - Plus**	**X2**
		---- Rs. in million ----	
Sales	[768×261,250 **(W-4)]**, [532×190,000**(W-4)]**	200.64	101.08
Variable production cost:			
Joint cost	(W-1)	(108.96)	(52.11)
Process II Conversion cost	(19.10m–3.82m)	(15.28)	-
Packing cost	(75×190,000)	-	(14.25)
Budgeted contribution margin		76.40	34.72
Fixed cost:			
Joint cost	(W-1)	(4.91)	(2.35)
Process II conversion cost		(3.82)	-
Budgeted profit		67.67	32.37
Total budgeted profit			100.04

W-1: Allocation of joint cost on the basis of NRV						
Joint products	**NRV at split-off point (Rs. per unit) (A)**	**Production (Units) (B)**	**Total NRV (A×B)**	**Joint cost allocation on NRV basis (C)**	**Fixed cost (D)**	**Variable joint cost (C-D)**
			-------------------- Rs. in million --------------------			
X1	694.89	261,250	181.54	113.87	4.91	108.96
	768–73.11 (W-3)	(W-4)		(168.33×181.5/ 268.37)	(7.26×181.54/ 268.37)	
X2	457.00	190,000	86.83	54.46	2.35	52.11
	(532–75)	(W-4)		(168.3×86.83/ 268.37)	(7.26×86.83/ 268.37) (W-1)	
			268.37	(W-2)168.33	7.26	161.07

W-2: Joint cost - Process I		**Rs. in million**
Direct material		98.75
Conversion cost		72.61
Proceeds from By product - Zee	(23,750 (W-4)×120)	(2.85)
Proceeds from sale of normal loss	(25,000(W-4)×0.7kg×10)	(0.18)
Total joint cost		168.33

W-3: Conversion cost -		
Process II (Rs. per unit)	[19,100,000 / 261,250 (W-4)]	73.11

W-4: Quantity schedule		Process I
		--- Liters ---
Input quantity		500,000
Joint product - X-1	(500,000–25,000)×55%	(261,250)
Joint product - X-2	(500,000–25,000)×40%	(190,000)
By product – Zee	(500,000–25,000)×5%	(23,750)
Normal loss	(500,000×5%)	(25,000)

b) CCL has recently received an offer from Football Industries Limited (FIL) to purchase the entire expected output of X-1 during the year ending 31 August 2019 at Rs. 670 per litter. It is estimated that if process II is not carried out, fixed costs associated with it would reduce by Rs. 2,500,000. Advise whether FIL's offer may be accepted.

Evaluation of offer from FIL	Rs. in million
Loss of revenue if offer is accepted {261,250 **(W-4)** ×(768–670)}	(25.60)
Variable cost saved in process-II (19.10m – 3.82m)	15.28
Fixed cost saved	2.50
(Decrease)/Increase in budgeted profits	(7.82)
Conclusion: Offer should not be accepted	

► *Example 11:*

Production at Platinum Chemicals (PC) involves two processes I and II. Following information pertains to the month of August 2017:

i. Actual cost:

	Process I	Process II
	--------- Rupees ---------	
Direct material (12,000 liters)	5,748,000	-
Conversion	2,610,000	1,542,000

ii. Production and sales

Description	Process I	Process II	Remarks
	------ Liters ------		
Products:			
Joint product – J101	5,000	-	Sold for Rs. 1,200 per liter after incurring packing cost of Rs. 120 per liter
Joint product – J202	4,500	-	Transferred to process II for conversion into a new product J-plus
By-product – BP01	1,000	-	Sold at the split-off point for Rs. 500 per liter
J-plus	-	3,400	Sold for Rs. 1,400 per liter
Work-in-process:			
Opening	-	-	
Closing	-	650	70% complete as to conversion

iii. Materials are introduced at the beginning of process I and PC uses 'weighted average method' for inventory valuation.

iv. Proceeds from sale of by-product are treated as reduction in joint costs. Joint costs are allocated on the basis of net realizable values of the joint products at split-off point.

v. Normal production losses in both processes are estimated at 10% of the input and are incurred at beginning of the process. Loss of each liter in process I results in a solid waste of 0.8 kg which is sold for Rs. 100 per kg. Loss of process II has no sale value.

a) The cost of sales of J101 and J-plus for the month of August 2017, would be calculated as follow:

Platinum Chemicals			
Cost of sales for the month of August 2017 - Product J101 and J-plus		**J101**	**J-plus**
Quantity sold	**Liters.**	**5,000**	**3,400**
		------------- Rupees -------------	
Allocated joint costs from process I	(W-1)	4,147,792	-
	3,456,494(W-1)÷(3,400+650)×3,400	-	2,901,748
Process II – Conversion cost	(3,400×400)	-	1,360,000
Packing cost	(5,000×120)	600,000	-
		4,747,792	4,261,748

W-1: Allocation of joint cost - Process I (on the basis of NRV)					
Joint product	**NRV per unit at split-off**		**Units produced**	**Total NRV**	**Joint cost allocation**
	------- Rs. -------		**Liters**	**------- Rupees -------**	
J101	(1,200-120)	1,080	5,000	5,400,000	4,147,792
J202	[1,400-400(W-3)]	1,000	4,500	4,500,000	3,456,494
				9,900,000	(W-2) 7,604,286

W-2: Joint costs - Process I		**Rupees**
Direct material		5,748,000
Proceeds from sale of solid waste - normal loss	1,200 (W-4)×80%×100	(96,000)
Proceeds from sale of by-product BP01	1,000(W-4)×500	(500,000)
		5,152,000
Cost of abnormal loss	5,152,000×300÷9,800	(157,714)
Conversion cost		2,610,000
Cost allocation between joint products J101 and J202		7,604,286
W-3: Conversion cost per unit - Process II		Rupees
Conversion cost of process II	A	1,542,000
Equivalent units	3,400(W-4)+(650×0.7) B	3,855
Cost per unit	(A÷B) C	400

W-4: Normal and abnormal losses quantity	Process I	Process II
	--------- Liters ---------	
Input quantity	12,000	4,500
Less: J101	(5,000)	-
J202 – Transfer to process II	(4,500)	
By-product BP01	(1,000)	-
J-plus	-	(3,400)
Closing work in process (70% conversion)	-	(650)
Normal loss - 10% of input (12,000×10%); (4,500×10%)	(1,200)	(450)
Abnormal loss	**300**	**-**

b) For the given example, accounting entries to record production gains/losses and their ultimate disposal, are as follows.

Journal entries to record production and disposal of solid waste			
Date	Description	Debit	Credit
		-------- Rupees --------	
30-Aug-2017	Solid waste inventory (normal loss at sale price) (W-2)	96,000	
	Solid waste inventory (abnormal loss at cost) (W-2)	157,714	
	WIP - Process I		253,714
	(Normal losses at sale price and abnormal losses at cost credited to WIP)		
30-Aug-2017	Bank (1,200+300)×0.8×100	120,000	
	Profit and loss account Balancing	133,714	
	Solid waste inventory		253,714
	(Sale of normal and abnormal solid waste)		

► *Example 12:*

Bela Enterprises (BE) produces a chemical that requires two separate processes for its completion. Following information pertains to process II for the month of August 2016:

	kg	Rs. in '000
Opening work in process (85% to conversion)	5,000	2,000
Costs for the month:		
Received from process I	30,000	18,000
Material added in process II	15,000	10,000
Conversion cost incurred in process II	-	11,000
Finished goods transferred to warehouse	40,000	-
Closing work in process (60% to conversion)	4,000	-

In process II, material is added at start of the process and conversion costs are incurred evenly throughout the process. Process losses are determined on inspection which is carried out on 80% completion of the process. Process loss is estimated at 10% of the inspected quantity and is sold for Rs. 100 per kg.

BE uses FIFO method for inventory valuation.

a) A statement of equivalent production units, would be prepared as follows:

Statement of equivalent units:		Equivalent units Material	Equivalent units Conversion	Quantity schedule
		------------------ kg	------------------	------------------
Opening WIP (85% to conversion)		(5,000)	(4,250)	5,000
Received from process I				30,000
Material added in process II				15,000
				50,000
Transferred to finished goods		40,000	40,000	40,000
Goods started and completed during the month	A	35,000	35,750	
Closing WIP (60% to conversion)	B	4,000	2,400	4,000
Normal loss at 10% (50,000–5,000–4,000)×10%				4,100
Abnormal loss (80% conversion) (Balancing)	C	1,900	1,520	1,900
	D	40,900	39,670	50,000

b) Computation of costs would be as follows

		Material	Conversion	Total
Cost per unit		---------- Rs. in '000	----------	
Opening WIP		-	-	2,000
Cost for the month:	Process I	18,000	-	18,000
	Process II	10,000	11,000	21,000
Normal loss quantity at sale price (4,100×100)		(410)	-	(410)
Total cost	E	27,590	11,000	40,590
		---------------- Rupees	----------------	
Cost per unit	F=(E÷D)	674.57	277.29	

(i)	Cost of finished goods:		-------------- Rs. in '000	------------	
	Opening WIP				2,000
	Cost for the month	A×F	23,610	9,913	33,523
					35,523
(ii)	Cost of closing WIP	B×F	2,698	666	3,364
(iii)	Cost of abnormal loss	C×F	1,282	x421	1,703

c) Accounting entries to account for production losses for the month would be as follows

Accounting entries to account for production losses:			
Date	Description	Debit	Credit
		--- Rs. in '000 ---	
1	Scrap inventory (normal loss quantity) 4,100×100	410	
	WIP – II		410
	(Normal loss quantity credited to WIP at sales value)		
2	Scrap inventory (abnormal loss quantity) 1,900×100	190	
	Profit and loss account (Balancing)	1,513	
	WIP – II As (iii) above		1,703
	(Loss on abnormal loss quantity debited to profit and loss account)		

▶ *Example 13:*

KS Limited operates two production departments A and B to produce a product XP-29.

Following information pertains to Department A for the month of December 2014.

	Liters	Rs. in '000
Opening work in process (Material 100%, conversion 80%)	15,000	
• Material		5,000
• Direct labor and overheads		2,125
Actual cost for the month:		
• Material	120,000	36,240
• Overheads		14,224
• Direct labor		11,500
Expected losses	5%	
Closing work in process (Material 100%, conversion 80%)	17,000	
Units transferred to Department B	110,000	

KS uses FIFO method for inventory valuation. Direct materials are added at the beginning of the process. Expected losses are identified at the time of inspection which takes place at the end of the process. Overheads are applied at the rate of 80% of direct labor cost.

a) Equivalent production units

KS Limited			
Equivalent production:		Material	Conversion
		----------- Liters -----------	
Units completed and transferred out		110,000	110,000
Closing WIP (100% material and 80% conversion)		17,000	13,600
Opening WIP (100% material and 80% conversion)		(15,000)	(12,000)
Abnormal loss	W.1	2,100	2,100
Equivalent production	(A)	114,100	113,700

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Cost per liter:		--------- Rupees ---------	
Cost incurred in December 2014	(B)	36,240,000	25,603,200 (14,224,000×1.8)
Cost per liter	(B÷A)	317.62	225.18

b) Cost of goods transferred to Department B

		Rs. in '000
From opening WIP:		
- Cost incurred prior to 1 Dec. 2014	*5,000+2,125*	7,125
- Conversion cost incurred in Dec. 2014	*15,000×20%×225.18*	676
		7,801
From units started and completed in Dec. 2014 *[(110,000-15,000)×(317.62+225.18)]*		51,566
		59,367

W.1: Abnormal loss		Liters
Opening WIP		15,000
Units started in December 2014		120,000
Closing WIP		(17,000)
Units completed in December 2014		118,000
Transferred to department B		(110,000)
Normal loss	*118,000 × 5%*	(5,900)
Abnormal loss		**2,100**

c) Accounting entries for the month of December 2014 are as follows

Date	Description	Debit	Credit
		Rs. in '000	
31-Dec-14	WIP - Department A	61,843	
	Raw material		36,240
	Payroll		14,224
	Applied overheads 14,224×80%		11,379
	(Cost charged / overheads applied to department A)		
31-Dec-14	Applied overheads	11,379	
	Cost of sale (under applied overheads)	121	
	Overhead control account		11,500
	(Under-absorbed overheads charged to P&L account)		
31-Dec-14	WIP - Department B	59,367	
	P&L account (abnormal loss) [2,100×(317.62+225.18)]	1,140	
	WIP - Department A		60,507
	(Units transferred to B and abnormal loss charged to department B and P&L account respectively)		

▶ *Example 14:*

Quality Chemicals (QC) produces one of its products through two processes A and B. Following information has been extracted from the records of process A for the month of January 2016.

	Quantity	Material	Conversion
	Units	--------Rs. In '000'-------	
Opening work in process	5,000	2,713	1,499
Input during the month	20,000	10,000	5,760
Transferred to process B	18,000	-	-
Closing work in process	6,000	-	-

Additional information:

i. Materials are introduced at the beginning of the process. In respect of conversion, opening and closing work in process inventories were 40% and 60% complete, respectively.

ii. Inspection is performed when the units are 50% complete. Expected rejection is estimated at 5% of the inspected units. The rejected units are not processed further and sold at Rs. 100 per unit.

iii. QC uses 'weighted average method' for inventory valuation.

a) Computation of equivalent production units and cost per unit, would require

Process A - production and cost for the month of January 2016	Quantity	Equivalent units	
Equivalent units under weighted average method:	**schedule**	**Material**	**Conv.**
	------------- No. of units -------------		
Opening WIP (40% to conversion)	5,000		
Input for the month	20,000		
A	25,000		
Transferred to process B	18,000	18,000	18,000
Closing WIP (60% to conversion)	6,000	6,000	3,600
Normal loss-5% of the inspected units (A×5%)	1,250	-	-
Abnormal gain (50% to conv.) (Bal.)	(250)	(250)	(125)
Normal equivalent units B	25,000	23,750	21,475
Cost per unit:		**------ Rs. in '000 ------**	
Opening WIP		2,713	1,499
Cost for the month		10,000	5,760
Scrapped units at sale price	1,250×100	(125)	-
	C	12,588	7,259
Cost per unit	**C÷B**	530	338

b) Journal entries to record the above transactions would be as follows

Accounting entries			
Date	**Description**	**Debit**	**Credit**
		--- Rs. in '000 ---	
1	WIP - Process A	15,760	
	Raw material		10,000
	Labor and overheads		5,760
	(Material, labor and overheads charged to Process A)		
2	WIP - Process A (250×530)+(125×338) *OR* (250×530)+(250×169)	175	
	Abnormal gain		175
	(To record abnormal gain)		
3	Scrapped units 1,250×100	125	
	WIP - Process A		125
	(Sales value of rejected units credited to WIP)		
4	WIP - Process B 18,000×(530+338)	15,624	
	WIP - Process A		15,624
	(Goods completed transferred to Process B)		
5	Abnormal gain (250×530)+(125×338)	175	
	Scrapped units 250×100		25
	Profit or loss account		150
	(Abnormal gain adjusted to profit or loss account)		

- *Example 15:*

Ravi Limited (RL) is engaged in production of industrial goods. It receives orders from steel manufactures and follows job order costing. The following information pertains to an order received on 1 December 2016 for 6,000 units of a product:

Production details for the month of December 2016:

	Units
Produced and transferred to finished goods	3,200
Delivered to the buyer from the finished goods	3,000
Units rejected during inspection	120
Closing work in process (100% material and 80% conversion)	680

Actual expenses for the month of December 2016:

	Rupees
Direct material	1,140,000
Direct labor (6,320 hours)	948,000
Factory overheads	800,000

Additional information:

- Factory overheads are applied at Rs. 120 per hour. Under/over applied factory overheads are charged to profit and loss account.
- Units completed are inspected and transferred to finished goods. Normal rejection is estimated at 10% of the units transferred to finished goods. The rejected units are sold as scrap at Rs. 150 per unit.
- RL uses weighted average method for inventory valuation.

a) Work in process for the month of December 2016 would be

WIP					
Description	**Units**	**Rupees**	**Description**	**Units**	**Rupees**
Raw material W.1 (A)	4,000	1,140,000	Finished goods [3,200×778.23 (W-2)]	3,200	2,490,336
Direct labor		948,000	Norm al loss (320×150)	320	48,000
Applied overheads (6,320×120)		758,400	Closing WIP *(Bal.)	680	463,710
Abnormal gain [200×(778.23)]	200	155,646			
	4,200	3,002,046		4,200	3,002,046
*(680×296.74)+(544×481.49)					

		Equivalent units	
W-1: Equivalent units and costs applied to the job	**Quantity schedule**	**Material**	**Conversion**
Transferred to finished goods	3,200	3,200	3,200
Closing WIP 680×80%	680	680	544
Normal loss at 10% of the units completed 3,200×10%	320		
	4,200		
Abnormal gain 120–320	(200)	(200)	(200)
Normal production A	**4,000**	**3,680**	**3,544**

W-2: Cost per unit	---------- Rupees ----------	
Raw material	1,140,000	
Direct labor	-	948,000
Applied overheads 6,320×120	-	758,400
Normal loss - sales price 320×150	(48,000)	
B	1,092,000	1,706,400
(B÷A)	296.74	481.49
	778.23	

b) Accounting entries to record over/under applied overheads and production loss/gains

Date	Description	Debit	Credit -
		--------- Rupee ---------	
31-Dec 2016	Factory overhead applied (6,320×120)	758,400	
	P& L account–overheads under applied	41,600	
	Factory overheads control		800,000
	(Transfer of applied factory overheads to control a/c and under applied overheads charged to P&L account)		
31-Dec 2016	WIP (200×778.23)	155,64 6	
	Abnormal gain		155,646
	(To record abnormal gain)		
31-Dec2016	Scrap inventory (320×150)	48,000	
	WIP		48,000
	(Sales value of rejected units credited to WIP)		
31-Dec2016	Abnormal gain (200×778.23)	155,646	
	Scrap inventory (320- 120)×150		30,000
	P&L account		125,646
	(Abnormal gain adjusted to P&L account)		

- *Example 16:*

Tulip Enterprises (TE) manufactures a product Alpha that requires two separate processes, A and B. Following information has been extracted from the cost records of Process B for the month of February 2019:

	Quantity	Process A cost	Process B cost	
			Material	Conversion
	Liters	-----------------Rs. In '000'---------------		
Opening work-in-process – Process B (80% complete as to conversion)	10,000	1,500	600	400
Cost for the month:				
- Received from process A	90,000	14,000	-	-
- Added during process B	12,000	-	7,000	5,600
Closing work-in-process – Process B (70% complete as to conversion)	9,500	-	-	-

Additional information:

i. Materials are added at start of the process.

ii. Normal loss is estimated at 5% of the input. Loss is determined at completion of the process. Loss of each liter results in a solid waste of 0.75 kg. During the month of February 2019, solid waste produced was 6,000 kg.

iii. Solid waste is sold for Rs. 170 per kg after incurring further cost of Rs. 20 per kg.

iv. TE uses weighted average method for valuation of inventory.

Accounting entries to record the transactions of process B are as follows (Narrations to accounting entries are not required)

Accounting entries for Process B

Date	Description	Debit	Credit
		------ Rs. in '000 ------	
1	WIP - Process B	26,600	
	WIP - Process A		14,000
	Raw material		7,000
	Labor and overheads		5,600
2	Scrapped inventory (Normal loss) [C×0.75×170]	653	
	Bank [C×0.75×20]		77
	WIP - Process B (Normal loss) **(W-1)**		576
3	Scrapped inventory (Abnormal loss) [D×0.75×170]	367	
	Profit or loss account **Balancing**	448	
	Bank [D×0.75×20]		43
	WIP - Process B (Abnormal loss) (D×H)		772
4	Finished goods (E×H)	25,366	
	WIP - Process B		25,366

W-1: Equivalent production and cost per liter - Weighted average method

			Quantity Schedule	Equivalent units	
				Material	Conversion
			----------------- Liters	-----------------	
Opening WIP (80% complete as to conversion)			10,000		
Input for the month -	Process A		90,000		
	Process B		12,000		
Total input		A	**112,000**		
Closing WIP (70% complete as to conversion)		B	9,500	9,500	6,650
Normal loss	(A–B)×5%	C	5,125	-	-
Abnormal loss [(6,000÷0.75)–C]		D	2,875	2,875	2,875
Transferred to finished goods **Balancing**		E	94,500	94,500	94,500
		F	**112,000**	**106,875**	**104,025**

			Process A & material costs	Process B conversion costs
			------ Rs. in '000 ------	
Opening WIP	Process A		1,500	
	Process B		600	400
Cost for the month	Process A		14,000	
	Process B		7,000	5,600
Scrapped inventory (Recovery from normal scrapped units) (C×0.75)×(170−20)			(576)	
Total cost		**G**	**22,524**	**6,000**
			Rupees	
		G÷F×1,000	**210.74**	**57.68**
Total - Cost per liter		**H**	**268.42**	

STICKY NOTES

Process costing is used where production is a continuous process, the output of one process will be input to the next until a finished product is being produced

Losses may occur in process. If a certain level of loss is expected this is called normal loss. If losses are greater than expected the difference is abnormal loss and if losses are less than normal the difference is known as abnormal gain

Scrap value of normal loss to be deducted from the cost of materials before cost per equivalent unit is calculated. Units of normal loss are valued at their scrap vale in the process account

Abnormal loss and gains have no concern with the cost of goods units of production. The scrap value of the abnormal losses is not credited to the process account, and abnormal loss and gain units carry the same full cost as a good unit of production

When units are partly completed at the end of a period (closing WIP) it is necessary to calculate the equivalent units of production in order to determine the cost of a completed unit

There are two methods to deal with opening work in progress i.e. FIFO and weighted average cost method.

In the weighted average method, no distinction is made between units of opening stock and new units introduced to the process during the period. The cost of opening stock is added to costs incurred during the period and units of opening stock are each given a value of one full equivalent unit off production

If there is opening and closing WIP, losses during the process and the loss has no scrap value the following rules should be followed.

- **Costs should be divided between finished output, closing stock and abnormal loss/gain using equivalent units as a basis of apportionment**
- **Units of abnormal loss / gain are often taken to be one full equivalent unit each, and are valued on this basis**
- **Abnormal loss units are an addition to the total equivalent units produced but abnormal gain units are subtracted in arriving at the total number of equivalent units produced**

When loss has a scrap value and the equivalent units are a different percentage of the total units for materials, labor and overheads, it is conventional that the scrap value of normal loss is deducted from the cost of materials before a cost per equivalent unit is calculated

If units are rejected as scrap or loss at an inspection stage before the completion of processing, units of abnormal loss should count as a proportion of an equivalent unit, according to the volume of work done and materials added up to the point of inspection

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CHAPTER 9

BUDGETING

IN THIS CHAPTER

AT A GLANCE

Forecasting refers to the use of historic data to determine the direction of future trends for which various qualitative and quantitative methods are used.

A Budget is a quantitative estimation of costs, revenues and resources of an entity for a defined period of time.

Companies use budgeting and forecasting as tools to determine allocation of resources for an upcoming period of time.

Both forecasting and budgeting, although distinct, but their use and their dependency on each other make them inseparable. Tus the has implications for business decisions.

1. INTRODUCTION TO FORECASTING

1.1 Forecasting

Forecasting refers to the use of historic data to determine the direction of future trends. Companies use forecasting as a tool to determine how to allocate their budgets for an upcoming period of time. Investors utilize forecasting as a measure to determine if events affecting a company (e.g. sales expectations) will increase or decrease the price of shares in that company. Forecasting also provides an important benchmark for firms which have a long-term perspective of operations. All financial forecasts, whether about the specifics of a business, like sales growth, or predictions about the economy as a whole, are informed guesses.

1.2 Types of forecasts

There are three major types of forecasts, which many businesses rely on:

- **Demand (Sales) forecast**: Demand or sales forecasts are fundamental to a company's planning and control decisions. They give the expected level of demand for the company's products or services through some future periods. In the case of manufacturing companies demand forecasts form the basis of the production levels.
- **Economic forecast:** Economic forecasts involve such matters as future state of the economy; inflation rates etc. and have a profound influence on the success of future business activities.
- **Technological forecast:** Technological forecasts usually focus on the rate of technological progress or the nature of technological developments in areas related to the business and technology.

1.3 Forecasting methods: Qualitative methods

There are a number of different methods by which a business forecast can be made. All the methods fall into one of two primary approaches: qualitative and quantitative.

Qualitative methods

The qualitative method is based on human judgement and opinions. It is a subjective and non-mathematical approach. It can incorporate well the latest changes in the environment but its being subjective can bias the forecast and reduce the forecast accuracy. Qualitative models have mostly been successful with short-term predictions, but this approach faces limitations due to its reliance on opinion over measurable data.

Qualitative models include:

- **Market Research:** uses surveys & interviews to identify customer preferences. This method is especially useful where the industry serves a limited market. Based on the future needs of the customers a general overall forecast for the demand can be made. For example, a market survey would be like

Rate the following fruit along the dimensions provided:

	Juicy	Sweet	Tasty	Crunchy	Tart	Flavorful
Apples						
Bananas						
Cantaloupe						
Cherries						
Grapes						
Lemons						
Mangoes						
Nectarines						
Pears						
Quinces						
Strawberries						
Watermelon						

- **Jury of Executive opinion:** It involves small group of high-level managers. The group participates in generating new ideas by working together wherein the managerial experience is combined with statistical models.
- **Delphi Method:** It is basically a more formal version of the jury of opinion method. A panel of experts is given a situation and asked to make initial predictions, on the basis of a prescribed questionnaire, these experts develop written opinions. These responses are analyzed and summarized and submitted back to the panel for further considerations. All these responses are anonymous so that no member is influenced by others' opinions. This process is repeated until a consensus is obtained.
- **Estimates of the sales force:** The sales people being closer to consumers can estimate future sales in their own territories more accurately. Based on these and the opinions of sales managers, reasonable trends of the future sales can be calculated. These forecasts are good for short range planning since sales people are not sufficiently sophisticated to predict long-term trends.

1.4 Forecasting methods: Quantitative methods

Quantitative model is based on mathematical modelling and attempts at trying to take the human element out of the analysis. These models are concerned merely with the data and avoid the uncertainty of subjectivity. The consistency and objectivity enable this approach to consider much information and data at one time.

Quantitative models include time series models and causal models.

1.4.1. Time Series Models:

These models are based on the assumption that all information needed is contained in the time series of data. Further it assumes that the future will follow the same pattern as the past. Time-series methods use time as independent variable to produce demand. In a time, series, measurements are taken at successive point in time or over successive periods. Some forecast models used to forecast the level of a time series are as follows:

Trend Projections:

<u>Trend:</u> is an important characteristic of time series models. Trends show gradual upward and downward movement of data over time. Although time series may display trend, there might be data points lying above or below trend line.

<u>Cyclic Component</u>: Any recurring sequence of points above and below the trend line that lasts for more than a year is considered to constitute the cyclical component of the time series—that is, these observations in the time series deviate from the trend due to fluctuations.

<u>Seasonal Component</u>: The component of the time series that captures the variability in the data due to seasonal fluctuations is called the seasonal component. The seasonal component is similar to the cyclical component in that they both refer to some regular fluctuations in a time series. Seasonal components capture the regular pattern of variability in the time series within one-year periods. Seasonal commodities are best examples for seasonal components.

<u>Irregular Component:</u> Random variations in times series is represented by the irregular component. The irregular component of the time series cannot be predicted in advance. The random variations in the time series are caused by short-term, unanticipated and nonrecurring factors that affect the time series.

Moving Averages

Averaging methods are appropriate when a time series displays no significant effects of trend, cyclical, or seasonal components. In such a case, the goal is to smooth out the irregular component of the time series by using an averaging process. The moving averages method is the most widely used smoothing technique. In this method, the forecast is the average of the last "x" number of observations, where "x" is some suitable number. Eg. The average of last three months of sales.

$$\text{Equation: Moving Average} = \frac{\sum \textbf{Demand in Previous n periods}}{\textbf{n}}$$

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- *Example 01:*

You are a manager of a museum store that sells historical replicas. You are required to forecast sales ('000) for 20X5 using a 3 period moving average.

Year	Output ('000 of units)	Moving Total	Moving Average
20X0	4	---	---
20X1	6	---	---
20X2	5	---	---
20X3	3	4+6+5 = 15	15/3 = 5.0
20X4	7	6+5+3 = 14	14/3 = 4.7
20X5	NA	5+3+7 = 15	15/3 = 5.0

Averaging methods further include weighted averages and weighted moving averages method.

Naïve approach:

Naïve approach assumes demand in next period is the same as demand in the most recent period, e.g. if June sales were Rs. 48,000, then July sales would also be Rs. 48,000.

- Example 02:

Period	Actual Demand Rs. (000's)	Forecast Rs. (000's)
January	46	
February	60	46
March	72	60
April	58	72
May	40	58
June		40

1.4.2. Causal Models:

Causal methods use the cause-and-effect relationship between the variable whose future value is being forecasted and other related variables or factors. A simple causal model is linear regression in which a straight-line relationship is modelled between the variable we are forecasting and another variable in the environment. The correlation is used to measure the strength of the linear relationship between these two variables.

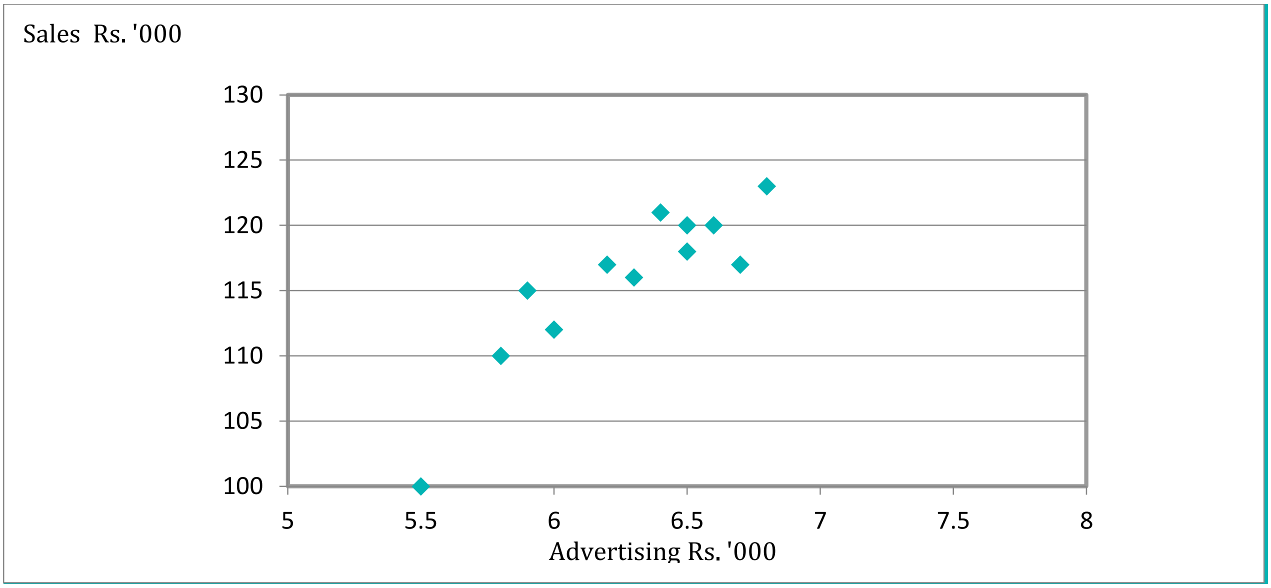
Linear regression method:

Regression analysis is a statistical technique used to develop a mathematical model that shows how a set of variables are related. This mathematical relationship can be used to generate forecasts. The variable that is being forecasted is called the dependent variable and the variable or variables that help in forecasting the values of the dependent variable are called the independent variables. Regression analysis that uses one dependent variable and one independent variable and estimates the relationship between these two variables by a straight line is called a simple linear regression.

<u>Scatter Plots:</u> The first step in regression is to plot your data on a scatter plot. The following table lists the monthly sales and advertising expenditures for all the months of the last year by a digital electronics company.

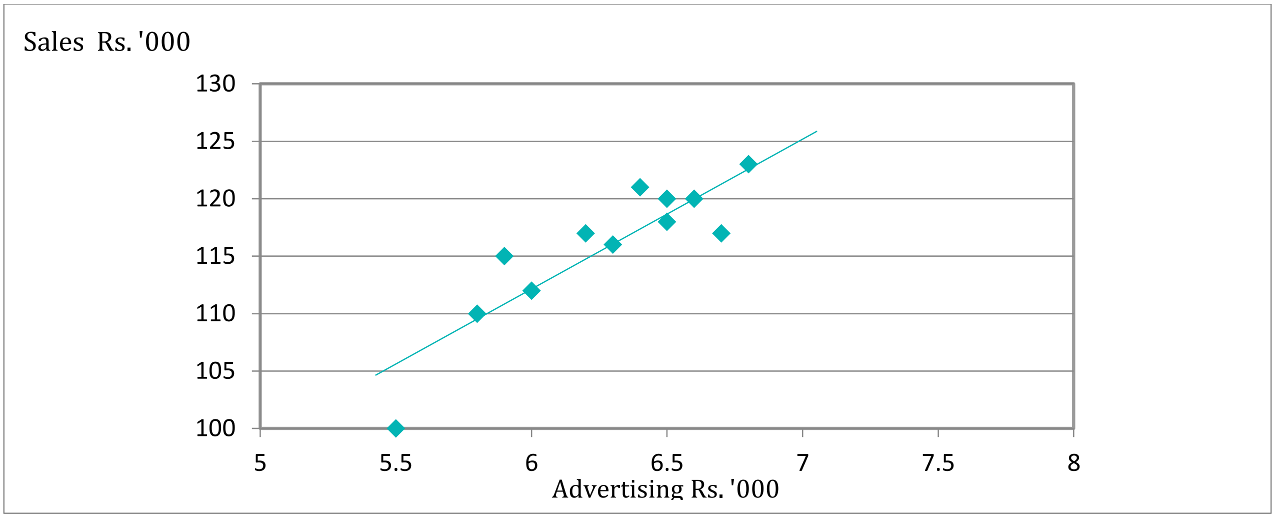
Month	Sales	Advertising
	Rs. '000	Rs. '000
January	100	5.5
February	110	5.8
March	112	6
April	115	5.9
May	117	6.2
June	116	6.3
July	118	6.5
August	120	6.6
September	121	6.4
October	120	6.5
November	117	6.7
December	123	6.8

In this case, you would plot last year's data for monthly sales and advertising expenditures as shown on the scatter plot below. (Data for independent and dependent variables must be from the same period of time.)



This scatter plot represents the historical relationship between an independent variable, shown on the x-axis, and a dependent variable, shown on the y-axis.

<u>Regression Line:</u> The figure below is the same as the scatter plot above, with the addition of a regression line fitted to the historical data.



The regression line is the line with the smallest possible set of distances between itself and each data point. As you can see, the regression line touches some data points, but not others. The distances of the data points from the regression line are called error terms.

The extension of the line of regression requires the assumption that the underlying process causing the relationship between the two variables is valid beyond the range of the sample data. Regression is a powerful business tool due to its ability to predict future relationships between variables such as these.

Equation of a Regression Line: You may recall the equation of a straight line from your review of the Linear Functions topic in the Algebra section of the course on Quantitative methods.

y = a + bx

Variables, constants, and coefficients are represented in the equation of a line as

- ***x*** represents the independent variable
- ***y*** represents the dependent variable
- the constant ***a*** denotes the y-intercept—this will be the value of the dependent variable if the independent variable is equal to zero, this represent the component value of y that is independent of x.
- the coefficient ***b*** describes the movement in the dependent variable as a result of a given movement in the independent variable

▶ *Formula:*

Given a number of pairs of data, a line of best fit (y = a + bx) can be constructed by calculating values for a and b using the following formulae:

$$a = \frac{\sum y}{n} - \frac{b\sum x}{n}$$

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

Where:

x, y = values of pairs of data.

n = the number of pairs of values for x and y.

$\sum$ = A sign meaning the sum of. (The capital of the Greek letter sigma).

Note: the term b must be calculated first as it is used in calculating a.

Method

- Set out the pairs of data in two columns, with one column for the values of **x** and the second column for the associated values of **y.** (For example, **x** for output and **y** for total cost.
- Set up a column for $\mathbf{x^2}$**,** calculate the square of each value of **x** and enter the value in the $\mathbf{x^2}$ column.
- Set up a column for **xy** and for each pair of data, multiply **x** by **y** and enter the value in the **xy** column.
- Sum each column.
- Enter the values into the formulae and solve for b and then **a.** (It must be in this order as you need **b** to find **a**).

The concept of predictability is an important one in business. Common business uses for linear regression include forecasting sales and estimating future investment returns.

Forecasting

Once the equation of the line of best fit is derived, it can be used to make forecasts of impact of changes in *x* on the value of *y*.

▶ *Example 03:*

A company has recorded the following output levels and associated costs in the past six months:

Month	Output (000 of units)	Total cost (Rs m)
January	6.8	42.3
February	8.7	48.1
March	9.2	50.7
April	7.1	42.6
May	7.5	46.5
June	8.5	48.2

In order to construct the equation of a line that is of best fit for this data, please see below

Working:	x	Y	x^2	xy
January	6.8	42.3	46.24	287.64
February	8.7	48.1	75.69	418.47
March	9.2	50.7	84.64	466.44
April	7.1	42.6	50.41	302.46
May	7.5	46.5	56.25	348.75
June	8.5	48.2	72.25	409.7
	47.8	278.4	385.48	2233.46
	$= \sum x$	$= \sum y$	$= \sum x^2$	$= \sum xy$

$b = \dfrac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$	$= \dfrac{6(2233.46) - (47.8)(278.4)}{6(385.48) - (47.8)^2}$
	$= \dfrac{13400.76 - 13307.52}{2312.88 - 2284.84} = \dfrac{93.24}{28.04} = 3.325$

	This is the cost in millions of rupees of making 1,000 units)
$a = \frac{\sum y}{n} - \frac{b \sum x}{n}$	$a = \frac{278.4}{6} - \frac{3.325(47.8)}{6}$
	$a = 46.4 - 26.49 = 19.91$
Line of best fit:	$y = a + bx$
	$y = 19.91 + 3.325x$

- *Example 04:*

The records of direct labor hours and total factory overheads of IMI Limited over first six months of its operations are given below:

	Direct labor Hours in 000	Total factory Overheads Rs. in 000
September 20X9	50	14,800
October 20X9	80	17,000
November 20X9	120	23,800
December 20X9	40	11,900
January 20X0	100	22,100
February 20X0	60	16,150

The management is interested in distinguishing between the fixed and variable portion of the overhead and using the least square regression method, it is required to estimate the variable cost per direct labor hour and the total fixed cost per month.

Both variable and fixed costs are calculated using regression analysis as follows:

	Direct labor Hours (x)	Overheads (y)	(xy)	(x^2)
September 20X9	50	14,800	740,000	2,500
October 20X9	80	17,000	1,360,000	6,400
November 20X9	120	23,800	2,856,000	14,400
December 20X9	40	11,900	476,000	1,600
January 20X0	100	22,100	2,210,000	10,000
February 20X0	60	16,150	969,000	3,600
	450	105,750	8,611,000	38,500

$$\text{b (Variable cost per unit)} = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2} = \frac{6 \times 8{,}611{,}000 - 450 \times 105{,}750}{6(38{,}500) - (450)^2} = 143.1053$$

$$\text{a (Fixed costs per month)} = \frac{(\sum y) - b(\sum x)}{n} = \frac{(105{,}750 - 143.11(450))}{6} = 6{,}892$$

- *Example 05:*

Linear regression analysis

A company has estimated the following linear regression line to describe the relationship between its output and costs:

$$\boldsymbol{y = 19.91 + 3.325x}$$

(Where x is in thousands and y is millions of rupees).

What costs would be expected for output of 3,000 units and 10,000 units? Using the equation, as follows the predicted costs would be $29.885 and $ 53.16

	$y = 19.91 + 3.325x$
3,000 units	$y = 19.91 + 3.325(3) = 29.885$
10,000 units	$y = 19.91 + 3.325(10) = 53.16$

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2. BASICS OF BUDGETING

2.1 Introduction to budgets

A budget is a quantitative estimation of costs, revenues and resources of an entity for a defined period of time. Budgeting has always been part of the activities of any business organization as it helps the business in better understanding of its business environment to navigate its position and direction.

Budgets help organizations to plan in advance about what resources they shall need and the time when such resources will be required. This helps the management to have a better understanding of resources to be arranged and managed, resulting in a smooth flow of operations and avoiding unfavorable surprises.

2.2 Forecasting vs. budgeting

Budgeting and Forecasting are two important constituents of managerial decision making process. To avoid crises in the business, managers and owners make use of two essential tools – forecasting and budgeting. Budgeting refers to preparing a list of guidelines for expenditures for future and it is usually done a year in advance. It is used as a benchmark in analyzing the financial health of a business, whereas forecasting uses accumulated historical data to predict financial outcomes for future months or years.

Even though both of these functions are distinct and are not same but their use and their dependency on each other make them inseparable and thus many confuse the two as same and use them interchangeably. Let's understand the technical difference between these two.

Forecasting	Budgeting
Forecasts are statements of probable events.	Budgets relate to planned events.
Forecast is only a tentative estimate.	Budget is a target fixed for a period.
Forecasting results in planning.	Planning results in budgeting.
Forecasting does not act as a tool to control.	Budgets serves as controlling tools.

Let's understand the difference between a forecast and a budget with the help of an example.

At the start of a financial period, a company expected to produce 200,000 units at the end of first quarter. Information gathered at the end of the first month in the quarter revealed that labor's learning rate was faster than expected and thus they have become more efficient and effective. If the process keeps its current pace as experienced in the first month then it is expected that at the end of the quarter the output would be 230,000.

In this example, 200,000 is the **budgeted figure**. This is the amount which the management established before starting production. During the production process however based on month end information it is predicted that output will be 230,000. This is the forecast amount which has been **forecasted** based on the latest information. And now this forecast will be used to prepare a revised budget to see its effect on different aspects.

2.3 Purposes of budgeting

Budgeting serves various purposes in an organization. Few purposes of budgets are as follows:

- **Planning:** is an important and integral part of any organization. Planning helps organizations set targets for the upcoming period so that everyone across the organization can work towards the achievement of such targets. An organization without a plan is just like a football team in the ground without a goal post. Budgets assist an organization in the planning process as through the formulation of budget an organization has a plan in hand about quantity of goods that they shall be producing and the number of units that will be sold etc. A properly structured planning process provides a suitable opportunity for the company to analyze its environment and how its business strategy fits with the same.

- **Control:** Performance cannot be measured and reviewed without giving targets at first place. Budgets when compared to actual results help in controlling the performance so that factors which might hinder the attainment of objectives can be identified. Managers are held accountable for controlling costs and revenues of their departments and they are asked to take remedial actions in case of discrepancies. There is no point in setting targets if actual performance is not compared with them. Likewise, there is no point in controlling actual performance if targets are not set before hand to compare.
- **Decision making:** One of the key purposes of management accounting is to provide information useful for decision making. Budgeting is important for decision making as it gives business a sense of direction, an estimation of revenues, cost and resources. From where these resources will be arranged and where they are consumed.

  For instance, a company sets an objective to increase profits by 10% over five years' term. Sales, production and purchases budgets are set up and cash requirements are also stated accordingly. Cash budget shows negative balance over next four months. Now here decision has to be made on how to make up for this deficiency. Either money has to be borrowed or asset has to be sold. A decision is required here so overall objectives are not affected. Thus, budgeting serves as a guiding post illuminating the pitfalls that the company might encounter in trying to achieve its objectives.
- **Resource allocation:** is an area of conflict amongst departmental managers. They often complain that resources assigned to them are not enough for the requirements. While preparing budgets, needs of each department are evaluated and resources are assigned to them accordingly. This process is usually performed with the participation of managers, however, in case of disagreements the decision is imposed. Organizations want to ensure that resources have been utilized to the maximum and reduce wastage of resources to the minimum. Because strategic level has got better understanding on the availability of resources and needs of each department, and it is the responsibility of the strategic management to make fair allocation of the available resources. There is a strong possibility that manager may not be satisfied with what they get but their grievances can be reduced by negotiations and counselling.
- **Coordination and communication:** Each employee in the organization wants to know what he or she is supposed to do. Budgets form a key to communicate organization's goals to its employees in monetary form. If an employee has been told that organization wants to increase shareholders' wealth, then he must ask what he has to do in order to increase it. Then budgets translate it and define them their task.

  An organization is often divided into many departments and divisions but the activities of these departments are somehow dependent on each other. The system cannot work properly without proper coordination and communication amongst these departments. If sales department doesn't coordinate with production department then customers' orders might not be met. The situation gets even worse when production department is out of stock because purchasing department did not know the quantity of material that has to be purchased. So while preparing budgets all department managers are required to coordinate and are assigned their responsibilities. The budgeting exercise serves as the occasion when the roles and responsibilities of each department are defined and communicated.

2.4 Stages in the budgeting process

Important terminologies that may need to be understood for the budgeting process are as follows:

Budget committee is a team comprising of senior level management and heads of departments that approves budgets and reviews the performance on periodic basis. It is not necessary that they are the ones who prepare budget. They have the responsibility to ensure that the objectives have been embedded into the budgets.

Budget manual is a document to provide useful information on how budgets will be prepared, how they are presented, to whom they are presented and when. It sets out the responsibilities of person connected with the budgets.

Budget period is time frame for which budget is prepared and used.

Planning Department is responsible for developing the budget after consulting with other departments and functions and the approval of the budget committee. In larger organizations, there might be a separate planning department, however, in smaller organizations the process may be delegated to the finance department in addition to their day-to-day activities.

Stages

- **Communicating details of budget policy:** First step is to communicate policies and manual to those responsible for preparation of budgets. Objectives and long term goals must be communicated to them. They must know the basis on which goals have been set.
- **Identify principal budget factor:** Principal budget factor refers to the resource that is restricted in supply, therefore before planning for the entire organization, budgeting is required for the Principal Budget Factor. For instance, if material is limited in supply so it has to identify how many kilograms of material can be available. On the basis of its availability production quantity will be determined and sales will then be calculated.
- **Preparation of budgets:** If all resources are in full supply, sales budget will be prepared first and the on basis of sales remaining budgets will be prepared including production, labor, and overheads budgets.
- **Final acceptance:** After all negotiation and documentation, budgets will be presented in front of budget committee for final approval. If there are any objections raised, necessary amendments will be made accordingly. Once budget has been improved, responsibilities are assigned to departmental managers to achieve targets mentioned in budgets.
- **Ongoing review of budgets:** The process is not ended up here. Periodic review is necessary so that managers must be focused and do not take budgets for granted. Performance should be compared with actual results on periodic basis and deviations from the budgets both negative and positive are investigated

2.5 Budgeting for profitability

Planning and budgeting process for profit aids companies to forecast profit and loss from the expected expenses and revenues. Targeted sales and estimated costs are matched with the desired profit in order to analyze financial implications. This means that companies would benefit from setting profit objectives or forecast profits based on expected operations. Usually, profit objectives are set and then sales and operational planning is done while at other times planning phase leads to projected profits decisions.

3. TYPES OF BUDGETS

3.1 Sales budget

Sales budget is the first and basic component of master budget and it shows the expected number of sales units of a period and the expected price per unit. If there is no restriction of resources, sales budget is the foundation of all other budgets, since all expenditure is ultimately dependent upon volume of sales.

- *Illustration:*

An extract from a sample sales budget is as under:

Product	A	B	C	D
No. of units	45,000	54,000	20,000	60,000
Selling price per unit (Rs.)	45	40	65	80
Total Sales (Rs.)	2,025,000	2,160,000	1,300,000	4,800,000

3.2 Production budget

Production budget is a schedule showing planned production in units which must be made by a manufacturer during a specific period to meet the expected demand for sales and the planned finished goods inventory. Normally the production budget lags the sales budget by one month. Eg. Stocks to be sold in May will be produced in April, however, this is dependent on production scheduling and storage needs.

- *Illustration:*

A sample of production budget is as under:

Product	A	B	C	D
Budgeted Sales (Qty)	45,000	54,000	20,000	60,000
Budgeted Closing inventory (Qty)	5,000	10,000	2,500	8,000
Total Production Required	50,000	64,000	22,500	68,000
Less: Opening Inventory	(3,000)	(5,000)	-	(2,500)
Products to be Manufactured	47,000	59,000	22,500	65,500

3.3 Direct materials budget

Direct material purchases budget shows budgeted beginning and ending direct material inventory, the quantity of direct material that will be used in production, the amount of direct material that must be purchased and its cost during a specific period. This forms the basis of the procurement plan.

- *Illustration:*

Direct materials budget

A sample of direct Material Purchases Budget is mentioned as under:

Product	A	B	C	D
Budgeted Production Units	47,000	59,000	22,500	65,500
Material Required / Unit (Kg)	3.00	4.50	8.00	4.00
Material Required for Production (Kg)	141,000	265,500	180,000	262,000
Budgeted Closing Material (Kg)	12,000	15,000	20,000	40,000
Budgeting Opening Material (Kg)	(4,500)	(6,000)	(12,000)	(22,000)
Budgeted Material Purchases (kg)	148,500	274,500	188,000	280,000
Cost / Kg	2.5	3.5	2.1	4
Budgeted Purchases (Rs.)	371,250	960,750	394,800	1,120,000

3.4 Direct labor budget

Direct labor budget shows the total direct labor cost and number of direct labor hours needed for production. It helps the management to plan its labor force requirements. This serves as the basis of recruitment plan.

- *Illustration:*

A sample Direct Labor Budget is as follows:

Product	A	B	C	D
Budgeted Production Units	47,000	59,000	22,500	65,500
Budgeted Labor / Unit (Hrs.)	1.50	2.50	3.00	1.00
Budgeted Labor Hours	70,500	147,500	67,500	65,500
Cost / Labor Hour (Rs.)	8	8	8	8
Budgeted Direct Labor Cost (Rs.)	564,000	1,180,000	540,000	524,000

3.5 Manufacturing overhead budget

The factory overhead budget shows all the planned manufacturing costs which are needed to produce the budgeted production level of a period, other than direct costs which are already covered under direct material budget and direct labor budget.

- *Illustration:*

A sample of the overhead budgets is as under:

Product	A	B	C	D
Budgeted Production Units	47,000	59,000	22,500	65,500
Variable OH / Unit (Rs.)	2.00	1.80	2.40	0.56
Total Variable OH (Rs.)	94,000	106,200	54,000	36,680
Allocated Fixed OH (Rs.)	65,000	25,000	35,000	84,500
Budgeted Direct Labor Cost (Rs.)	159,000	131,200	89,000	121,180

- *Example 06:*

Following data is available from the production records of Flamingo Limited (FL) for the quarter ended 30 June 20X1.

	Rupees
Direct material	120,000
Direct labor @ Rs. 4 per hour	75,000
Variable overhead	70,000
Fixed overhead	45,000

The management's projection for the quarter ended 30 September 20X1 is as follows:

i. Increase in production by 10%.
ii. Reduction in labor hour rate by 25%.
iii. Decrease in production efficiency by 4%.
iv. No change in the purchase price and consumption per unit of direct material.

Variable overheads are allocated to production on the basis of direct labor hours.

Preparation of a production cost budget for the quarter ended 30 September 20X1, would be as follows

Production Cost Budget	Actual (30-06-20X1)	Budget (30-09-20X1)
	Rupees	
Direct material cost	120,000	132,000
Direct labor cost (W-1)	75,000	64,350
Prime Cost	195,000	196,350
Production Overhead:		
Variable	70,000	80,080
Fixed	45,000	45,000
Total cost	310,000	321,430

W-1:

The labor hours will increase by 10%. Also there will be increase in labor hours as production efficiency has decreased by 4%. Therefore, increased total labor hours will be:

$$(75{,}000 \div 4) = 18{,}750 \times \frac{110}{100} \times \frac{104}{100} = 21{,}450$$

Rate is decreased to Rs. 3. Therefore, direct labor cost will be 21,450 x 3 = Rs. 64,350.

3.6 Ending finished goods inventory budget

The ending finished goods inventory budget calculates the cost of the finished goods inventory at the end of every budget period. It also includes the unit quantity of finished goods at the end of every budget period; the real basis of this information is the production budget. The principal aim of inventory budget is to provide for the amount of the inventory asset that appears in the budgeted balance sheet. When a company needs to closely monitor its fund balances on an ongoing basis, the ending finished goods inventory budget should be reviewed on a regular basis.

The ending finished goods inventory budget contains an itemization of three major costs that are required to be included in the inventory asset in the balance sheet. These costs are:

- **Direct materials:** The cost of materials per unit (as listed in the direct materials budget), multiplied by the number of ending units in inventory (as listed in the production budget).
- **Direct labor:** The direct labor cost per unit (as listed in the direct labor budget), multiplied by the number of ending units in inventory (as listed in the production budget).
- **Overheads:** The amount of overhead cost per unit (as listed in the manufacturing overhead budget), multiplied by the number of ending units in inventory (as listed in the production budget).

▶ *Illustration*

XYZ Corporation sells a product "S" and has derived its main cost components. Its ending finished goods inventory budget would be as follows:

	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Cost per unit:				
Direct materials cost	Rs.12.50	Rs.12.50	Rs.12.75	Rs.12.75
Direct labor cost	4.00	4.50	4.50	4.50
Manufacturing Overhead cost	6.50	6.50	6.50	6.75
Total cost per unit	**Rs.23.00**	**Rs.23.50**	**Rs.23.75**	**Rs.24.00**
Ending finished goods units	8,000	12,000	10,000	9,000
x Total cost per unit	Rs.23.00	Rs.23.50	Rs.23.75	Rs.24.00
= Ending finished goods inventory	Rs.184,000	Rs.282,000	Rs.237,500	Rs.216,000

3.7 Cost of goods manufactured budget

Cost of goods manufactured is the cost incurred to manufacture the finished goods and includes elements of all the costs including material, purchases and manufacturing overheads.

The cost of goods manufactured budget outlines the total budgeted cost of units manufactured for a period.

- *Illustration:*

Product	A	B	C	D
Direct Material Purchases	371,250	960,750	394,800	1,120,000
Opening Direct Material	11,250	21,000	25,200	88,000
Closing Direct Material	(30,000)	(52,500)	(42,000)	(160,000)
Direct Material Cost	352,500	929,250	378,000	1,048,000
Direct Labor Cost	564,000	1,180,000	540,000	524,000
Manufacturing Overhead	159,000	131,200	89,000	121,180
Budgeted Cost of Goods manufactured	1,075,500	2,240,450	1,007,000	1,693,180

3.8 Cost of goods sold budget

Cost of goods sold is the accumulated total of all costs used to create a product or service, which has been sold.

The cost of goods sold budget outlines the total budgeted cost of units sold for a period. Once the cost of goods manufactured budget and cost of goods sold budget are drawn up, information from these budgets appear in other budgets for the same period as well. For example, the budgeted income statement uses the value of cost of goods sold to determine the gross profit for the period and the balance sheet includes the finished goods ending inventory in total assets.

- *Illustration:*

Product	A	B	C	D
Budgeted Cost of Goods manufactured	1,075,500	2,240,450	1,007,000	1,693,180
Finished goods beginning inventory	90,000	140,000	190,000	90,000
Total cost of goods available for sale	1,165,500	2,380,450	1,197,000	1,783,180
Finished goods ending inventory	(130,000)	(120,000)	(260,000)	(290,000)
Cost of goods sold	1,035,500	2,260,450	937,000	1,493,180

3.9 Selling and administrative expenses budget

Selling and administrative expense budget provides details of budgeted costs for the sales of the products and for managing affairs of the business.

Selling and administrative expenses can be both either fixed or variable. For example, sales staff may be paid commission on every unit sold by them or they can get a fixed salary, furthermore administrative expenses could be fixed like rent, depreciation or it could vary depending upon entertainment expense incurred etc.

The selling and administrative budget is dependent upon the sales and production budget, the number of sales staff is directly correlated with the sales figure and the space rentals are determined on the basis of production requirements.

► *Illustration:*

Sample Selling and Administrative budget is as under:

Product	A	B	C	D
Budgeted Selling Expenses				
Sales Commission (Rs.)	26,200	43,550	2,410	3,590
Budgeted Admin. Expenses:				
Office Rent	76,000	25,400	8,000	8,000
Office Salaries	45,000	45,000	10,000	10,000
Total Selling & Admin. Expense	147,200	113,950	20,410	21,590

3.10 Capital expenditure budget

This is the budget that provides for the acquisition of assets necessitated by the following factors:

- Replacement of existing assets
- Purchase of additional assets to meet increased production
- Installation of improved type of machinery to reduce costs

Capital expenditure budgeting is the process of establishing a financial plan for purchases of long-term business assets.

The capital expenditure budget should take account of the principal budget factor. If available funds are limiting the organization's activities, then they will more than likely limit capital expenditure. As part of the overall budget coordination process, the capital expenditure budget must also be reviewed in relation to the other budgets.

This is in some respect the riskiest element of any budget, as its long term impact would be greater than the other budget types eg. Investing in a technology that subsequently becomes obsolete might imperil the very survival of the company.

► *Illustration*

Project	Description/detail of capital investment items	Month	Rs. '000
LV 45	Installation of new personal computers and flat screen monitors throughout office and factory	April	10,000
LV46	Plant replacement of obsolete packing equipment by new automated and electronic machinery	October	50,000
Budgeted capital expenditure			60,000

3.11 Cash budget

Cash budget is a summary statement of the firm's expected cash inflows and outflows over a projected time period. It helps in determining the future cash needs of the firm and also assists in planning for financing of those needs. It acts as a tool to exercise control over cash and liquidity of the firm. The overall objective is to enable the firm to meet all its commitments in time and preventing accumulation of unnecessary large balances with it as well.

Functions of cash budget

- **Assists with the identification of required cash when commitments are due:** If debts are not paid in time, poor reputation will affect the credit rating of the business. Cash budgets ensure that cash is available when commitments fall due.

AT A GLANCE SPOTLIGHT STIKCY NOTES

- **Reveals periods of excess funds:** Businesses avoid keeping idle funds in bank accounts as these amounts earn them lower interest returns. Cash budgets help businesses identify idle funds and the opportunities where they could invest these amounts to earn higher returns.
- **Reveals weaknesses in business's debt collection policy:** Cash budgets can locate the weaknesses in business's credit collection policy by comparing the trends that the debtors follow in making payments with the credit period allowed.
- **Adjustments for seasonal fluctuations:** Some businesses experience high/low sales during different seasons of the year, e.g. Tourism, farming etc. Cash budgets can help in making adjustments for such seasonal fluctuations.
- **Reveals periods when shortages of funds may occur:** The periods where shortages of funds may occur can be identified ahead of time. This can help businesses make arrangements with banks to meet shortfalls. Cash budgets are often demanded by banks as well when businesses seek loans, to find if the business is capable of meeting repayments.

▶ *Illustration:*

A cash budget for January, February and March 20X6 is to be prepared from the following information.

	January	February	March
	Rs.	Rs.	Rs.
Cash Sales	100,000	200,000	150,000
Cash Purchases	60,000	80,000	100,000
Expenses	10,000	15,000	20,000
Collection from debtors	30,000	50,000	20,000
Payment to creditors	20,000	10,000	70,000

*Opening balance for 1st January is Rs. 15,000.

Opening Balance	15,000	55,000	200,000
Add: Receipts			
Cash sales	100,000	200,000	150,000
Collection from debtors	30,000	50,000	20,000
	145,000	305,000	370,000
Less: Payments			
Cash Purchases	60,000	80,000	100,000
Expenses	10,000	`15,000	20,000
Payment to creditors	20,000	10,000	70,000
Closing balance	55,000	200,000	180,000

▶ *Example 07:*

During the year ending June 30, 20X1 Abdul Habib Company Limited has planned to launch a new product which is expected to generate a profit of Rs. 9.3 million as shown below:

	Rs. in '000'
Sales revenue (24,000 units)	51,600
Less: cost of goods sold	37,500
Gross profit	14,100
Less: operating expenses	4,800
Net profit before tax	9,300

The following additional information is available:

i. 75% of the units would be sold on 30 days credit. Credit prices would be 10% higher than the cash price. It is estimated that 70% of the customers will settle their account within the credit term while rest of the customers would pay within 60 days. Bad debts have been estimated @ 2% of credit sales. All cash and credit receipts are subject to withholding tax @ 6%.

ii. 80% of the expenses forming part of cost of goods sold are variable. These are to be paid one month in arrears.

iii. The production will require additional machinery which will be purchased on July 1, 20X0 at a cost of Rs. 60 million. The machine is expected to have a useful life of 15 years and salvage value of Rs. 7.5 million. The company has a policy to charge depreciation on straight line basis. The depreciation on the machinery is included in the cost of goods sold as shown above.

iv. Variable operating expenses excluding bad debts are Rs. 105 per unit. These are to be paid in the same month in which the sale is made.

v. 50% of the fixed costs would be paid immediately when incurred while the remaining 50% would be paid 15 days in arrears.

vi. The management has decided to maintain finished goods stock of 1,000 units.

If it is required to calculate the cash requirements for the first two quarters, following solution may be considered

Cash Management

Total sales	Units	Weight	Sales Ratio
Cash sales – 25%	6,000	1.0	6,000
Credit sales – 75%	18,000	1.1	19,800
	24,000		25,800
Sales Revenue (Rs. in '000)			51,600
Cash Selling price per unit			2,000
Credit selling price per unit			2,200

Cash Requirement 20X1

Particulars	Qtr. 1	Qtr. 2
	--- Rs. in '000 ---	
Purchase of machinery	(60,000)	-
Sale receipts		
Cash sales (2,000 × 6,000 / 4 × 94%)	2,820	2,820
Receipts from credit sales – as per working below	5,211	9,120
Cost of goods sold – variable (37,500 x 80%) /12×2 and 3	(5,000)	(7,500)
Variable cost of finished stock 30,000 / 24,000 × 1,000	(1,250)	-
Variable operating expenses (105 × 3 × 2,000)	(630)	(630)
Payment of fixed costs (457 × 2.5) / (457 × 3.0)	(1,143)	(1 ,372)
	(59,992)	2,438

	Month 1	Month 2	Month 3	1st Qtr.	Month 4	Month 5	Month 6	2nd Qtr.
	---------- Rs. in '000 ----------							
Working for credit sales								
Credit sales (18,000÷12×2,200)	3,30	3,300	3,300		3,300	3,300	3,300	
Settlement – 70%		2,310	2,310		2,310	2,310	2,310	
28%			924		924	924	924	
Gross receipts		2,310	3,234	5,544	3,234	3,234	3,234	9,702
Tax @ 6%				(333)				(582)
Receipts net of tax				5,211				9,120

Operating expenses	
Total operating expenses – given	4,800
Less: Variable cost per unit (105 × 24,000)	(2,520)
Bad debt expense (2,200 × 18,000 × 2%)	(792)
Fixed operating expenses	1,488
Fixed cost	
Fixed factory overheads	7,500
Less: Depreciation (60m – 7.5m) / 15	(3,500)
Fixed operating overheads	1,488
	5,488
Fixed cost per month	457

3.12 Master budget

As demonstrated above, budgeting is a collective process in which various departments / divisions of the organization prepare their plans for the upcoming periods, which in turn are aggregated into a corporate budget. Corporate Budget is also termed as Master Budget.

Master Budgets are in the form of Projected Financial Statements and they help an organization plan in advance about its targets for the upcoming periods.

Preparation of Master Budget in any organization would require company to prepare various components of operational budgets which could then be aggregated into the master budget. It can be referred to as the end product of the budgeting process. It takes the macro view of the business and coordinates with production, raw materials, manpower and other resources with production targets. It cuts across divisional boundaries to coordinate firms' diverse activities. The operating budgets are the building blocks that complete the master budget.

Elements of master budget with their brief explanation have already been mentioned earlier in this chapter. Following example explains the overall process of preparing a master budget.

- *Example 08:*

XYZ Company manufactures two products STAR and BRIGHT. There are two manufacturing departments in a company Dept 1 and Dept 2. All material has been added in dept 1

The standard material and labor usage for each product is as follows:

		STAR	BRIGHT
Details of Dept 1			
Material X	(Rs. 20/kg)	3 kgs	5 kgs
Material Y	(Rs. 15/kg)	5 kgs	4 kgs
Direct Labor	(Rs. 10/hr)	5 hrs	2.5 hrs
Details of Dept 2			
Material		Nil	Nil
Direct Labor	(Rs. 12/hr)	4 hrs	6 hrs

Inventory details

Finished Product	STAR	BRIGHT
Forecast Sales (Units)	8000	2000
Selling Price / Unit (Rs.)	500/-	450/-
Ending Inventory	1800	200
Beginning Inventory	2000	500
RAW MATERIAL	**MATERIAL X**	**MATERIAL Y**
Beginning Inventory	5000 Kgs	6000 Kgs
Ending Inventory	4000 Kgs	7000 Kgs

Details of overheads		
Budgeted variable overhead rates per labor hour	**DEPT 1**	**DEPT 2**
Indirect labor	Rs. 4	Rs. 3
Electricity (variable)	Rs. 3	Rs. 5
Maintenance (variable)	Rs. 2	Rs. 4
Budgeted fixed overheads		
Rent	Rs.50,000	Rs.45,000
Supervision	Rs. 20,000	Rs. 10,000
Electricity (fixed)	Rs. 6,500	Rs. 5,000
Maintenance (fixed)	Rs. 10,000	Rs. 2,100

Non-manufacturing overheads

- Salaries Rs. 30,000
- Depreciation Rs. 20,000
- Advertising Rs. 25,000
- Miscellaneous Rs. 10,000

Budgeted cash flows are as follows:

	Q1	Q2	Q3	Q4
	Rs.	Rs.	Rs.	Rs.
Receipts	800,000	1,000,000	800,000	900,000
Payments:				
Material	400,000	200,000	300,000	100,000
Wages	200,000	500,000	100,000	129,300
Other	300,000	200,000	400,000	100,000

Balance Sheet as on 200X

	Rs. 000	Rs. 000	Rs. 000
Land		2,000	
Building and equipment Acc. Depreciation:	3,000 (480)	 2,520	 4,520
Current Assets Inventory – Finished goods – Raw materials		 1,300 800	
Debtors		800	
Cash		1,000	3,900
Total Assets			8,420
Equity and Liabilities			
Ordinary share capital Reserves		3,000 2,000	 5,000
Non-current liabilities Current liabilities		2,000 1,420	 3,420
Total Equity And Liabilities			8,420

A Master budget for 200Y and the relevant budgets are as follows:

a) Sales Budget

Product	Units Sold	Selling Price /Unit (Rs.)	Total Revenue (Rs.)
Star	8,000	500	4,000,000
Bright	2,000	450	900,000
			4,900,000

b) Production Budget and Stock Level

Once the sales budget has been completed next step is to find out how many units need to be produced. Because ultimately resources have been consumed on units produced rather than units sold.

	STAR	BRIGHT
Sales	8000	2000
Closing stock	1800	200
Units Required	9800	2200
Already held in stock	(2000)	(500)
Production	7800	1700

c) Direct Material Usage Budget

	Star			Bright			Total		
Material	Kgs	Price	Total Rs. '000	Kgs	Price	Total Rs. '000	Kgs	Price	Total Rs. '000
X	*23,400	20	468	***8,500	20	170	319,00	20	638
Y	**39,000	15	585	****6,800	15	102	45,800	15	687
			1,053			272			1,325

* 7800 units x 3 kgs/unit = 23,400

** 7800 units x 5 kgs/unit = 39,000

*** 1700 units x 5 kgs/unit = 8,500

**** 1700 units x 4 kgs/unit = 6,800

d) Material Purchase Budget

The objective of material purchase budget is to purchase right quantity of material at right time and at right price. It is purchasing manager's responsibility to do so. He or she on the basis of material usage budget and stock determines the estimated quantity to be purchased to meet up the requirement of next year.

	Material X (kgs)	Material Y (kgs)
Material usage	31900 (Schedule #3)	45,800 (Schedule #3)
Ending stock	4,000	7,000
Material required	35,900	52,800
Already in stock (Opening)	(5,000)	(6,000)
Total purchases	30,900	46,800
Unit Price	Rs. 20/kg	Rs. 15/kg
Purchases (In Rs.)	618,000	702,000

e) Direct Labor Budget

On the basis of units produced it has to be determined that how many labor hours are required during next year, where different grades of labor exists. These should be specified separately in the budget

	Star			Bright			Total		
Dept	Hrs	Rate	Total Rs. '000	Hrs	Rate	Total Rs. '000	Hrs	Rate	Total Rs. '000
1	*39,000	10	390	***4,250	10	42.5	43,250	10	432.5
2	**31,200	12	374.4	****10,200	12	122.4	41,400	12	496.8
			764.4			164.9			929.3

* 7800 units x 5 hrs/unit = 39,000

** 7800 units x 4 hrs/unit = 31,200

*** 1700 units x 2.5 hrs/unit = 4250

**** 1700 units x 6 hrs/unit = 10,200

f) Manufacturing Overheads

Departmental activity on which overheads have to be absorbed must be decided first before overheads have been absorbed into products.

Dept 1: Factory Overhead Budget

Anticipated activity	Star	39,000
	Bright	4,250
		43,250 hrs

	STAR	BRIGHT	TOTAL
Variable overheads			
Indirect labor (Rs. 4/hr)	Rs. 156000	Rs. 17,000	Rs. 173,000
Electricity – variable (Rs. 3/hr)	117,000	12,750	129,750
Maintenance – variable (Rs. 2/hr)	78,000	8,500	86,500
	351,000	38,250	389,250

Fixed overheads			
Rent			50,000
Supervision			20,000
Electricity-fixed			6,500
Maintenance-fixed			10,000
			Rs. 86,500
Total labor hours			43,250
Fixed overhead rate			Rs. 2/hr
Fixed overhead charged to products	*78,000	*8,500	
Total overheads	429,000	46,750	475,750

* Rs. 2/hr x 39,000 hrs = 78,000

** Rs. 2/hr x 4,250 hrs = 8,500

Dept. 2 Factory Overhead Budget:

Anticipated activity	Star	31,200
	Bright	10,200
		41,400 hrs

	STAR	BRIGHT	TOTAL
Variable overheads			
Indirect labor (Rs. 3/hr)	Rs. 93,600	Rs. 30,600	Rs. 124,200
Electricity – variable (Rs. 5/hr)	156,000	51,000	207,000
Maintenance – variable (Rs. 4/hr)	124,800	40,800	165,600
	374,400	122,400	496,800
Fixed overheads			
Rent			45,000
Supervision			10,000
Electricity-fixed			5,000
Maintenance-fixed			2,100
			Rs. 62,100
Total labor hours			41,400
Fixed overhead rate			Rs. 1.5/hr
Fixed overhead charged to products	*46,800	**15,300	
Total overheads	421,200	137,700	558,900

* Rs. 1.5/hr x 31,200 hrs = 46,800

** Rs. 1.5/hr x 10,200 hrs = 15,300

g) Cash Budget

For Six Month Period Ending June, 200y

All values are in Rs. 000

	Q1	Q2	Q3	Q4	TOTAL
Opening Balance	1,000	900	1,000	1,000	1,000
Receipts	800	1,000	800	900	3,500
	1,800	1,900	1,800	1,900	4,500
Payments					
Purchase of material	400	200	300	100	1000
Payment of wages	200	500	100	129.3	929.3
Other expenses	300	200	400	100	1000
	900	900	800	329.3	2929.3
Closing balance	900	1000	1000	1570.7	1570.7

Balance Sheet as On 200Y

	Rs. 000	Rs. 000	Rs. 000
Land		2,000	
Building and equipment	3,000		4,500
Acc. Depreciation	*(500)	2,500	
Current assets			
Inventory – Finished goods		**1570.7	
– Raw material		185	
Debtors		688.7	
Cash		***2,200	4,644.4
Total Assets			9,144.4
Equity and liabilities			
Ordinary share capital			3,000
Reserves		2,000	
Profit and loss account		299.75	2,299.75
Con-current liabilities		2,000	
Current liabilities		****1,844.65	3,844.65
Total Equity And Liabilities			9,144.4

*	accumulated depreciation at start of the year	Rs. 480,000
	Depreciation expense of the year	20,000
	Accumulated depreciation at end of the year	**500,000**

** from cash budget

*** opening debtors + sales - receipts

800 + 4900 - 3500 = **2200**

****	opening creditors			1420
	Purchase of material	1320		
	Less: payment of material	(1000)		320
	Labor expense		929.3	
	Payment	929.3		--
	VOH		886.05	
	FOH		148.6	
	Selling and admin (90 – 20)	70		
	Payment for other expense	(1000)		104.65
	Closing creditors			1844.65

h) Selling and Administration Budget

Salaries	Rs. 30,000
Depreciation	20,000
Advertising	25,000
Miscellaneous	10,000
Total	85,000

Cost per unit

	STAR		BRIGHT	
	Units	Rs.	Units	Rs.
Direct material				
X (Rs. 20/kg)	3kgs	60	5kgs	100
Y (Rs. 15/kg)	5kgs	75	4kgs	60
Direct labor				
Dept 1 (Rs. 10/hr)	5 hrs	50	2.5 hrs	25
Dept 2 (Rs. 12/hr)	4hrs	48	6hrs	72
Variable overheads				
Dept 1 (Rs. 9/hr)	5 hrs	45	2.5 hrs	22.5
Dept 2 (Rs. 12/hr)	4hrs	48	6hrs	72
Fixed overheads				
Dept 1 (Rs. 2/hr)	5 hrs	10	2.5 hrs	5
Dept 2 (Rs. 1.5/hr)	4hrs	6	6 hrs	9
		342/unit		365.5/unit

i) Master Budget

Budgeted Income Statement

For The Year Ending Dec 200y

	Rs. 000	Rs. 000	Rs. 000
Sales (a)			4,900
Opening stock of raw material (balance sheet)	800		
Purchases (d)	1,320		
Less: Closing stock of raw material	*(185)		
Cost of raw material consumed	1,935		
Direct labor (e)	929.3		
Variable overhead (f)	886.05		
Fixed overhead (f)	148.6		
Total manufacturing cost		3,898.5	
Opening stock of finished goods (balance sheet)		1,300	
Less: Closing stock of finished goods		**(688.7)	
Cost of goods sold			(4,510.25)
Gross Profit			389.75
Selling and administration cost			(85)
Net Profit			304.75

* From schedule # 4 4000 kgs x Rs. 20/kg + 7000 x Rs.15/kg

** From schedule # 2 1800 units x Rs.342/unit + 200 units x Rs.365.5/unit

4. APPROACHES TO BUDGETING

4.1 Flexible and fixed budgets

Flexible budgets

Flexible budgets are, as their names suggest variable and flexible depending on the variability in the results expected in the future. Such budgets are most useful for businesses that operate in an ever changing business environment, and have the need to prepare budgets that are able to reflect the many outcomes that are possible. The use of a flexible budget ensures that a firm is prepared to some extent to deal with the unexpected turn around in events, and able to better guard itself against losses arising from such scenarios. A possible disadvantage of this form of budgeting is known to be the fact that they may be complicated to prepare, especially when the scenarios being considered are numerous in number, and complex in nature. Another issue is that they may confuse the employees as to their ultimate targets and goals.

▶ *Illustration*

Activity Level: Direct Labor hours	8000	9000	10,000	11,000	12,000
Variable Costs					
Indirect materials (Rs. 1.50)	Rs. 12,000	Rs. 13,500	Rs. 15,000	Rs. 16,500	Rs. 18,000
Indirect labor (Rs. 2.00)	16,000	18,000	20,000	22,000	24,000
Utilities (Rs. 0.50)	4,000	4,500	5,000	5,500	6,000
Total Variable Costs	32,000	36,000	40,000	44,000	48,000
Fixed Costs					
Depreciation	15,000	15,000	15,000	15,000	15,000
Supervision	10,000	10,000	10,000	10,000	10,000
Property taxes	5,000	5,000	5,000	5,000	5,000
Total Fixed costs	30,000	30,000	30,000	30,000	30,000
Total Costs	Rs. 62,000	Rs. 66,000	Rs. 70,000	Rs. 74,000	Rs. 78,000

Fixed budgets

Fixed budgets are used in situations where the future income and expenditure can be known, with a higher degree of certainty, and have been quite predictable over time. These types of budgets are commonly used by organizations that do not expect much variability in the business or economic environment. Fixed budgets are simpler to prepare and less complicated. In addition, keeping track is easier with fixed budgets, since the budget will not vary from time to time. One significant disadvantage of using a fixed budget is that it does not account for changes in expenditure and income over time. Thus, during times of unexpected economic changes the actual scenario may turn out to be different from what is laid out in a fixed budget.

4.2 Incremental budgeting

It is a simple approach towards budgeting which starts by taking the budgets from previous budget period and then adds (or subtracts) any incremental amount for the next budget period. Incremental amounts will be added for:

- Inflation in costs next year
- Any other changes like tax rates
- Possibly, the cost of additional activities that will be carried out next year

Incremental budgeting may be appropriate for certain costs. For example, in a stable environment it may be sufficient to budget salary costs by taking current year plus wage inflation.

Traditionally this type of budgeting would have been very evident in the public sector. This would often result in departments becoming locked in to public expenditure.

Advantages of incremental budgeting

- It is a simple, quick and easy approach towards budgeting.
- Suitable in a stable environment where historic figures are reliable and are
- not expected to change.
- Information does not need to be searched, it is readily available.

Disadvantages of incremental budgeting

- The deficiencies or say 'budgetary slack' which were incorporated in previous period is likely to be carried forward for the next budget period.
- Uneconomic economic activities may continue for the next period, for example a company may continue to make parts in-house when it might be cheaper to outsource.
- Amount of increment (inflation or growth) may be difficult to estimate.

▶ *Example 09:*

Falcon (Private) Limited (FPL) is in the process of preparing its annual budget for the next year. The available information is as follows:

i. Budgeted and actual production and sales for the current year:

	Budgeted	Actual
	--------- Units ---------	
Production	25,000	23,760
Sales	24,000	22,800

ii. Current year's actual production cost per unit:

		Rupees
Raw material input	(49 kg)	980
Direct labor		800
Variable production overheads		500
Fixed production overheads		400
		2,680

iii. Inventory balances:

FPL maintains the following inventory levels:

Raw material	Average two months' consumption based on budgeted production
Finished goods	Average one month's budgeted sales
Work in process (opening as well as closing)	1,500 units (100% complete as to material and 60% as to conversion cost)

FPL follows absorption costing and uses FIFO method for valuation of inventory.

iv. Impact of inflation:

	Inflation %
Raw material and variable overheads	8
Direct labor	10
Fixed overheads (excluding depreciation)	5

v. Sales volume would increase by 10%.

vi. Balancing and modernization of plant would be carried out at a cost of Rs. 20 million which would:

- increase depreciation from Rs. 5,800,000 to Rs. 7,016,800;
- reduce raw material wastages from 5% to 2% of input; and
- increase labor efficiency by 7%.

For the above example, budgeted statement of cost of sales for the next year may be as follows:

Falcon (Private) Limited		Rupees
Opening work in process:		
Raw material cost	1,500×980	1,470,000
Conversion cost	1,500×60%×(800+500+400)	1,530,000
	A	3,000,000
Manufacturing expenses:		
Raw material cost	(W-4)	25,497,753
Conversion cost	25,170(W-1)×1,791(W-2)	45,079,470
	B	70,577,223
Closing work in process:		
Raw material cost	1,500×1,026(W-2)	(1,539,000)
Conversion cost	1,500×60%×1,791(W-2)	(1,611,900)
	C	(3,150,900)
Finished goods:		
Opening stock	2,000(W-1)×2,680 D	5,360,000
Closing stock	2,090(W-1) ×2,817(W-2) E	(5,887,530)
Cost of sales	(A+B+C+D+E)	69,898,793

W-1: Budgeted production for the next year			Units
Sales for the next year		22,800×1.1	25,080
Finished goods inventory:	Closing	25,080÷12	2,090
	Opening	24,000÷12	(2,000)
Work in progress:	Closing (100% to material and 60% to conversion)		1,500
	Opening (100% to material and 60% to conversion)		(1,500)
			25,170

W-2: Budgeted cost per unit for the next year		Rupees
Raw material	980×0.95÷0.98×1.08	1,026
Direct labor	800×93%×1.1	818
Variable overheads	500×1.08	540
Fixed overheads	10,906,000**(W-3)**÷25,170**(W-1)**	433
		1,791
		2,817

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W-3: Budgeted fixed overheads for the next year		**Rupees**
Current year's fixed overheads (excluding depreciation)	(400×23,760)-5,800,000	3,704,000
5% increase for next year's fixed overheads (excluding depreciation)	3,704,000×1.05	3,889,200
Depreciation for the next year		7,016,800
		10,906,000
W-4: Budgeted raw material consumption for the next year		**Kg**
Required raw material including 2% wastage	25,170 **(W-1)** × (49×0.95÷0.98)	1,195,575
Opening raw material inventory	(25,000×49×2÷12)	204,167
Raw material issues on FIFO basis from:		**Rupees**
- Opening raw material inventory	204,167×(980÷49)	4,083,340
- Current purchases at revised price	(1,195,575-204,167)×(980÷49)×1.08	21,414,413
		25,497,753

4.3 Zero based budgeting

A simple idea of preparing a budget from a zero base each time i.e. as though there is no expectation of current activities to continue from one period to the next. ZBB is normally found in **service** industries where costs are more likely to be **discretionary**. A form of ZBB is used in local government. There are four basic steps to follow:

- **Prepare decision packages:** Identify all possible services (and levels of service) that may be provided and then cost each service or level of service, these are known individually as **decision packages.**
- **Rank**: Rank the decision packages in order of importance, starting with the mandatory requirements of a department. This forces the management to consider carefully what their aims are for the coming year.
- **Funding**: Identify the level of funding that will be allocated to the department.
- **Utilize:** Use up the funds in order of the ranking until exhausted.

Advantages (as opposed to incremental budgeting)

- Emphasis on future need not past actions.
- Eliminates past errors that may be perpetuated in an incremental analysis.
- A positive disincentive for management to introduce slack into their budget.
- A considered allocation of resources.
- Encourages cost reduction.

Disadvantages

- Can be costly and time consuming.
- May lead to increased stress for management.
- Only really applicable to a service environment.
- May "re-invent" the wheel each year.
- May lead to loss continuity of action and short term planning.

4.4 Continuous budgeting (Rolling budgets)

In a periodic budgeting system, the budget is normally prepared for one year, a totally separate budget will then be prepared for the following year. In continuous budgeting the budget from one period is "rolled on" from one year to the next.

Typically, the budget is prepared for one year, only the first quarter in detail, the remainder in outline. After the first quarter is revised for the following three quarters based on the actual results and a further quarter is budgeted for.

This means that the budget will again be prepared for 12 months in advance. This process is repeated each quarter (or month or half year).

Advantages (as opposed to periodic budgeting)

- The budgeting process should be more accurate.
- Much better information upon which to appraise the performance of management.
- The budget will be much more relevant by the end of the traditional budgeting period.
- It forces management to take the budgeting process more seriously.

Disadvantages

- More costly and time consuming.
- An increase in budgeting work may lead to less control of the actual
- results.

4.5 Performance budgeting

Performance budgeting is a system of planning, budgeting and evaluation that emphasizes the relationship between money budgeted and results expected. Performance budgeting focuses on results as departments are held accountable to certain performance standards. By focusing the relationship between strategic planning and resource allocation, performance budgeting focuses more attention on longer time horizons. These budgets are established in such a way that each item of expenditure is related to specific responsibility center and is closely linked with the performance of that standard. This type of budget is commonly used by the government to show the link between the funds provided to the public and the outcome of these services. Decisions made on these types of budgets focus more on outputs or outcomes of services than on decisions made based on inputs. In other words, allocation of funds and resources are based on their potential results.

5. BUDGETING IN NON-PROFIT ORGANISATIONS

5.1 Budgeting needs of Non – profit organizations

As we know that the objectives of an organization form the basis of its budgets. Budgets in profit oriented and non-profit organizations have same characteristics, except for the fact that the budgets for non-profit organizations are not designed with a focus on profitability.

Non-profit organizations normally face difficulty in arranging finances because they don't have access to several sources of finances like profit oriented businesses. They are more dependent on charities, donations, ministry funds which cannot be predicted with reasonable accuracy. Moreover, performance of non-profit organizations relies heavily on external stakeholders, so under such circumstances forecasting future results becomes a challenge.

In a non-profit organization the budgeting process is initiated with an exercise by the managers where they calculate the expected costs of the activities being supervised by them. Any desirable changes are also accommodated if needed. The available resources to fund the budgeted level of public services should be enough to cover the overall costs of such services.

The difficulty central to the budgeting process of non-profit organizations is the issue of defining "specific quantifiable objectives", besides, the actual accomplishments are even more difficult to be measured. This is because at many occasions the outputs cannot be measured in monetary terms. In organizations driven by profit motive sales revenues reflect the outputs. This explains well the concept that budgets in non-profit organizations tend to be mainly concerned with the input resources (i.e. expenditure) whereas in profit oriented organizations the budgets focus on the relationship between inputs and outputs. However, in recent years' efforts have been put in to overcome the deficiencies and attempts are being made to develop measures to be used for the comparison of budgeted and actual accomplishments.

5.2 Traditional format: Line item budgets

A line item budget is considered as the traditional format of budgeting in non-profit organizations. In such budgets the expenditures are presented in detail, but the activities undertaken are given less attention. It shows the nature of the expenses but not the purpose. Any anticipated or expected changes in costs and activity levels are reflected in the budget. These budgeted figures when compared with the actual expenditure show if the authorized budgeted expenditure has been exceeded or under-spending was witnessed. Moreover, the spending pattern too can be analyzed by comparing the data of the current year and for the previous year.

Line item budgets though fail to recognize the cost of activities and the programs to be executed. Moreover, line item budgets do not guarantee the efficient and effective use of the resources.

► *Illustration*

	Actual 20X4	Original budget 20X5	Revised budget 20X5	Proposed budget 20X6
	Rs.	Rs.	Rs.	Rs.
Employees	1,200,000	1,350,000	1,360,000	1,630,000
Maintenance expenses	6,000	10,000	8,000	12,000
Office supplies	30,000	40,000	44,000	143,000
Freight	24,000	28,600	28,900	30,200
Establishment expenses	223,000	220,000	216,000	200,000
Agency charges	8,000	7,000	6,800	9,600
Financing charges	3,500	3,900	4,000	114,000
Other expenses	2,200	3,000	3,300	3,700
	1,496,700	1,662,500	1,671,000	2,142,500

6. HUMAN AND MOTIVATIONAL ASPECTS OF BUDGETING

6.1 Budgetary slack

Success of budgets depend upon how motivated employees are to meet budget targets. Two employees might have different perception about a single budget. It is very difficult to involve each of them. If a very large number of employees have been involved in budget making process, there is a likelihood of budgetary slack to result as a consequence. Budgetary slack (or bias) is a deliberate overestimation of expenditure and/or underestimation of revenues in the budgeting process. This can happen because managers want easy targets (e.g. for an "easy life" or to ensure targets are exceeded and bonuses won) or simply to "play the system". Either way, this results in a budget that is poor for control purposes and gives rise to meaningless variances.

6.2 Dysfunctional behavior

Budgets may also lead to dysfunctional behavior. Dysfunctional behavior is when individual managers seek to achieve their own objectives at the expense of the objectives of the organization i.e. Abetting a "silo culture" in the organization whereby departmental goals and objectives are prioritized over those of the organization. A key performance management issue is to ensure that the system of targets and measures used do not encourage such behavior but rather encourages goal congruence.

6.3 Budgetary styles

In order to motivate employees to take targets seriously, commitment from senior level management to implement budgetary control and system must be shown. In many organizations, targets are duly set but these are not used to compare the actual performance. As a result, in such cases, employees after getting targets show relax attitude as they know they would not be held accountable against the targets.

Many managers seek budgets as a punitive device, which basically aims at punishing them on their poor performance rather than to reward them. It happens when employees have lower confidence on senior level management and they think that budgets are set up in such a way that makes it impossible to achieve those set targets, such a scenario would result in a severe dysfunctional organization.

Level of participation and budgetary style also affects human behavior. Two common budgetary styles are:

- **Imposed style of budgeting:** A budget that is set without allowing the ultimate budget holder to have the opportunity to participate in the budgeting process. Also called "top-down" budgeting.
- **Participative style of budgeting:** A system in which budget holders have the opportunity to participate in setting their own targets. Also called "bottom up" budgeting.

Advantages of participation	Disadvantages of participation
Increased motivation to the budget holders.	Senior managers may not be able to give up control.
Should contain better information due to participation by those who are closer to the action.	Poor decision making due to inexperienced staff.
Increases managers' understanding.	Lack of goal congruence and wastage of resources.

6.4 Motivation

Budgets represent a target and aiming for target is itself a strong motivator. Managers and employees know in advance what level of performance is expected from them. What if mangers have been told that 'good' performance is expected from you. Next question they ask is 'define good'? They want targets in quantified terms and time frame in which these targets are to be attained. Level of motivation depends upon how easy or difficult they perceive that target. If target becomes too easy, there is no motivation to perform well or task is no more challenging. If it's too difficult, motivation still goes down because they might take targets to be un-attainable. So, the aim is to set budgets which are perceived as being possible, but which motivate employees to try harder than they otherwise might have done.

7. COMPREHENSIVE EXAMPLES

- *Example 01:*

Double Crown Limited (DCL) is engaged in manufacturing of a product Zee. Sales projections according to DCL's business plan for the year ending 31 December 2017, are as follows:

	May	June	July	August
	----------------------- Rs. in million -----------------------			
Sales	60	55	70	68

Additional information includes:

i. Goods are sold at a gross margin of 40% on sales.

ii. Ratio of direct material, direct wages and overheads is 6:3:1 respectively.

iii. Normal loss is 5% of the units completed.

iv. Inventory levels maintained by DCL are as under:

Direct materials	Next month's budgeted consumption
Finished goods	50% of next month's budgeted sales

v. 10% of all purchases are in cash. Remaining purchases are paid in the following month.

vi. Direct wages include DCL's contribution at 5% of the direct wages, towards canteen expenses. An equal amount is deducted from the employees' wages. Direct wages are paid on the last day of each month. Both contributions are paid to the canteen contractor in the following month.

vii. Overheads for each month include depreciation on plant and machinery and factory building rent, amounting to Rs. 0.2 million and Rs. 0.1 million respectively. The rent is paid on half yearly basis in advance on 30 June and 31 December each year.

If required to prepare budget for material purchases, direct wages and overheads, for the month of June 2017, working would involve:

Budget for material purchases, direct wages and overheads for the month June 2017			May	Jun	Jul	Aug
			---------- Rs. in million ----------			
Sales		(A)	60.00	55.00	70.00	68.00
Cost of sales		A×60% (B)	36.00	33.00	42.00	40.80
Finished goods:	Opening stock	B÷2	(18.00)	(16.50)	(21.00)	
	Closing stock		16.50	21.00	20.40	
Cost of goods manufactured			34.50	37.50	41.40	
5% Normal loss - no effect, as being normal loss it is already included in cost of goods produced			-	-	-	
Cost of goods produced		(C)	34.50	37.50	41.40	

		May	Jun	Jul	Aug
		----------- Rs. in million -----------			
Budgeted direct material purchases - (as opening inventory is equal to current month consumption, purchases would be equal to the next month consumption) (37.5×60%),(41.4×60%)	(D)	22.50	24.84		
Budgeted direct wages	C×3÷10 (E)		11.25		
Budgeted overheads	C×1÷10 (F)		*3.75		
** (Including fixed overheads – Depreciation and Rent amounted to Rs. 0.2 million and Rs. 0.1 million respectively)*					

▶ *Example 02:*

Tennis Trading Limited (TTL) was incorporated on 1 September 2018 and would start trading from the month of October 2018. As part of planning and budgeting process, the management has developed the following estimates:

i. During the month of September 2018, TTL would pay Rs. 5 million, Rs. 2 million and Rs. 1.2 million for purchase of a property, equipment and a motor vehicle respectively.

ii. Projected sales for October is Rs. 12 million. The sales would increase by Rs. 2.5 million per month till January 2019. From February 2019 and onwards, sales would be Rs. 25 million per month.

iii. Cash sales is estimated at 30% of the total sales.

iv. Credit customers are expected to pay within one month of the sales.

v. 80% of the credit sales would be generated by salesmen who would receive 5% commission on sales. The commission is payable in the following month after sales.

vi. Gross profit margin would be 30%.

vii. TTL would maintain inventory at 80% of the projected sale of the following month, up to December 2018 and thereafter, 85% of the projected sale of the following month.

All purchases of inventories would be on two months' credit.

i. Salaries would be Rs. 1.5 million in September and Rs. 2 million per month, thereafter. Other administrative expenses would be Rs. 1 million per month from September till January 2019 and Rs. 1.3 million per month thereafter. Both types of expenses would be paid in the same month in which they are incurred.

ii. An aggressive marketing scheme would be launched in September 2018. The related expenses are estimated at Rs. 7 million. 50% of the amount would be payable in September and 50% in October 2018.

iii. Marketing expenses from October 2018 would consist of 65% variable and 35% fixed expenses. Total expenses in October 2018 would be Rs. 2 million. All expenses would be paid in the month in which they occur.

iv. Bank balance as of 1 September 2018 is Rs. 12 million. TTL has arranged a running finance facility from a local bank at a mark-up of 10% per annum. The mark-up is payable at the end of each month on the closing balance.

The TTL wants now a cash forecast (month-wise) from September 2018 to February 2019 to analyze sustainability over the period.

In order to forecast cash inflows and outflows first of all working for sales (W-1) and purchases (W-2) is done as follows:

W-1: Monthly sales	**Sep-18**	**Oct-18**	**Nov-18**	**Dec-18**	**Jan-19**	**Feb-19**
	---------------------- Rs. in million ------------------					
Sales		12.00	14.50	17.00	19.50	25.00
			(12+2.5)	(14.50+2.5)	(17+2.5)	

W-2: Purchases	**Sep-18**	**Oct - 18**	**Nov-18**	**Dec-18**	
	---------------------- Rs. in million ------------------				
Cost of sale (70% of sales)	-	8.40	10.15	11.90	13.65
Less: Opening stock	-	(6.72)	(8.12)	(9.52)	
Add: Closing stock (80% of cost of sales of next month till Dec.)	6.72	8.12	9.52	10.92	
Total purchases	6.72	9.80	11.55	13.30	

Cash budget for the period from September 2018 to February, 2019

		Sep-18	**Oct-18**	**Nov-18**	**Dec-18**	**Jan-19**	**Feb-19**
		---------------------- Rs. in million ------------------					
Collections							
- From cash sales (Sales of current month(W-1)×30%)		-	3.60	4.35	5.10	5.85	7.50
- From credit customers (Sales of previous month (W-1)×70%)		-	-	8.40	10.15	11.90	13.65
Total cash inflows	A	-	3.60	12.75	15.25	17.75	**21.15**
Payments							
Cash paid to suppliers	W-2	-	-	6.72	9.80	11.55	13.30
Wages and salaries		1.50	2.00	2.00	2.00	2.00	2.00
Other administrative expenses		1.00	1.00	1.00	1.00	1.00	1.30
Commission (Last month sale × 70% ×80%×5%)		-	-	0.34	0.41	0.48	0.55
Marketing expenses – Fixed		-	0.70	0.70	0.70	0.70	0.70
Marketing expenses - Variable {(2×65%/12**(W-1)**)×Sales}		-	1.30	1.57	1.84	2.11	2.71
Initial promotion and advertisement expenses (7×50%)		3.50	3.50	-	-	-	-
Property		5.00	-	-	-	-	-
Equipment		2.00	-	-	-	-	-
Motor vehicle		1.20	-	-	-	-	-
Total cash outflows	B	14.20	8.5	12.33	15.75	17.84	20.56

		Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19
		---------------------- Rs. in million -------------------					
Net cash inflows / (outflows)	(A-B)	(14.20)	(4.90)	0.42	(0.50)	(0.09)	0.59
Opening balance		12.00	(2.22)	(7.18)	(6.82)	(7.38)	(7.53)
Closing balance for mark-up calculation		(2.20)	(7.12)	(6.76)	(7.32)	(7.47)	(6.94)
Mark-up @ 10% p.a	(Closing balance × 10%/12)	(0.02)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Closing balance		(2.22)	(7.18)	(6.82)	(7.38)	(7.53)	(7.00)

- *Example 03:*

Smart Limited has prepared a forecast for the quarter ending December 31, 20X9, which is based on the following projections:

i. Sales for the period October 20X9 to January 20X0 has been projected as under:

	Rupees
October 20X9	7,500,000
November 20X9	9,900,000
December 20X9	10,890,000
January 20X0	10,000,000

Cash sale is 20% of the total sales. The company earns a gross profit at 20% of sales. It intends to increase sales prices by 10% from November 1, 20X9. Effect of increase in sales price has been incorporated in the above figures.

ii. All debtors are allowed 45 days credit and are expected to settle promptly.

iii. Smart Limited follows a policy of maintaining stocks equal to projected sale of the next month.

iv. All creditors are paid in the month following delivery. 10% of all purchases are cash purchases.

v. Marketing expenses for October are estimated at Rs. 300,000. 50% of these expenses are fixed whereas remaining amount varies in line with the value of sales. All expenses are paid in the month in which they are incurred.

vi. Administration expenses paid for September were Rs. 200,000. Due to inflation, these are expected to increase by 2% each month.

vii. Depreciation is provided @ 15% per annum on straight line basis. Depreciation is charged from date of purchase to the date of disposal.

viii. On October 31, 20X9 office equipment having book value of Rs. 500,000 (40% of the cost) on October 1, 20X9 would be replaced at a cost of Rs. 2,000,000. After adjustment of trade-in allowance of Rs. 300,000 the balance would have to be paid in cash.

ix. The opening balances on October 1, 20X9 are projected as under:

	Rupees
Cash and bank	2,500,000
Trade debts – related to September	5,600,000
Trade debts – related to August	3,000,000
Fixed assets at cost (20% are fully depreciated)	8,000,000

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Based on the given information, preparation a month-wise cash budget for the quarter ending December 31, 20X9, would be as follows

Cash budget for the quarter October - December 20X9		October	November	December
		Rupees in '000'		
Opening cash and bank balances		2,500	1,476	1,428
Cash receipts:				
Cash sales		1,500	1,980	2,178
Collection from debtors	Note 1	5,800	5,800	6,960
Total receipts		7,300	7,780	9,138
		9,800	9,256	10,566
Cash payments:				
Cash purchases	Note 2	720	792	727
Creditors	Note 2	5,400	6,480	7,128
Marketing expenses – Fixed (300/2)		150	150	150
Marketing expenses - Variable	Note 3	150	198	218
Admin. Expenses (2% increase per month)		204	208	212
Purchase of equipment (2,000-300)		1,700		
Total payments		8,324	7,828	8,435
Closing cash and bank balances		1,476	1,428	2,131

Profit & Loss Account for the quarter ending December 31, 20X9		
	Rupees in '000'	
Sales (7,500+9,900+10,890)		28,290
Cost of goods sold:		
Opening stock (80% of October sale of Rs. 7,500)		6,000
Purchases (7,200+7,920+7,273)		22,393
Goods available for sale		28,393
Closing stock (Purchases of Dec. 20X9)		(7,273)
		21,120
Gross profit		7,170
Admin. & Marketing expenses:		
Marketing expenses - Fixed		450
Marketing expenses – variable	Note 3	566
Admin. Expenses		624
Depreciation	Note 4	258
Loss on replacement of machinery {500-(1,250*15%/12=16)-300}		184
		2,082
NET PROFIT		5,088

Note 1 - Cash collection from sales:	Oct.X9 Rs.'000	Nov.X9 Rs.'000	Dec.X9 Rs.'000	Jan.X0 Rs.'000
Total sales	7,500	9,900	10,890	10,000
Cash sales (20% of total)	1,500	1,980	2,178	
Credit sales (80% of total)	6,000	7,920	8,712	
Cash from debtors:				
2nd. fortnight of August	3,000			
1st. fortnight of September (5,600/2)	2,800			
2nd. fortnight of September (5,600/2)		2,800		
1st. fortnight of October (6,000/2)		3,000		
2nd. fortnight of October (6,000/2)			3,000	
1st. fortnight of November (7,920/2)			3,960	
	5,800	5,800	6,960	

Note 2 - Purchases:	Oct.X9 Rs.'000	Nov.X9 Rs.'000	Dec.X9 Rs.'000	Jan.X0 Rs.'000
Sales	7,500	9,900	10,890	10,000
Sale price increase	0%	10%	10%	10%
Sales excluding price increase effect	7,500	9,900/ 1.10	10,890/ 1.10	10,000/ 1.10
	7,500	9,000	9,900	9,091
Projected purchases	9,000*0.80	9,900*0.80	9,091*0.80	
based on next month sales	7,200	7,920	7,273	
Cash purchases 10%	720	792	727	
Credit purchases 90%	6,480	7,128	6,545	
Payment to creditors (Last month's balance of creditors)	(7,500*0.8*0.9) 5,400	6,480	7,128	

Note 3 - Variable marketing expenses:				
Sales	7,500	9,900	10,890	
Variable marketing expenses	300 / 2	150/7,500* 9,900	150/7,500* 10,890	-
	150	198	218	-

Note 4 – Depreciation		Oct.X9	Nov.X9	Dec.X9	Jan.X0
Fixed assets at cost	8,000	-	-	-	
Less: Fully depreciated assets 20%	(1,600)	-	-	-	-
	6,400	80	-	-	-
Disposals on Oct. 31 at cost (500,000/40%)	(1,250)	-	-	-	-
	5,150	-	-	-	-
Additions on October 31 at cost	2,000	-	-	-	-
	7,150	-	89	89	-

▶ *Example 04:*

Shahid Limited is engaged in manufacturing and sale of footwear. The company sells its products through company operated retail outlets as well as through distributors. The management is in the process of preparing the budget for the year 20X0-X1 on the basis of following information:

i. The marketing director has provided the following annual sales projections:

	No. of units	Retail price range
Men	1,200,000	Rs. 1,000 – 4,000
Women	500,000	Rs. 800 – 2,500

The previous pattern of sales indicates that 60% of units are sold at the minimum price; 10% units are sold at the maximum price and remaining 30% at a price of Rs. 2,000 and Rs. 1,200 per footwear for men and women respectively.

ii. It has been estimated that 30% of the units would be sold through distributors who are offered 20% commission on retail price. The remaining 70% will be sold through company operated retail outlets.

iii. The company operates 22 outlets all over the country. The fixed costs per outlet are Rs. 1.2 million per month and include rent, electricity, maintenance, salaries etc.

iv. Sales through company outlets include sales of cut size footwears which are sold at 40% below the normal retail price and represent 5% of the total sales of the retail outlets.

v. The company keeps a profit margin of 120% on variable cost (excluding distributors' commission) while calculating the retail price.

vi. Fixed costs of the factory and head office are Rs. 45 million and Rs. 15 million per month respectively.

In preparing budgeted profit and loss account for the year 20X0 – 20X1, considering above conditions, working may be done as follows:

	Price		Units		Amount (Rs. '000s)	
	Men	Women	Men	Women	Men	Women
Minimum	1,000	800	720,000	300,000	720,000	240,000
Maximum	4,000	2,500	120,000	50,000	480,000	125,000
Average	2,000	1,200	360,000	150,000	720,000	180,000
Total			1,200,000	500,000	1,920,000	545,000

		Rs. 000s
Sales revenue – gross (1,920,0000 + 545,000)		2,465,000
Less : Commission to distributors	20% ×30% of above	147,900
Cut size discount	40% × (5% of 70%)	34,510
		182,410
Sales – net		2,282,590
Variable cost	100/220 of gross revenue	1,120,455
		1,162,135
Less : Factory overheads	12 × 45m	540,000
Gross profit		622,135
Less : Admin overheads	12 ×15m	180,000
Cost of retail outlets	12 × 22 × 1.2m	316,800
		496,800
Net profit		125,335

- *Example 05:*

Beta (Private) Limited (BPL) deals in manufacturing and marketing of bed sheets. The management of the company is in the phase of preparation of budget for the year 20X3-X4. BPL has production capacity of 4 million bed sheets per annum. Currently the factory is operating at 68% of the capacity. The results for the recently concluded year are as follows:

	Rs. in million
Sales	3,400
Cost of goods sold	
Material	(1,493)
Labor	(367)
Manufacturing overheads	(635)
Gross profit	905
Selling expenses (60% variable)	(287)
Administration expenses (100% fixed)	(105)
Net profit before tax	513

Other relevant information is as under:

i. The raw material and labor costs are expected to increase by 5%, while selling and distribution costs will increase by 4% and 8% respectively. All overheads and fixed expenses except depreciation will increase by 5%.

ii. Manufacturing overheads include depreciation of Rs. 285 million and other fixed overheads of Rs. 165 million. During the year 20X3–X4 major overhaul of a machine is planned at a cost of Rs. 35 million which will increase the remaining life from 5 to 12 years. The current book value of the machine is Rs. 40 million and it has a salvage value of Rs. 5 million. At the end of 12 years, salvage value will increase on account of general inflation to Rs. 9 million. The company uses straight line method for depreciating the assets.

iii. Variable manufacturing overheads are directly proportional to the production volume of production.

iv. Selling expenses include distribution expenses of Rs. 85 million, which are all variable

v. Administration expenses include depreciation of Rs. 18 million. During 20X3–X4, an asset having book value of Rs. 1.5 million will be sold at Rs. 1.8 million. No replacement will be made during the year. Depreciation for the year 20X3-X4 would reduce to Rs. 17 million.

The management has planned to take following steps to increase the sale and improve cost efficiency:

- Increase selling price by Rs. 150 per unit.
- The sales are to be increased by 25%. To achieve this, commission on sales will be introduced besides fixed salaries. The commission will be paid on the entire sale and the rate of commission will be as follows:

No. of units	Commission % on total sales
Less than 35,000	1.00%
35,000 – 40,000	1.25%
40,000 – 50,000	1.50%
Above 50,000	1.75%

- Currently the sales force is categorized into categories A, B and C. Number of persons in each category is 20, 30 and 40 respectively. Previous data shows that total sales generated by each category is same. Moreover, sales generated by each person in a particular category is also the same. The trend is expected to continue in future.
- The overall efficiency of the workforce can be increased by 15% if management allows a bonus of 20%. Further increase in production can be achieved by hiring additional labor at Rs. 180 per unit.

In order to prepare profit and loss budget for the year 20X3–X4 step by step calculations are as follows:

Production capacity	4,000,000
Actual production (4,000,000 × 68% = 2,720,000 × 1.25)	3,400,000
Selling price / unit [(3,400 ÷ 2.72) + 150]	Rs. 1,400

	Rs.in million
Sales (1,400 × 3,400,000)	4,760.00
Less: sales commission (W-1)	(63.50)
	4,696.50
Cost of goods sold (W–2)	(3,170.70)
Gross profit	1,525.80
Selling expenses	
Distribution expenses (1.08 × 1.25 × 85m)	(114.75)
Selling expenses -Variable [(287 × 60% – 85m) × 1.04 × 1.25]	(113.36)
Selling expenses - Fixed [(287 × 40%) × 1.05]	(120.50)
	(348.61)
Administration expenses	
Admin expenses - other than depreciation [(105 – 18)m × 1.05]	(91.40)
Admin expenses - depreciation (18 – 1)m	(17.00)
	(108.40)
Other income (Gain on sale of asset) (1.8 – 1.5)m	0.30
Net profit / (loss)	**1,068.49**

W-1: Sales commission

Categories	Ratio	Units to be sold (A)	No. of persons	Avg. unit sale/ person	Commission % (B)	Commission (Rs.'000) A×B×Rs. 1,400
A	33.33%	1,133,333	20	56,667	1.75%	27,767
B	33.33%	1,133,333	30	37,778	1.25%	19,833
C	33.33%	1,133,334	40	28,333	1.00%	15,867
	100%	3,400,000	90			63,467

W-2: Cost of goods sold		**Rs. in million**
Material (1,493 × 1.05 × 1.25)		1,959.6
Labor (W-2.2)		511.5
Variable overheads [(635-285-165)×1.05×3,400÷2,720]		242.8
Overheads fixed - other than depreciation(165 × 1.05)		173.3
Overheads fixed - depreciation (W-2.1)		283.5
		3,170.7
W-2.1: Depreciation		
Existing depreciation		285.0
Less: depreciation on machine to be overhauled [(40 – 5)m ÷ 5]		7.0
		278.0
Add: Depreciation on machine after overhauling [(40+35–9)m ÷12]		5.5
		283.5
W-2.2: Labor Cost	**Units**	**Total cost**
Cost of existing units (367 × 1.05)	2,720,000	385.4
15% increase in production by paying bonus @ 20% (2,720,000 × 15%) (385.4 × 20%)	408,000	77.1
Existing labor cost with increased efficiency	3,128,000	462.5
Cost of remaining units by hiring additional labor @ Rs. 180 (3,400,000 – 2,720,000 – 408,000)	272,000	49.0
	3,400,000	511.5

▶ *Example 06:*

Cinemax Limited has recently constructed a fully equipped theatre and 3 cinema houses at a cost of Rs. 30 million. The theatre has a capacity of 800 seats and each cinema has a capacity of 600 seats. Information and projections for the first year of operations are as follows:

i. Fixed administration and maintenance cost of the entire facility is Rs. 4.5 million per year.

ii. The average cost of master print of a Hollywood film is Rs. 4 million while the cost of master print of a Bollywood film is Rs. 6.5 million.

iii. Two cinema houses are dedicated for Hollywood films which show the same film at the same time while one cinema house will show Bollywood films.

iv. Each Bollywood film is displayed for 6 weeks and the average occupancy level is 70%. Each Hollywood film is displayed for 4 weeks and the average occupancy level is 65%. On weekdays, there are 2 shows while on weekends (Sat and Sun), 3 shows are displayed. Ticket price has been fixed at Rs. 350.

v. Variable cost per show is Rs. 35,000 and setup cost of each film is Rs. 500,000.

vi. No films would be shown during 8 weeks of the year.

vii. Theatre is rented to production houses at Rs. 60,000 per day. Each play requires setup time of 2 days while rehearsal time needs 1 day. Each play is staged 45 times. One show is staged on weekdays whereas two shows are staged on weekends.

viii. There is an interval of 2 days whenever a new play is to be staged. No plays are staged during the month of Ramadan and first 10 days of Muharram.

ix. The construction costs of theatre and cinema houses are to be depreciated over a period of 15 years.

Assume 52 weeks in a year and 30 days in a month.

In order to calculate budgeted profit, estimated revenue and expenses can be calculated as follows:

W-1: Revenue from Cinemas		Hollywood film	Bollywood film
No. of weeks		52	52
No shows		(8)	(8)
No. of weeks during which show to be displayed	A	44	44
No. of weeks each film is displayed	B	4	6
No. of cinemas	C	2	1
Total no. of films	D= A/B	11	7.33
No. of shows per week (2×5+3×2)	F	16	16
Total shows per film	G=B×C×F	128	96
Average occupancy per show (600×65%,70%)	H	390	420
Ticket price	I	350	350
Revenue from Cinemas	G×H×I×D	192,192,000	103,488,000

W-2: Variable costs		Hollywood film	Bollywood film
Cost per film	Rs.	4,000,000	6,500,000
Setup cost	Rs.	500,000	500,000
Show cost [35,000×128/96(G from W-1)]	Rs.	4,480,000	3,360,000
Variable cost per film	Rs.	8,980,000	10,360,000
Total number of films in a year (E from W-1)		11	7.33
Total variable costs	Rs.	98,780,000	75,938,800

W-3: No. of days theatre rented out.		
No. of available days (360—30—10)	A	320
No. of days one play will be staged (45/9×7)	C	35
Gap between two plays	D	2
Setup and rehearsal time	E	3
	F	40
Total no. of plays	G=B÷F	8
Per day rental	Rs.	60,000
Rental income from theatre [320—(2×8) × 60,000]	Rs.	18,240,000

AT A GLANCE SPOTLIGHT STIKCY NOTES

Budgeted Profit And Loss Statement	
Revenues	**Rupees**
Revenue from Cinemas [192,192,000(W-1)+103,488,000(W-1)]	295,680,000
Rental income from theatre	18,240,000
	313,920,000
Expenses	
Variable costs of films [98,780,000(W-2)+75,938,800(W-2)]	174,718,800
Depreciation on Cinema and Theatre houses (30m÷15)	2,000,000
Fixed administration and maintenance cost	4,500,000
	181,218,800
Budgeted profit	132,701,200

▶ *Example 08:*

Rose Industries Limited (RIL) is in process of preparation of its budget for the year ending 31 March 2020. In this respect, following information has been extracted from RIL's projected financial statements for the year ending 31 March 2019:

Information and projections for the budget year ending 31 March 2020:

i. The management estimates that profitability can be increased by employing the following measures:

- Introduction of cash sales at 5% less than the credit sales price. This would increase the total sales volume by 30% whereas credit sales volume would reduce by 20% as some of the existing customers would shift to cash sales.
- Installation of a software that would automatically generate follow-up emails to the customers and relevant reports for the management. The software having useful life of 10 years would be operational from 1 April 2019. The software would cost Rs. 2.5 million and its maintenance cost is estimated at Rs. 0.15 million per quarter. It is expected that as a result of the use of this software, RIL would be able to reduce its fixed operating costs by 15%.
- As the purchases increase, RIL would negotiate with the suppliers and receive 2% trade discount.
- Cost reduction measures would be taken which would save 5% of the variable conversion and variable operating costs.

ii. The increase in working capital requirements would be met by arranging a running finance facility of Rs. 100 million at a mark-up of 10% per annum. It is estimated that on an average, 90% of the facility would remain utilized during the budget year.

iii. Effect of inflation on price of raw material and all other costs (excluding depreciation) would be 10%.

iv. Closing raw material and finished goods inventories would increase by 8%.

RIL uses marginal costing and follows FIFO method for valuation of inventory.

Budgeted profit or loss statement for the year ending 31 March 2020, assuming that except stated otherwise, all transactions are evenly distributed over the year (360 days), would be prepared as follows

Budgeted profit or loss statement for the year ending 31 March 2020		Rs. in million
Sales - credit	2,800×0.8	2,240.00
Sales - cash	[(2,800×1.3)–2,240]×0.95	1,330.00
		3,570.00

AT A GLANCE SPOTLIGHT STIKCY NOTES

Variable cost of goods sold:		**Rs. in million**
Raw material consumption	(W-1)	(1,574.84)
Variable conversion cost	[280÷360,000×471,200(W-2)]×0.95×1.1	(382.98)
Manufacturing cost		(1,957.82)
Opening finished goods		(110.00)
Closing finished goods	(W-3)	179.99
Variable cost of goods sold		(1,887.83)
Gross contribution margin		1,682.17
Variable operating cost	(190×1.30)×0.95×1.1	(258.12)
Net contribution margin		1,424.05
Fixed conversion cost	(160–24)×1.1+24	(173.60)
Fixed operating cost	[(45–16)×0.85×1.1+16] +(2.5×10%)+(0.15×4)	(43.97)
10% mark-up on running finance facility	100×90%×10%	(9.00)
Net profit		1,197.48
W-1: Budgeted raw material consumption		**Rs. in million**
Consumption at last year's price	1,120÷360,000×471,200(W-2)	1,465.96
Use of opening raw material		70.00
Use of current purchases	[(1,465.96–70)×1.10]×0.98	1,504.84
		1,574.84
W-2: Budgeted production quantity		**Units**
Sales	360,000×1.3	468,000
Finished goods inventory - closing	40,000×1.08	43,200
- opening		(40,000)
		471,200
W-3: Finished goods inventory valuation using marginal costing and FIFO		**Rs. in million**
Raw material cost	43,200×(1,120÷360,000)×1.1×0.98	144.88
Variable conversion cost	43,200×(280÷360,000)×1.1×0.95	35.11
		179.99

► *Example 08:*

Mazahir (Pakistan) Limited manufactures and sells a consumer product Zee. Relevant information relating to the year ended June 30, 20X3 is as under:

Raw material per unit	5 kg at Rs. 60 per kg
Actual labor time per unit (same as budgeted)	4 hours at Rs. 75 per hour
Actual machine hours per unit (same as budgeted)	3 hours
Variable production overheads	Rs. 15 per machine hour
Fixed production overheads	Rs. 6 million
Annual sales	19,000 units
Annual production	18,000 units
Selling and administration overheads (70% fixed)	Rs. 10 million

Salient features of the business plan for the year ending June 30, 20X4 are as under:

i. Sale is budgeted at 21,000 units at the rate of Rs. 1,100 per unit.

ii. Cost of raw material is budgeted to increase by 4%.

iii. A quality control consultant will be hired to check the quality of raw material. It will help improve the quality of material procured and reduce raw material usage by 5%. Payment will be made to the consultant at Rs. 2 per kg.

iv. The management has negotiated a new agreement with labor union whereby wages would be increased by 10%. The following measures have been planned to improve the efficiency:

- 30% of the savings in labor cost would be paid as bonus.
- A training consultant will be hired at a cost of Rs. 300,000 per annum to improve the working capabilities of the workers.

On account of the above measures, it is estimated that labor time will be reduced by 15%.

v. Variable production overheads will increase by 5%.

vi. Fixed production overheads are expected to increase at the rate of 8% on account of inflation. Fixed overheads are allocated on the basis of machine hours.

vii. The company has a policy of maintaining closing stock at 5% of sales. In order to avoid stock-outs, closing stock would now be maintained at 10% of sales. The closing stocks are valued on FIFO basis.

A budgeted profit and loss statement for the year ending June 30, 20X4 under marginal and absorption costing would be as follows:

	Units	Marginal Costing	Absorption Costing	Marginal Costing	Absorption Costing
		Cost per unit	Cost per unit	Rupees	
Sales	21,000	1,100		23,100,000	23,100,000
Cost of goods sold					
Opening stock	950	300+300+45	300+300 +45+333.33	612,750	929,414
Production for the year	22,150	648.5	648.5+306.09	14,364,275	21,144,169
Closing inventory	2,100	648.5	648.5+306.09	(1,361,850)	(2,004,639)
				13,615,175	20,068,944
Variable selling and administration cost	21,000	157.89		3,315,690	
Contribution margin / Gross profit				**6,169,135**	**3,031,056**
Selling and administration costs {(21,000x157.89} + 7,000,000					10,315,690
Fixed cost - production			**W -2**	6,780,000	
Fixed cost - Selling & administration			(70% × 10,000,000)	7,000,000	
Net loss				**(7,610,865)**	**(7,284,634)**

Profit reconciliation:			
In absorption costing fixed costs:			
- Brought forward from the last year through opening inventory	950 × 333.33	(316,664)	
- Carried forward to the next year through closing inventory	2,100 × 306.09	642,789	
- Rounding of difference		106	
		(7,284,634)	**(7,284,634)**

W-1: Variable cost per unit for 20X3-X4		
Raw material	(5*0.95*60*1.04)	296.40
Raw material inspection	(5*0.95*2)	9.50
Labor	(4*0.85*75*1.1)	280.50
Labor incentive cost	30%*(4*0.15*75*1.1)	14.85
Variable production overheads	15*1.05*3	47.25
Variable production costs		648.50
Variable selling and admin. costs	(30%*10,000,000)/19,000	157.89
		806.39

W-2: Fixed production cost for 20X3-X4		
Annual fixed production overheads	(6,000,000*1.08)	6,480,000
Training consultant cost		300,000
		6,780,000

W-3: Fixed production cost per unit		
Year ended June 30, 20X3	6,000,000/18,000	333.33
Year ended June 30, 20X4	6,780,000/22,150	306.09

W-4: Production for the year		**Units**
Sales		21,000
Opening inventory	19,000* 5%	(950)
Closing inventory	21,000*10%	2,100
Production for the year		**22,150**

- *Example 09:*

Zinc Limited (ZL) is engaged in trading business. Following data has been extracted from ZL's business plan for the year ended 30 September 20X2:

Sales	**Rs. '000**
Actual:	
January 20X2	85,000
February 20X2	95,000

Sales	Rs. '000
Forecast:	
March 20X2	55,000
April 20X2	60,000
May 20X2	65,000
June 20X2	75,000

Following information is also available:

i. Cash sale is 20% of the total sales. ZL earns a gross profit of 25% of sales and uniformly maintains stocks at 80% of the projected sale of the following month.

ii. 60% of the debtors are collected in the first month subsequent to sale whereas the remaining debtors are collected in the second month following sales.

iii. 80% of the customers deduct income tax @ 3.5% at the time of payment.

iv. In January 20X2, ZL paid Rs. 2 million as 25% advance against purchase of packing machinery.

The machinery was delivered and installed in February 20X2 and was to be operated on test run for two months. 50% of the purchase price was agreed to be paid in the month following installation and the remaining amount at the end of test run.

v. Creditors are paid one month after purchases.

vi. Administrative and selling expenses are estimated at 16% and 24% of the sales respectively and are paid in the month in which they are incurred. ZL had cash and bank balances of Rs. 100 million as at 29 February 20X2.

A month-wise cash budget for the quarter ending 31 May 20X2, would be as follows.

Month-wise Cash Budget	Rs. in '000		
	Mar	Apr	May
Opening balance	100,000	109,204	104,828
Collections	83,800	68,800	59,400
Payments:			
Purchases	(47,250)	(44,250)	(48,000)
Selling expenses	(13,200)	(14,400)	(15,600)
Administrative expenses	(8,800)	(9,600)	(10,400)
Packing machinery	(3,000)	(3,000)	-
Tax withheld by 80% of customers @ 3.5%	(2,346)	(1,926)	(1,663)
	(74,596)	(73,176)	(75,663)
Closing balance	109,204	104,828	88,565

Working notes:			
W-1: Collections - Jan Sales			85,000
Feb Sales			95,000

	Mar	Apr	May
Sales Gross	55,000	60,000	65,000
Collections:			
Cash sales	11,000	12,000	13,000
1st month after sale	45,600	26,400	28,800
2nd month after sale	27,200	30,400	17,600
	83,800	68,800	59,400

W-2 Purchases:					
Sales Gross (June)					75,000
		Feb	**Mar**	**Apr**	**May**
Sales Gross		95,000	55,000	60,000	65,000
Cost of sales [75% of sales]	**A**	71,250	41,250	45,000	48,750
Less: Opening stock [80% of cost of sale]	**B**	(57,000)	(33,000)	(36,000)	(39,000)
Add: Closing stock **[80% of next month's cost of sales]**	**C**	33,000	36,000	39,000	45,000
Purchases (A+C–B)		47,250	44,250	48,000	54,750
Payment to creditors			47,250	44,250	48,000

► *Example 10:*

Sadiq Limited (SL) is in the process of preparation of budget for the year ending 31 December 2018. Following are the extracts from the statement of profit or loss for the year ended 31 December 2017:

	Rs. in million
Sales (30% cash sales)	7,500
Cost of goods sold	(4,000)
Gross profit	3,500
Operating expenses	(1,250)
Net profit before tax	2,250

Raw material inventory as on 1 January 2017 amounted to Rs. 152 million. There were no opening and closing inventories of work in process and finished goods. SL follows FIFO method for valuation of inventories.

Following are the projections to be used in the preparation of the budget:

i. Selling price would be reduced by 5%. Further, credit period offered to customers would be reduced from 45 days to 30 days. As a result, volumes of cash and credit sales are expected to increase by 10% and 5% respectively.

ii. Ratio of manufacturing cost was 5:3:2 for raw material, direct labor and factory overheads respectively.

iii. All operating expenses and 20% of factory overheads are fixed. Total depreciation for the year 2017 amounted to Rs. 100 million and was apportioned between manufacturing cost and operating expenses in the ratio of 7:3. Depreciation for the next year would remain the same.

iv. Raw material inventory would be maintained at 30 days of consumption. Up to 31 December 2017, it was maintained at 45 days of consumption.

v. Raw material prices and direct labor rate would increase by 10% and 6% respectively.

vi. Impact of inflation on all other costs would be 5%.

vii. The existing policy of payment to raw material suppliers in 30 days is to be changed to 15 days. Other costs are to be paid in the month of incurrence.

The budgeted net cash inflows/(outflows) for the year ending 31 December 2018 (Assuming there are 360 days in a year), would be as follows

Inflows		Rs. in million
Cash sales	(7,500×30%)×1.1×95% – A	2,351.25
Budgeted credit sales 2018	(7,500×70%)×95%×1.05	5,236.88
Trade debtor (Opening)	(7,500×70%)×(45/360)	656.25
Trade debtor (Closing)	5,236.88×30/360	(436.41)
Collections from debtors	B	5,456.72
Total inflows	A+B	7,807.97

Outflows		
Payment to suppliers	**(W-1)**	2,343.78
Direct labor	4,000×{(70%×1.05)+(30%×1.1)} ×30%×1.06	1,354.68
Variable factory overheads	4,000×{(70%×1.05)+(30%×1.1)}× {(20%–(20%×20%)}×1.05	715.68
Fixed factory overheads	[{4,000×(20%×20%)}–{(100×70%)}]×1.05	94.50
Operating expenses	{1,250–(100×30%)}×1.05	1,281.00
Total outflows		5,789.64
Net cash inflows		2,018.33

W-1: Payments to material suppliers		
Consumption of raw material 2018 at 2017 price	(4,000×50%)×{(70%×1.05)+(30%×1.1)}	2,130.00
Opening raw material at 2017 price	(4,000×50%)×(45/360)	(250.00)
Closing raw material at 2017 price	2,130×30/360	177.50
Purchases of 2018 at 2017 price		2,057.50
Purchases of 2018 – at increased price	2,057.50×1.1	2,263.25
Trade creditor (Opening)	2,098(W-2)×30/360	174.83
Trade creditor (Closing)	2,263.25×15/360	(94.30)
Payment to suppliers		2,343.78

W-2: Purchases 2017		
Consumption of raw material 2017	4,000×50%	2,000.00
Opening raw material	*Given*	(152.00)
Closing raw material	(W-1)	250.00
Purchases 2017		2,098.00

▶ *Example 11:*

Queen Jewels (QJ) deals in imitated ornaments and operates its business on-line through a web-portal. Orders are received through the website and dispatched through a courier.

The mode of payments available to customers are as follows:

Mode of payments	% of sales
Cash on delivery which is collected by the courier	60%
Advance payments through credit cards	40%

Cash collected by the courier is settled after every 7 days. The courier company's charges are Rs. 300 per order which are deducted on a monthly basis from the first payment due in the subsequent month. Payments through credit cards are credited by the bank in 7 days.

High value items which represent 25% of the sales through credit cards are dispatched after 15 days of receipt of payment. All other dispatches are made immediately and delivered on the same day.

Following further information is available:

i. Sales are made at cost plus 30%.

ii. Sales and sales orders are projected as under:

	Sep. 2015	Oct. 2015	Nov. 2015	Dec. 2015	Jan. 2016
Sales (Rs.)	4,600,000	5,000,000	4,200,000	5,800,000	6,000,000
Sales orders (Nos.)	400	450	470	490	520

iii. High value items are purchased on receipt of the order. Stock level of other goods is maintained at 25% of projected sales of the next month. 40% of all purchases are paid in the same month whereas balance is paid in the next month.

iv. Purchases during the month of September 2015 amounted to Rs. 3.2 million.

v. Selling and administrative expenses are estimated at Rs. 50 million per annum and include depreciation of tangible and amortization of intangible assets amounting to Rs. 8 million and Rs. 2 million respectively.

vi. Cash and bank balances as at 30 September 2015 amounted to Rs. 5.5 million.

vii. Purchases/sales occur evenly throughout the quarter.

A cash budget of QJ for the quarter ending 31 December 2015 is as follows (Month-wise cash budget is not required)

Receipts:		Rs. in '000'
Collection from sales excluding 10% sales of high valued items:		
- 7 days sale in September received in October	(4,600÷30×7×90%)	966
- Sales for the quarter ending 31 December 2015	(5,000+4,200+5,800)×90%	13,500
- 7 days sale in December collected in January 2015	(5,800/30×7×90%)	(1,218)
		13,248

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Receipts:		**Rs. in '000'**
Collection in advance from 10% sales of high valued items:		
- 8 days(15-7) sales in October received in September	(5,000/30×8×10%)	(133)
- Sales for the quarter ending 31 December 2015	(5,000+4,200+5,800)×10%	1,500
- 8 days sale of Jan. 2016 collected in Dec. 2015	(6,000÷30×8×10%)	160
		1,527
Deduction of courier charges from collection		
- No. of orders recorded in the previous month	(400+450+470)	1,320
- No. of high value orders of Aug. delivered in Sep. 2015		-
- No. of high value orders of Nov. delivered in Dec. 2015	(470×10%÷2)	(24)
No. of orders delivered previous month		1,296
Courier charges at Rs. 300 per order	1,296×300	(389)
Total collection for the quarter		14,386
Payments:		
Cost of sales for the quarter (cost plus 30%)	(5,000+4,200+5,800)÷1.3	11,538
Opening stock 1 October 2015	5,000×90%×25%÷1.3	(865)
Closing stock 31 December 2015	6,000×90%×25%÷1.3	1,038
Purchases		11,712
60% of Sept. purchases paid in Oct.	(3,200×60%)	1,920
60% of Dec. purchases to be paid in Jan. 2016	(W.1) 4,496×60%	(2,698)
Payments for purchases		10,934
Expenses paid excluding depreciation and amortization	(50,000-8,000-2,000)÷4	10,000
Net outflow for the quarter ended 31 December 2015		(6,548)
Cash and bank balances as at 1 October 2015		5,500
Cash and bank balances as at 31 December 2015 - Overdraft		(1,048)
W.1: Purchases for December 2015		
Cost of sales for Dec. 2015 (cost plus 30%)	5,800÷1.3	4,462
Opening stock 1 December 2015	4,462×90%×25%	(1,004)
Closing stock 31 December 2015	6,000×90%×25%÷1.3	1,038
Purchases		4,496

► *Example 12:*

The home appliances division of Umair Enterprises assembles and markets television sets. The company has a long term agreement with a foreign supplier for the supply of electronic kits for its television sets.

Relevant details extracted from the budget for the next financial year are as follows:

	Rupees
C&F value of each electronic kit	9,500
Estimated cost of import related expenses, duties etc.	900
Variable cost of local value addition for each set	3,500
Variable selling and admin expenses per set	900
Annual fixed production expenses	12,000,000
Annual fixed selling and admin expenses	9,000,000

Fixed production overheads are allocated on the basis of budgeted production which is 5,000 units.

The present supply chain is as follows:

i. The company sells to distributors at cost of production plus 25% mark-up.
ii. Distributors sell to wholesalers at 10% margin.
iii. Wholesalers sell to retailers at 4% margin.
iv. Retailers sell to consumers at retail price i.e. at 10% mark-up on their cost.

Performance of the division had not been satisfactory for the last few years. A business consulting firm was hired to assess the situation and it has recommended the following steps:

a) Reduce the existing supply chain by eliminating the distributors and wholesalers.
b) Reduce the retail price by 5%.
c) Offer sales commission to retailers at 15% of retail price.
d) Provide after sales services.
e) Launch advertisement campaign; expected cost of campaign would be around Rs. 5 million.

It is expected that the above steps will increase the demand by 1,500 sets. The average cost of providing after sales service is estimated at Rs. 450 per set.

a) The total budgeted profit under the present situation; and if the recommendations of the consultants are accepted and implemented are as follows:

Budgeted cost and sales price per set	Rupees
C & F value	9,500
Import related costs and duties	900
Variable cost of local value addition	3,500
Variable cost per set	13,900
Fixed production overheads (Rs. 12,000,000/5,000 sets)	2,400
Budgeted cost of production per set	16,300
Add: Gross profit (Rs. 16,300 × 25%)	4,075
Budgeted sales price per set to distributor	20,375

	Rupees
Budgeted gross profit (Rs 4,075 × 5,000 sets)	20,375,000
Less: Admin & selling expenses	
Variable (Rs. 900 × 5,000 sets)	(4,500,000)
Fixed	(9,000,000)
Budgeted annual profit	6,875,000

Computation of budgeted consumer price of each set	
Budgeted sales price of the company	20,375.00
Add: distributor margin (Rs. 20,375 × 10/90)	2,263.88
Budgeted sales price of the distributor	22,638.88
Add: wholesaler margin (Rs. 22,638.88 × 4/96)	943.29
Budgeted sales price of wholesaler	23,582.17
Add: retailer's markup (Rs. 23,582.17 × 10%)	2,358.21
Budgeted retail price	25,940.39
Revised retail price (Rs. 25,940.39 × 95%)	**24,643.37**

Revised profit forecast after considering consultants' recommendation:	
	Rupees
Sales (6,500 sets × Rs. 24,643.37)	160,181,905
Less: Cost of goods sold for 6,500 units	
Electronic Kits @ Rs 9,500	61,750,000
Cost of import and duty @ Rs 900	5,850,000
Local value addition @ Rs 3,500	22,750,000
Fixed overhead cost	12,000,000
	(102,350,000)
Gross Profit	57,831,905
Less: **Selling & Admin expenses**	
Variable (6,500 sets × Rs 900)	5,850,000
Fixed	9,000,000
Cost of advertisement campaign	5,000,000
Cost of after-sale service (6,500 × Rs. 450)	2,925,000
Retailers commission (Rs. 160,181,905 × 15%)	24,027,285
	(46,802,285)
Profit by implementing the proposal of consultant	11,029,620
Based on above results, management should accept the recommendation of the consultant.	

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b) Description of what other factors would you consider while implementing the consultants' recommendations are as follows.

In the light of the changes recommended by the consultant, the company will have to consider whether it has the necessary infrastructure to:

i. deal with a far larger number of retailers as against the present few distributors.

ii. produce and sell extra 30% t.v. sets.

iii. attend to after sale activities on its own. The question is silent as to who presently attends to this activity.

iv. conduct effective advertisement campaign.

Fixed expenses related to manufacturing as well as selling and admin are likely to increase but no such increase has been anticipated.

► *Example 13:*

RS Enterprises is a family concern headed by Mr. Rameez. It is engaged in manufacturing of a single product but under two brand names i.e. A and B. Brand B is of high quality and over the past many years, the company has been charging a 60% higher price as compared to brand A. As the company has progressed, Mr. Rameez has felt the need for better planning and control. He has compiled the following data pertaining to the year ended November 30,20X8:

	Rupees	Rupees
Sales		5,522,400
Production costs:		
Raw materials	2,310,000	
Direct labor	777,600	
Overheads	630,000	3,717,600
Gross profit		1,804,800
Selling and administration expenses		800,000
		1,004,800

	A	B
No. of units sold	5400	3600
Labor hours required per unit	5	6

Other information is as follows:

i. 20% of B was sold to a corporate buyer who was given a discount of 10%. The buyer has agreed to double the purchases in 20X9 and Mr. Rameez has agreed to increase the discount to 15%.

ii. In view of better margins in B, Mr. Rameez has decided to promote its sale at a cost of Rs. 250,000. As a result, its sales to customers other than the corporate customer, are expected to increase by 30%. However, the production capacity is limited. He intends to reduce the production/sale of A if necessary. Mr. Rameez has ascertained that 90% capacity was utilized during the year ended November 30, 20X8 whereas the time required to produce one unit of B is 20% more than the time required to produce a unit of A.

iii. 2.4 kgs of the same raw material is used for both brands but the process of manufacturing B is slightly complex and 10% of all raw material is wasted in the process. Wastage in processing A is 4%.

iv. The price of raw material has remained the same for the past many years. However, the supplier has indicated that the price will be increased by 10% with effect from March 1, 20X9.

v. Direct labor per hour is expected to increase by 15%.

vi. 40% of production overheads are fixed. These are expected to increase by 5%. Variable overheads per unit of B are twice the variable overheads per unit of A. For 20X9, the effect of inflation on variable overheads is estimated at 10%.

vii. Selling and administration expenses (excluding the cost of promotional campaign on B) are expected to increase by 10%.

A profit forecast statement for the year ending November 30, 20X9 would be prepared as follows.

Computation of Sales for 20X8				
	A	B Normal	B Corporate	Total
Ratio of sale price	1.00	1.60	1.44	
Actual sale Qty	5,400.00	2,880.00	720.00	
Ratio of sale value	5,400.00	4,608.00	1,036.80	11,044.80
Sales value	2,700,000.00	2,304,000.00	518,400.00	5,522,400.00

	A	B
Current year's production (at 90% capacity)	5,400.00	3,600.00
Production at full capacity	6,000.00	4,000.00

If only B is produced the company can produce 9,000 units (4,000 + 6,000 / 1.2).

Required production of B in the next year = (2,880 x 1.3) + (2 x 720) = 3744 + 1440 = 5,184 units

Remaining capacity can be utilized to produce 4,579 units of A [(9,000 - 5,184) x 1.2].

Computation of Sales for 20X9	Rupees
Sales of A (4,579 x 500)	2,289,500
Sales of B (5,184 x 800)	4,147,200
	6,436,700
Discount to Corporate customer (1,440 × 800 × 15%)	172,800
	6,263,900

Consumption of Raw Material	Kgs
Consumption of raw material in 20X8 (A: 5,400 x 2.4 / 0.96)	13,500.00
Consumption of raw material in 20X8 (B: 3,600 x 2.4 / 0.90)	9,600.00
Total	23,100.00
	Rupees
Price per kg of raw material (2,310,000 / 23,100)	100.00
Total expected consumption in 20X9 (A: 4,579 x 2.4 / 0.96)	11,447.50
Total expected consumption in 20X9 (B: 5,184 x 2.4 / 0.90)	13,824.00
Total consumption for 20X9	25,271.50
Average price for 20X9 ((100 x 3) + (110 x 9)) / 12	107.50
Total cost of raw material for 20X9	2,716,686.25

Computation of Direct Labor	Hours
Labor hours used in 20X8 (A: 5,400 × 5)	27,000
Labor hours used in 20X8 (B: 3,600 × 6)	21,600
	48,600
Labor hours forecast for 20X9 (A: 4,579 × 5)	22,895
Labor hours forecast for 20X9 (B: 5,184 × 6)	31,104
	53,999
Increase in labor hours	5,399
Labor cost for 20X9 (1.15 x (777,600 x 53,999 / 48,600))	Rs. 993,582

Production overheads for 20X8 :	Rupees
Fixed overheads (40% x 630,000)	252,000.00
Variable overheads (630,000-252,000)	378,000.00

		A	B	Total
Ratio of variable overheads		1.00	2.00	
Total units produced		5,400.00	3,600.00	
Product (units)	**(K)**	5,400.00	7,200.00	12,600.00
Total variable overheads (Rs.)	**(L)**	162,000.00	216,000.00	378,000.00
Per unit variable overheads (Rs.)	**(L /K)**	30.00	60.00	

Production overheads for 20X9:	A	B	Total
Fixed overheads (1.05 x 252,000) (Rs.)			264,600.00
Per unit variable overheads (Rs.)	33.00	66.00	
Total units	4,579	5,184	
Total variable overheads (Rs.)	151,107.00	342,144.00	493,251.00
Total overheads (Rs.)			757,851.00

PROFIT FORECAST STATEMENT FOR 20X9	Rupees	
Sales		6,263,900.00
Material	2,716,686.25	
Labor	993,582.00	
Overheads	757,851.00	4,468,119.25
Gross margin		1,795,780.75
Selling and administration expenses (800,000 x 1.1) + 250,000		1,130,000.00
		665,780.75

STICKY NOTES

Forecasting uses historical data to make informed decisions about the businesses' future. Types of forecast involve Demand (sales) forecast, Economic forecast, Technological forecast

Qualitative methods of forecasting include market research, jury of executive opinion, Delphi method & Estimates of the sales force.

Quantitative methods of forecasting include time series models (trend projections, moving averages & Naïve approaches) and causal models (linear Regression method)

Budgeting refers to preparing a list of guidelines for expenditures for future and it is usually done a year in advance. Purposes of budget include planning, control, decision making, resource allocation as well as coordination and communication.

There are also fixed or flexible budgets where contextual situations and business environments are known or varied respectively.

Types of budget include from sales and production budget, direct material & labor budget, manufacturing overhead to cash and capital expenditure budget. A master budget entails all the segments of the budget into one collective process; also called corporate budget.

Zero based budgeting means preparing budget from a zero base each time. Past actions or impact are less likely to impact future decisions.

Budgeting in Non-Profit organizations are similar to corporate budgeting process, except for the fact that the budget for non-profit organizations are not designed with a focus on profitability.

There are some human and motivational aspects in budgeting process too. These include budgetary slack, dysfunctional behavior, budgetary styles as well as motivation to complete the process.

CHAPTER 10

STANDARD COSTING

IN THIS CHAPTER

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Standard costing is the preparation of standard costs to assist setting budgets and evaluating managerial performance.

A standard cost is carefully predetermined estimated unit cost. It is usually a standard cost per unit of production or per unit of service rendered.

A standard cost when established is an average expected unit cost because it is only an average actual results will vary to some extent above and below the average.

The difference between standard and actual is known as variance. The process by which the total difference between standard and actual results is analyzed in known as variance analysis.

1. USING AND DERIVING STANDARD COSTS

1.1 Standard costing

Standard costing involves the establishment of predetermined estimates of the costs of products or services, the collection of actual costs and the comparison of the actual results with the predetermined estimates. The predetermined costs are known as standard costs and the difference between standard and actual is known as variance.

- Standard cost is an estimated or predetermined cost of performing an operation or producing a good or service, under normal conditions.
- Standard costing is a control technique that reports variances by comparing actual costs to pre-set standards so facilitating action through management by exception.

Standard costing may be used with either a system of absorption costing or a system of marginal costing.

In simple words…

Standard costing involves using an expected cost (standard cost) as a substitute for actual cost in the accounting system. Periodically the standard costs are compared to the actual costs. Differences between the standard and actual are recorded as variances in the costing system.

When is standard costing appropriate?

Standard costing can be used in a variety of situations.

- It is most useful when accounting for homogenous goods produced in large numbers, when there is a degree of repetition in the production process.
- A standard costing system may be used when an entity produces standard units of product or service that are identical to all other similar units produced.
- Standard costing is usually associated with standard products, but can be applied to standard services too.

A standard unit should have exactly the same input resources (direct materials, direct labor time) as all other similar units, and these resources should cost exactly the same. Standard units should therefore have the same cost.

1.2 Standard cost

A **standard cost is a predetermined unit cost** based on expected direct materials quantities and expected direct labor time, and priced at a predetermined rate per unit of direct materials and rate per direct labor hour and rate per hour of overhead.

Standard costs of products are usually restricted to production costs only, not administration and selling and distribution overheads.

Overheads are normally absorbed into standard production cost at an absorption rate per direct labor hour.

► *Example 01:*

The standard cost of a Product XYZ might be:

	Rs.	Rs.
Direct materials:		
Material A: 2 litres at Rs.4.50 per litre	9.00	
Material B: 3 kilos at Rs.4 per kilo	12.00	
		21.00

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	Rs.	Rs.
Direct labor		
Grade 1 labor: 0.5 hours at Rs.20 per hour	10.00	
Grade 2 labor: 0.75 hours at Rs.16 per hour	12.00	
		22.00
Variable production overheads: 1.25 hours at Rs.4 per hour		5.00
Fixed production overheads: 1.25 hours at Rs.40 per hour		50.00
Standard (production) cost per unit		98.00

Who sets standard costs?

Standard costs are set by managers with the expertise to assess what the standard prices and rates should be. Standard costs are normally reviewed regularly, typically once a year as part of the annual budgeting process.

- Standard prices for direct materials should be set by managers with expertise in the purchase costs of materials. This is likely to be a senior manager in the purchasing department (buying department).
- Standard rates for direct labor should be set by managers with expertise in labor rates. This is likely to be a senior manager in the human resources department (personnel department).
- Standard usage rates for direct materials and standard efficiency rates for direct labor should be set by managers with expertise in operational activities. This may be a senior manager in the production or operations department, or a manager in the technical department.
- Standard overhead rates should be identified by a senior management accountant, from budgeted overhead costs and budgeted activity levels that have been agreed in the annual budgeting process.

1.3 The uses of standard costing

Standard costing has four main uses.

- It is an alternative system of cost accounting. In a standard costing system, all units produced are recorded at their standard cost of production.
- When standard costs are established for products, they can be used to prepare the budget.
- It is a system of **performance measurement**. The differences between standard costs (expected costs) and actual costs can be measured as variances. Variances can be reported regularly to management, in order to identify areas of good performance or poor performance.
- It is also a system of **control reporting.** When differences between actual results and expected results (the budget and standard costs) are large, this could indicate that operational performance is not as it should be, and that the causes of the variance should be investigated. Management can therefore use variance reports to identify whether control measures might be needed, to improve poor performance or continue with good performances.

When there are large adverse variances, this might indicate that actual performance is poor, and control action is needed to deal with the weaknesses.

When there are large favorable variances, and actual results are much better than expected, management should investigate to find out why this has happened, and whether any action is needed to ensure that the favorable results continue in the future.

Variances and controllability

The principle of controllability should be applied in any performance management system

When variances are used to measure the performance of an aspect of operations, or the performance of a manager, they should be reported to the manager who is:

- responsible for the area of operations to which the variances relate, and
- able to do something to control them.

There is no value or practical purpose in reporting variances to a manager who is unable to do anything to control performance by sorting out problems that the variances reveal and preventing the variances from happening again.

It is also unreasonable to make a manager accountable for performance that is outside his control, and for variances that he can do nothing about.

1.4 Deriving a standard cost

A standard variable cost of a product is established by building up the standard materials, labor and production overhead costs for each standard unit. This will be the standard cost in marginal costing system.

In a standard absorption costing system, the standard fixed overhead cost is a standard cost per unit, based on budgeted data about fixed costs and the budgeted production volume.

Deriving the standard usage for materials

The standard usage for direct materials can be obtained by using:

- historical records for material usage in the past, or
- the design specification for the product

Deriving the standard efficiency rate for labor

The standard efficiency rate for direct labor can be obtained by using:

- historical records for labor time spent on the product in the past, or
- making comparisons with similar work and the time required to do this work, or
- 'time and motion study' to estimate how long the work ought to take

Deriving the standard price for materials

The standard price for direct materials can be estimated by using:

- historical records for material purchases in the past, and
- allowing for estimated changes in the future, such as price inflation and any expected change in the trade discounts available

Deriving the standard rate of pay for labor

Not all employees are paid the same rate of pay, and there may be differences to allow for the experience of the employee and the number of years in the job. There is also the problem that employees may receive an annual increase in pay each year to allow for inflation, and the pay increase may occur during the middle of the financial year.

- The standard rate of pay per direct labor hour will be an average rate of pay for each category or grade of employees.
- The rate of pay may be based on current pay levels or on an expected average pay level for the year, allowing for the expected inflationary pay rise during the year.

► *Example 02:*

A company produces bookshelves. Each bookshelf requires three planks of wood. A box of wood contains 15 planks and costs Rs.45.

Currently 20% of wood is wasted during production. Management would like to reduce this wastage to 10%.

Calculate a standard material cost for a bookshelf based on

a) Ideal conditions
Standard cost per plank = Rs.45/15 planks = Rs.3 per plank
Ideal standard: 3 planks × Rs.3 = Rs.9 per bookshelf

b) Current conditions
Current standard: 3/0.80 planks = 3.75 planks at Rs.3 = Rs.11.25 per bookshelf

c) Attainable conditions
Attainable or target standard: 3/0.9 = 3.33 planks at Rs.3 = Rs.10 per bookshelf

1.5 Types of standard & their behavioral aspects

Standards are predetermined estimates of unit costs but how is the level of efficiency inherent in the estimate determined? Should it assume perfect operating conditions or should it incorporate an allowance for waste and idle time? The standard set will be a performance target and if it seen as unattainable this may have a detrimental impact on staff motivation. If the standard set is too easy to attain there may be no incentive to find improvements.

There are four types of standard, and any of these may be used in a standard costing system. One of the purposes of standard costing is to set performance standards that motivate employees to improve performance. The type of standard used can have an effect on motivation and incentives. The types of standards and their behavioral aspects are given below:

Ideal standards.

These assume perfect operating conditions. No allowance is made for wastage, labor inefficiency or machine breakdowns. The ideal standard cost is the cost that would be achievable if operating conditions and operating performance were perfect. In practice, the ideal standard is not achieved.

Ideal standards are unlikely to be achieved. They may be very useful as long term targets and may provide senior managers with an indication of the potential for savings in a process but generally the ideal standard will not be achieved. Consequently, the reported variances will always be adverse. Employees may be becoming de-motivated when their performance level is always worse than standard and they know that the standard is unachievable.

Attainable standards.

These assume efficient but not perfect operating conditions. An allowance is made for waste and inefficiency. However, the attainable standard is set at a higher level of efficiency than the current performance standard, and some improvements will therefore be necessary in order to achieve the standard level of performance.

Attainable standards are the most likely to motivate employees to improve performance as they are based on challenging but attainable targets. It is for this reason that standards are often based on attainable conditions. However, a problem with attainable standards is deciding on the level of performance that should be the target for achievement. For example, if an attainable standard provides for some improvement in labor efficiency, should the standard provide for a 1% improvement in efficiency, or a 5% improvement, or a 10% improvement?

Current standards.

These are based on current working conditions and what the entity is capable of achieving at the moment. Current standards do not provide any incentive to make significant improvements in performance, and might be considered unsatisfactory when current operating performance is considered inefficient.

Current standards may be useful for producing budgets as they are based on current levels of efficiency and may therefore give a realistic guide to resources required in the production process. However current standards are unlikely to motivate employees to improve their performance, unless there are incentives for achieving favorable variances (for achieving results that are better than the standard), such as annual cash bonuses.

Basic standards.

These are standards which remain unchanged over a long period of time. Variances are calculated by comparing actual results with the basic standard, and if there is a gradual improvement in performance over time, this will be apparent in an improving trend in reported variances.

Basic standards will not motivate employees to improve their performance as they are based on achievable conditions at some time in the past. They are also not useful for budgeting because they will often be out of date. In practice, they are the least common type of standard.

When there is waste in production, or when idle time occurs regularly, current standard costs may include an allowance for the expected wastage or expected idle time. This is considered in more detail later.

1.6 Reviewing standards

How often should standards be revised? There are several reasons why standards should be revised regularly.

Regular revision leads to standards which are meaningful targets that employees may be motivated to achieve (for example, through incentive schemes).

Variance analysis is more meaningful because reported variances should be realistic.

In practice, standards are normally reviewed annually. Standards by their nature are long-term averages and therefore some variation is expected over time. The budgeting process can therefore be used to review the standard costs in use.

2. ALLOWING FOR WASTE AND IDLE TIME

2.1 Materials wastage in standard costing

Waste is an unavoidable feature of some production processes. The actual amount of materials wasted may vary from one period to another, but there may be a standard rate of wastage or a 'normal' rate of loss which is a measure of the average rate of wastage or loss.

An allowance for expected loss can be included in a standard cost. The standard cost can be based on the expected quantity of input materials required to produce one unit of output (which is the same principle as that used for normal loss in process costing).

▶ *Example 03:*

A company manufactures a product in a process production system. There is some wastage in production, and normal loss is 10% of the number of units input to the process. One unit of raw material is required to produce one unit of finished goods.

The standard price per unit of direct material is Rs.4.50 per unit.

a) If an ideal standard is used, and the standard does not provide for any loss in process, standard direct material cost per unit of output would be as follows

Ideal standard

No loss; therefore, standard cost =

1 unit of direct materials at Rs.4.50 per unit of material = Rs.4.50 per unit of output.

b) If the standard cost allows for a loss of 10% of input materials in producing each unit of output, then Standard Direct material cost per unit of output would be:

Attainable or current standard: allow for 10% loss

Standard input to produce one unit of = 1/0.9 units = 1.111 units.

Therefore, standard cost =

1.111 units of materials at Rs.4.50 per unit = Rs.5 per unit of output.

▶ *Example 04:*

A company produces sandwiches. Each sandwich requires two slices of bread and a loaf of bread contains 24 slices. Each loaf of bread costs Rs.6. It is estimated that currently 20% of bread is wasted. Management would like to reduce this wastage to 10%.

Calculation of a standard material cost for a sandwich based on various conditions are given below

a) Ideal conditions

Standard cost per slice of bread = Rs.6/24 slices = Rs.0.25

Ideal standard: 2 slices × Rs.0.25 = Rs.0.50

b) Current conditions

Current standard: 2/0.80 slices = 2.5 slices at Rs.0.25 = Rs.0.625

c) Attainable conditions

Attainable or target standard: 2/0.9 = 2.22 slices at Rs.0.25 = Rs.0.555.

Note that the current and attainable standard costs include an allowance for wastage, and a materials usage variance will occur only if the actual wastage rate differs from the standard wastage rate.

2.2 Idle time and standard costing

Idle time occur when the direct labor employees are being paid but have no work to do. The causes of idle time may be:

- A breakdown in production, for example a machine breakdown that halts the production process
- Time spent waiting for work due to a bottleneck or hold-up at an earlier stage in the production process
- Running out of a vital direct material, and having to wait for a new delivery of the materials from a supplier.
- A lack of work to do due to a lack of customer orders.

A feature of idle time is that it is recorded, and the hours 'lost' due to idle time are measured.

Sometimes idle time may be an unavoidable feature of the production process, so that an allowance for idle time is included in the standard cost.

Methods of including idle time in standard costs

There are different ways of allowing for idle time in a standard cost.

- **Method 1.** Include idle time as a separate element of the standard cost, so that the standard cost of idle time is a part of the total standard cost per unit.
- **Method 2.** Allow for a standard amount of idle time in the standard hours per unit for each product. This is the same approach described above for materials wastage and standard costing. The standard hours per unit therefore include an allowance for expected idle time.

► *Example 05:*

A company manufactures Product X. Due to the nature of the production process, there is some idle time and it has been estimated that the 'normal' amount of idle time is 10% of hours worked.

Ignoring idle time, the standard time to make 1 unit of Product X is 0.36 hours. Labor is paid Rs.18 per hour.

This means that the labor time to make 1 unit of product X is 0.36/0.90 = 0.40 hours, of which 0.04 hours are idle time.

There are two ways of making an allowance for in the standard cost the expected idle time.

Method 1: Include idle time as a separate element of the standard cost. The standard cost per unit will include the following items:

	Rs.
Active hours worked: 0.36 hours × Rs.18 per hour	6.48
Idle time: 0.04 hours × Rs.18 per hour	0.72
	7.20

Method 2: Include an allowance for expected idle time in the standard hours per unit for each product.

Standard cost = 0.40 hours × Rs.18 per hour = Rs.7.20

3. COMPREHENSIVE EXAMPLES

- *Example 01:*

A company manufactures two products, X and Y. In Year 1 it budgets to make 2,000 units of Product X and 1,000 units of Product Y. Budgeted resources per unit and costs are as follows:

	Product X	Product Y
Direct materials per unit:		
Material A	2 units of material	1.5 units of material
Material B	1 unit of material	3 units of material
Direct labor hours per unit	0.75 hours	1 hour
Costs		
Direct material A	Rs.4 per unit	
Direct material B	Rs.3 per unit	
Direct labor	Rs.20 per hour	
Variable production overhead	Rs.4 per direct labor hour	

Fixed production overheads per unit are calculated by applying a direct labor hour absorption rate to the standard labor hours per unit, using the budgeted fixed production overhead costs of Rs.120,000 for the year.

The standard full production cost per unit of product X and Y are as follows

First calculate the budgeted overhead absorption rate.

Budgeted direct labor hours	hours
Product X: (2,000 units × 0.75 hours)	1,500
Product Y (1,000 units × 1 hour)	1,000
	2,500
Budgeted fixed production overheads	Rs.120,000
Fixed overhead absorption rate/hour	Rs.48

	Product X		Product Y	
		Rs.		Rs.
Direct materials				
Material A	(2 units × Rs.4)	8	(1.5 units × Rs.4)	6
Material B	(1 unit × Rs.3)	3	(3 units × Rs.3)	9
Direct labor	(0.75 hours × Rs.20)	15	(1 hour × Rs.20)	20
Variable production overhead	(0.75 hours × Rs.4)	3	(1 hour × Rs.4)	4
Standard variable prod’n cost		29		39
Fixed production overhead	(0.75 hours × Rs.48)	36	(1 hour × Rs.48)	48
Standard full production cost		65		87

- *Example 02:*

A company manufactures two products, Laurel and Hardy. In Year 1 it budgets to make 6,000 units of Product Laurel and 2,000 units of Product Hardy. Budgeted resources per unit and costs are as follows:

	Laurel	Hardy
Direct materials per unit:		
Material X	3 kg	1kg
Material Y	2 kg	6 kg
Direct labor hours per unit	1.6 hours	3 hours
Budgeted Costs		
Direct material X	Rs. 3 per unit	
Direct material Y	Rs. 4 per unit	
Direct labor	Rs. 25 per hour	
Variable production overhead	Rs. 5 per direct labor hour	

Fixed production overheads per unit are calculated by applying a direct labor hour absorption rate to the standard labor hours per unit, using the budgeted fixed production overhead costs of Rs.187,200 for the year.

The standard full production cost per unit of product Laurel and Hardy are as follows

First calculate the budgeted overhead absorption rate.

Budgeted direct labor hours	hours
Laurel: (6,000 units × 1.6 hours)	9,600
Hardy (2,000 units × 3 hours)	6,000
	15,600
Budgeted fixed production overheads	Rs. 187,200
Fixed overhead absorption rate/hour	Rs. 12 / hour

	Laurel		Hardy	
		Rs.		Rs.
Direct materials				
Material X	(3 kg × Rs. 3)	9	(1 kg × Rs. 3)	3
Material Y	(2 kg × Rs.4)	8	(6 kg × Rs. 4)	24
Direct labor	(1.6 hrs × Rs.25)	40	(3 hrs × Rs.25)	75
Variable production overhead	(1.6 hrs × Rs.5)	8	(3 hrs × Rs.5)	15
Standard variable prod'n cost		65		117
Fixed production overhead	(1.6 hrs × Rs.12)	19.2	(3 hrs × Rs.12)	36
Standard full production cost		84.2		153

▶ *Example 03:*

A company manufactures Product Y. Due to the nature of the production process, there is some idle time and it has been estimated that the 'normal' amount of idle time is 20% of hours worked.

Ignoring idle time, the standard time to make 1 unit of Product Y is 0.56 hours. Labor is paid Rs.30 per hour.

Calculate the standard cost of the expected idle time using each of the following three methods:

i. Include idle time as a separate element of the standard cost

ii. Include an allowance for expected idle time in the standard hours and standard cost

The labor time to make 1 unit of product X is 0.56/0.80 = 0.70 hours, of which 0.14 hours are idle time.

i. Include idle time as a separate element of the standard cost.

The standard cost per unit will include the following items:

	Rs.
Active hours worked: 0.56 hours × Rs.30 per hour	16.80
Idle time: 0.14 hours × Rs.30 per hour	4.20
	21.00

ii. Include an allowance for expected idle time in the standard hours and in standard cost.

Standard cost = 0.70 hours × Rs.30 per hour = Rs.21.00

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STICKY NOTES

A standard is a pre-determined unit of cost for stock valuation, budgeting and control

A standard cost card shows full details of the standard cost of each product

The standard for each type of cost (material, labor and Overhead) is made up of a standard resource price and a standard resource usage

The difference between standard and actual is known as a variance. The process by which the total difference between standard and actual results is analyzed in known as variance analysis.

Performance standards are used to set efficiency targets. There are four types: Ideal, Current, Basic and Attainable

There may be a standard rate of wastage or a 'normal' rate of loss which is a measure of the average rate of wastage or loss. An allowance for expected loss can be included in a standard cost.

CHAPTER 11

VARIANCE ANALYSIS

IN THIS CHAPTER

AT A GLANCE

A budget is a standard, set to coordinate between different departments and managers.

We prepare budgets to motivate managers and to evaluate their performance.

The original budget prepared at the beginning of a budget period is known as the fixed budget. When we shift our standard for actual activity it is called flexed budget.

Variances are calculated for control purposes.

Total Cost variances are to be calculated by comparing total standard cost with total actual cost.

Total material, labor and overhead variances can be calculated by comparing total standard cost with total Actual cost respectively.

Material variance can be divided into material Price and usage variance.

Labor variance can be divided into labor rate and efficiency variance.

Variable overhead can vary with number of units or with number of hours.

Fixed overhead variances are Expenditure and volume variances.

For all cost variances if actual cost is greater than standard it is an adverse variance.

Variances can be interrelated for example an adverse material usage variance may be due to favorable material price variance.

Mix variances are to be calculated where there is more than one type of material or labor involved.

Work back of variance is where we have to calculate actual and standard cost from variances given.

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1. STANDARD COST AND BUDGETS

Business entities plan their future activities. This is often done through the drafting of budgets. A budget is a formal plan (for a specified time period), expressed mainly in financial terms and covering all the activities of the entity.

Standard costing is a component of budgeting in some companies. It is appropriate for companies engaged in mass production of large numbers of homogenous (identical) items where there is a great deal of repetition in the production process. In such cases it is relatively straightforward to identify a standard unit of output (cost unit) and to establish how much making a single unit should cost.

Standard costs are constructed by estimating the quantities of standard amounts of input (for example materials and labor) and estimating the cost of buying these over the future period covered by the standard.

Companies can often measure the standard quantities with a high degree of confidence. Remember that standard costing is appropriate in conditions of high production numbers and a lot of repetition. In an environment in which the future could be predicted with a reasonable degree of certainty. Companies might make thousands of items and this experience leads to knowledge of the process and a better idea of cost structure and flow of costs through the process.

Standard costs for a unit are often set out in a record called a standard cost card. A typical standard cost card is as follows.

▶ *Example 01:*

Standard cost card (Marden Manufacturing Limited)

		Rs.
Direct materials	5 kg @ Rs.1,000 per kg	5,000
Direct labor	4 hours @ Rs. 500 per hour	2,000
Variable overhead	4 hours @ Rs. 200 per hour	800
Marginal production cost		7,800
Fixed production overhead	4 hours @ Rs. 600 per hour	2,400
Total absorption cost		10,200

The above standard costs will be used in examples throughout this chapter to illustrate variance analysis.

Standard costs link to the budget through activity levels. For example, if a company wanted to make 1,200 of the above units the budget would show a material cost of Rs. 6,000,000 (1,200 ×Rs. 5,000)

1.1. Budgets and actual results for a period:

1.1.1.Fixed budget

The original budget prepared at the beginning of a budget period is known as the fixed budget. A fixed budget is a budget for a specific volume of output and sales activity, and it is the ‘master plan’ for the financial year that the company tries to achieve.

▶ *Example 02:*

Marden Manufacturing Limited has budgeted to make 1,200 units and sell 1,000 units in January.

The selling price per unit is budgeted at Rs. 15,000.

The standard costs of production are as given in the previous example.

The budget prepared for January is as follows:

Unit sales		1,000
Unit production		1,200

Budget		Rs. '000
Sales	(1,000 units ×15,000)	15,000
Cost of sales:		
Materials	(1,200 units ×Rs. 5,000 per unit)	6,000
Labor	(1,200 units ×Rs. 2,000 per unit)	2,400
Variable overhead	(1,200 units ×Rs. 800 per unit)	960
Fixed overhead	(1,200 units ×Rs. 2,400 per unit)	2,880
		12,240
Closing inventory	(200 units ×Rs. 10,200 per unit)	(2,040)
Cost of sales	(1,000 units ×Rs. 10,200 per unit)	(10,200)
Profit		4,800

Note: Budgeted profit = 1,000 units × (Rs. 15,000 –Rs. 10,200 per unit) = Rs. 4,800,000

One of the main purposes of budgeting is budgetary control and the control of costs. Costs can be controlled by comparing budgets with the results actually achieved.

Differences between expected results and actual results are known as variances. Variances can be either favorable (F) or adverse (A) depending on whether the results achieved are better or worse than expected.

Consider the following:

- *Example 03:*

At the end of January Marden Manufacturing Limited recorded its actual results as follows.

	Budget	Actual
Unit sales	1,000	900
Unit production	1,200	1,000
Budget	**Rs. '000**	**Rs. '000**
Sales	15,000	12,600

Cost of sales:	Budget	Actual
Materials	6,000	4,608
Labor	2,400	2,121
Variable overhead	960	945
Fixed overhead	2,880	2,500
	12,240	10,174
Closing inventory	(2,040)	(1,020)
Cost of sales	(10,200)	(9,154)
Profit	4,800	3,446

Note: The actual closing inventory of 100 units is measured at the standard cost of Rs. 10,200 per unit. This is what happens in standard costing systems. (in exam if question is silent about inventory measurement then actual closing inventory shall be measured at actual absorption cost.

What does this tell us?

The actual results differ from the budget. The company has not achieved its plan in January. Profit is less than budgeted. The company would like to understand the reason for this in as much detail as possible.

The technique that explains the difference between actual results and the budget is called variance analysis. This technique identifies the components of the difference between the budgeted profit and the actual profit in detail so that they can be investigated and understood by the company.

The sales figure is less than budgeted but why? The sales figure is a function of the quantity sold and the selling price per unit. The quantity sold is 100 units less than budgeted but what about the impact of any difference in the sales price?

At first sight it looks as if the company has made savings on every cost line. For example budgeted material cost was Rs. 6,000,000 but actual spend was only Rs. 4,608,000. However, this is not a fair comparison because the budgeted cost was to make 1200 units whereas the company only made 1,000 units.

1.1.2. Flexed budget

Variances are not calculated by comparing actual results to the fixed budget directly because the figures relate to different levels of activity and the comparison would not be like to like. A second budget is drawn up at the end of the period. This budget is based on the actual levels of activity and the standard revenue and standard costs. This budget is called a flexed budget.

- *Example 04:*

The flexed budget prepared by Marden Manufacturing Limited at the end of January (based on actual levels of activity and standard revenue per unit and standard cost per unit) is as follows:

Unit sales		900
Unit production		1,000
Budget		**Rs. '000**
Sales	(900 units ×15,000)	13,500

Cost of sales:		**Rs. '000**
Materials	(1,000 units ×Rs. 5,000 per unit)	5,000
Labor	(1,000 units ×Rs. 2,000 per unit)	2,000
Variable overhead	(1,000 units ×Rs. 800 per unit)	800
Fixed overhead	(1,000 units ×Rs. 2,400 per unit)	2,400
		10,200
Closing inventory	(100 units ×Rs. 10,200 per unit)	(1,020)
Cost of sales	(900 units ×Rs. 10,200 per unit)	(9,180)
Profit		4,320

This shows the amount that the company would have received for the actual number of units sold if they had been sold at the budgeted revenue per item.

It shows what the actual number of units produced (1,000 units) would have cost if they had been made at the standard cost.

The flexed budget is a vital concept. It sits at the heart of variance analysis.

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1.1.3. Comparison of actual results to the flexed budget.

All three statements can be combined as follows:

- *Example 05:*

Fixed budget, flexed budget and actual results for a period.

At the end of January, Marden Manufacturing Limited has recorded its actual results as follows (together with the original fixed budget and the flexed budget for the month).

	Fixed budget	Flexed budget	Actual
Unit sales	1,000	900	900
Unit production	1,200	1,000	1,000

	Budget	Actual	Actual
Budget	**Rs. '000**	**Rs. '000**	**Rs. '000**
Sales	15,000	13,500	12,600
Cost of sales:			
Materials	6,000	5,000	4,608
Labor	2,400	2,000	2,121
Variable overhead	960	800	945
Fixed overhead	2,880	2,400	2,500
	12,240	10,200	10,174
Closing inventory	(2,040)	(1,020)	(1,020)
Cost of sales	(10,200)	(9,180)	(9,154)
Profit	4,800	4,320	3,446

Note: The actual closing inventory of 100 units is measured at the standard total absorption cost of Rs. 10,200 per unit. This is what happens in standard costing systems. (in exam if question is silent about inventory measurement then actual closing inventory shall be measured at actual absorption cost

The information for Marden Manufacturing Limited's performance in January will be used throughout this chapter to illustrate variance analysis.

Note that the above example is unlikely to be something that you would have to produce in the exam. It is provided to help you to understand what variance analysis is about.

1.2. Variance Analysis

Variance analysis explains the difference between the fixed budget profit and the actual profit in detail. This paragraph provides an initial commentary for variances which will be explained in detail later.

Both the fixed budget and the flexed budget are based on the standard revenue per unit and the standard costs per unit. Therefore, the difference between the fixed budget profit and the flexed budget profit is caused only by difference in volume. This figure of Rs. 480,000 (Rs. 4,800,000 –Rs. 4,320,000) is called the **sales volume variance**.

Revenue is sales quantity × sales price per unit. The revenue in the flexed budget and the actual revenue are both based on the actual quantity sold. Therefore, the difference between the two figures of Rs. 900,000 (Rs. 13,500,000 –Rs. 12,600,000) is due to a difference in the selling price per unit. This difference is called **the sales price variance**.

The difference between each variable cost line in the flexed budget and the equivalent actual figure is a **total cost variance** for that item. For example, the actual results show that 1,000 units use material which cost Rs. 4,608,000. The flexed budget shows that these units should have used material which cost Rs. 5,000,000. The difference of Rs. 392,000 is due to a combination of the actual material used being different to the budgeted usage of 5kgs per unit and the actual price per kg being different to the budgeted price per kg. In other words, the total variance can be explained in terms of usage and price.

Variable cost variances can be calculated for all items of variable cost (direct materials, direct labor and variable production overhead). The method of calculating the variances is similar for each variable cost item.

The total cost variance for the variable cost item is the difference between the actual variable cost of production and the standard variable cost of producing the items.

However, the total cost variance is not usually calculated. Instead, the total variance is calculated in two parts, that add up to the total cost variance:

- a price variance or rate variance or expenditure per hour/per kg variance.
- a usage or efficiency variance.

The difference between the fixed overhead in the flexed budget and the actual fixed overhead is over absorption.

1.3. Cost variances

Adverse and favorable cost variances

In a standard costing system, all units of output are valued at their standard cost. Cost of production and cost of sales are therefore valued at standard cost.

Actual costs will differ from standard costs. A cost variance is the difference between an actual cost and a standard cost.

- When actual cost is higher than standard cost, the cost variance is adverse (A) or unfavorable (U).
- When actual cost is less than standard cost, the cost variance is favorable (F).

Different variances are calculated, relating to direct materials, direct labor, variable production overhead and fixed production overhead.

In a cost accounting system, cost variances are adjustments to the profit in an accounting period.

- Favorable variances increase the reported profit.
- Adverse variances reduce the reported profit.

The method of calculating cost variances is similar for all variable production cost items (direct materials, direct labor and variable production overhead).

A different method of calculating cost variances is required for fixed production overhead.

1.4. Variances and performance reporting

Variance reports are produced at the end of each control period (say, at the end of each month).

- Large adverse variances indicate poor performance, provided they are due to factors controllable by management, and the need for control action by management.
- Large favorable variances indicate unexpected good performance. Management might wish to consider how this good performance can be maintained in the future.

Variances might be reported in a statement for the accounting period that reconciles the budgeted profit with the actual profit for the period. This statement is known as an **operating statement**.

2. DIRECT MATERIALS VARIANCES

2.1 Direct materials: total cost variance

The total direct material cost variance is the difference between the actual material cost in producing units in the period and the standard material cost of producing those units.

▶ *Illustration:*

	Rs.
Standard material cost of actual production:	
Actual units produced × Standard kgs per unit × Standard price per kg	X
Actual material cost of actual production:	
Actual units produced × Actual kgs per unit × Actual price per kg	(X)
	X

The variance is adverse (A) if actual cost is higher than the standard cost, and favorable (F) if actual cost is less than the standard cost.

▶ *Example 06:*

For Marden Manufacturing Limited, following information is given.

Standard material cost per unit: (5kgs @Rs. 1,000 per kg) = Rs. 5,000 per unit

Actual production in period = 1,000 units.

Materials purchased and used: 4,850 kgs at a cost of Rs. 4,608,000

Direct materials total cost variance is calculated as follows:

	Rs. '000
Standard: 1,000 units should cost (@ Rs. 5,000 per unit)	5,000
Actual: 1,000 units did cost	(4,608)
Total cost variance (F)	392

The direct materials total cost variance can be analyzed into a price variance and a usage variance.

- A price variance measures the difference between the actual price paid for materials and the price that should have been paid (the standard price).
- A usage variance measures the difference between the materials that were used in production and the materials that should have been used (the standard usage).

▶ *Example 07:*

A unit of Product P123 has a standard cost of 5 liters of Material A at Rs.3 per liter. The standard direct material cost per unit of Product 123 is therefore Rs.15.

In a particular month, 2,000 units of Product 123 were manufactured. These used 10,400 liters of Material A, which cost Rs.33,600.

The total direct material cost variance is calculated as follows:

	Rs.	
2,000 units of output should cost (× Rs.15)	30,000	
They did cost	33,600	
Total direct materials cost variance	3,600	(A)

The variance is adverse, because actual costs were higher than the standard cost.

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2.2 Direct materials price variance

The price variance may be calculated for the materials purchased or materials used. Usually it is calculated at the point of purchase as this allows the material inventory to be carried at standard cost.

- *Illustration:*

	Rs.
Standard material cost of actual production:	
Actual kgs purchased × Standard price per kg	X
Actual material cost of actual purchases	
Actual kgs purchased × Actual price per kg	(X)
	X

- *Example 08:*

For Marden Manufacturing Limited, standard material cost per unit is (5kgs @Rs. 1,000 per kg) = Rs. 5,000 per unit

Actual production in period = 1,000 units.

Materials purchased and used: 4,850 kgs at a cost of Rs. 4,608,000

Direct materials price variance is calculated as follows:

	Rs. '000
Standard: 4,850 kgs should cost (@ Rs. 1,000 per kg)	4,850
Actual: 4,850 kgs did cost	(4,608)
Materials price variance (F)	242

If there are two or more direct materials, a price variance is calculated separately for each material.

- *Example 09:*

A unit of Product P123 has a standard cost of 5 liters of Material A at Rs.3 per liter. The standard direct material cost per unit of Product 123 is therefore Rs.15. In a particular month, 2,000 units of Product 123 were manufactured. These used 10,400 liters of Material A, which cost Rs.33,600.

The price variance is calculated on the quantity of materials purchased/used.

Materials price variance:

	Rs.	
10,400 litres of materials should cost (× Rs.3)	31,200	
They did cost	33,600	
Material price variance	2,400	(A)

The price variance is adverse because the materials cost more to purchase than they should have done (i.e. actual cost was higher than the standard or expected cost).

2.3 Direct materials usage variance

The usage variance is calculated by comparing the actual quantity of material used to make the actual production to the standard quantity that should have been used to produce those units. In other words, the actual usage of materials is compared with the standard usage for the actual number of units produced, The difference is the usage variance, measured as a quantity of materials. This is converted into a money value at the standard price for the material.

- *Illustration:*

	kgs
Standard quantity of material used to make the actual production	X
Actual quantity of material used to make the actual production	(X)
Usage variance (kgs)	X
Standard cost per kg (multiply by)	X
Usage variance (Rs.)	X

- *Example 10:*

For Marden Manufacturing Limited, standard material cost per unit: (5kgs @Rs. 1,000 per kg) = Rs. 5,000 per unit

Actual production in period = 1,000 units.

Materials purchased and used: 4,850 kgs at a cost of Rs. 4,608,000

Direct materials usage variance is calculated as follows:

	kgs
Standard: Making 1,000 units should have used (@ 5 kgs per unit)	5,000
Actual: Making 1,000 units did use	(4,850)
Usage variance (kgs) (F)	150
Standard cost per kg	Rs. 1,000
Usage variance (Rs.) (F)	Rs. 150,000

2.4 Alternative calculations

Variances can be calculated in a number of ways. A useful approach is the following line by line approach.

- *Formula:*

$AQ_{\text{purchased}} \times AC$	X		
		X	Price variance
$AQ_{\text{purchased}} \times SC$	X		
		X	Inventory movement
$AQ_{\text{used}} \times SC$	X		
		X	usage variance
$SQ_{\text{used}} \times SC$	X		

Where:

AQ = Actual quantity

AC = Actual cost per kg

SC = Standard cost per kg

SQ = Standard quantity needed to make actual production

- *Example 11:*

Alternative method for calculating material variances (Marden Manufacturing Limited)

Standard material cost per unit: (5kgs ×Rs. 1,000 per kg) = Rs. 5,000 per unit

Actual production in period = 1,000 units.

Materials purchased and used: 4,850 kgs at a cost of Rs. 4,608,000

	Rs. '000	Rs. '000
AQ $_{purchased}$× AC		
4,850 kgs×Rs. X per kg	4,608	
AQ $_{purchased}$× SC		242 (F) Price variance
4,850 kgs×Rs. 1,000 per kg	4,850	
AQ $_{used}$× SC		nil inventory movement
4,850 kgs×Rs. 1,000 per kg	4,850	
SQ $_{used}$× SC		150 (F) Usage variance
5,000 kgs×Rs. 1,000 per kg	5,000	
SQ = 1,000 units × 5 kgs per unit = 5,000 kgs		

- *Example 12:*

A unit of Product P123 has a standard cost of 5 liters of Material A at Rs.3 per liter.

The standard direct material cost per unit of Product 123 is therefore Rs.15. In a particular month, 2,000 units of Product 123 were manufactured.

These used 10,400 liters of Material A, which cost Rs. 33,600.

The direct material usage variance is calculated as follows

Materials usage variance

	litres	
2,000 units of Product P123 should use (× 5 litres)	10,000	
They did use	10,400	
Material usage variance in litres	400	(A)
Standard price per litre of Material A	Rs.3	
Material usage variance in Rs.	Rs.1,200	(A)

The usage variance is adverse because more materials were used than expected, which has added to costs.

2.5 Direct materials: possible causes of variances

When variances occur and they appear to be significant, management should investigate the reason for the variance. If the cause of the variance is something within the control of management, control action should be taken. Some of the possible causes of materials variances are listed below.

Materials price variance: causes

Possible causes of favorable materials price variances include:

- Different suppliers were used and these charged a lower price (favorable price variance) than the usual supplier.

- Materials were purchased in sufficient quantities to obtain a bulk purchase discount (a quantity discount), resulting in a favorable price variance.
- Materials were bought that were of lower quality than standard and so cheaper than expected.

Possible causes of adverse materials price variances include:

- Different suppliers were used and these charged a higher price (adverse price variance) than the usual supplier.
- Suppliers increased their prices by more than expected. (Higher prices might be caused by an unexpected increase in the rate of inflation.)
- There was a severe shortage of the materials, so that prices in the market were much higher than expected.
- Materials were bought that were better quality than standard and more expensive than expected.

Materials usage variance: causes

Possible causes of favorable materials usage variances include:

- Wastage rates were lower than expected.
- Improvements in production methods resulted in more efficient usage of materials (favorable usage variance).

Possible causes of adverse materials usage variances include:

- Wastage rates were higher than expected.
- Poor materials handling resulted in a large amount of breakages (adverse usage variance). Breakages mean that a quantity of materials input to the production process are wasted.
- Materials used were of cheaper quality than standard, with the result that more materials had to be thrown away as waste.

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3. DIRECT LABOR VARIANCES

3.1 Direct labor: total cost variance

The total direct labor cost variance is the difference between the actual labor cost in producing units in the period and the standard labor cost of producing those units.

- *Illustration:*

	Rs.
Standard labor cost of actual production:	
Actual units produced × Standard hrs per unit × Standard rate per hr	X
Actual labor cost of actual production:	
Actual units produced × Actual hours per unit × Actual rate per hour	(X)
	X

The variance is adverse (A) if actual cost is higher than the standard cost, and favorable (F) if actual cost is less than the standard cost.

- *Example 13:*

Direct labor – Total cost variance (Marden Manufacturing Limited)

Standard labor cost per unit: (4 hrs@Rs. 500 per hr) = Rs. 2,000 per unit

Actual production in period = 1,000 units.

Labor hours paid for: 4,200 hours at a cost of Rs. 2,121,000

Direct labor total cost variance is calculated as follows:

	Rs. '000
Standard: 1,000 units should cost (@ Rs.2,000 per unit)	2,000
Actual: 1,000 units did cost	(2,121)
Total cost variance (A)	121

The direct labor total cost variance can be analyzed into a rate variance and an efficiency variance. These are calculated in a similar way to the direct materials price and usage variances.

- A rate variance measures the difference between the actual wage rate paid to per labor hour and the rate that should have been paid (the standard rate of pay).
- An efficiency variance (or productivity variance) measures the difference between the time taken to make the production output and the time that should have been taken (the standard time).

3.2 Direct labor rate variance

The direct labor rate variance is calculated for the actual number of hours paid for.

The actual labor cost of the actual hours paid for is compared with the standard cost for those hours. The difference is the labor rate variance.

- *Illustration:*

	Rs.
Standard labor cost of actual production:	
Actual hours paid for × Standard rate per hour	X
Actual labor cost of actual purchases	
Actual hours paid for × Actual rate per hour	(X)
	X

- *Example 14:*

For Marden Manufacturing Limited), standard labor cost per unit: (4 hrs@Rs. 500 per hour) = Rs. 2,000 per unit

Actual production in period = 1,000 units.

Labor hours paid for: 4,200 hours at a cost of Rs. 2,121,000

Direct labor rate variance is calculated as follows:

	Rs. '000
Standard: 4,200 hours should cost (@ Rs. 500 per hour)	2,100
Actual: 4,200 hours did cost	(2,121)
Labor rate variance (A)	21

If there are two or more different types or grades of labor, each paid a different standard rate per hour, a rate variance is calculated separately for each labor grade.

3.3 Direct labor efficiency variance

The direct labor efficiency variance is calculated for the hours used on the units produced.

For the actual number of standard units produced, the actual hours worked is compared with the standard number of hours that should have been worked to produce the actual output. The difference is the efficiency variance, measured in hours. This is converted into a money value at the standard direct labor rate per hour.

- *Illustration:*

	Hours
Standard labor hours used to make the actual production	X
Actual labor hours used to make the actual production	(X)
Efficiency variance (hours)	X
Standard cost per hour (multiply by)	X
Efficiency variance (Rs.)	X

- *Example 15:*

For Marden Manufacturing Limited, standard labor cost per unit: (4 hrs@Rs. 500 per hour) = Rs. 2,000 per unit

Actual production in period = 1,000 units.

Labor hours paid for: 4,200 hours at a cost of Rs. 2,121,000

Direct labor efficiency variance is calculated as follows:

	Hours
Standard: Making 1,000 units should have used (@ 4 hours per unit)	4,000
Actual: Making 1,000 units did use	(4,200)
Efficiency variance (hours) (A)	200
Standard cost per hour	Rs. 500
Efficiency variance (Rs.) (A)	Rs. 100,000

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► *Example 16:*

Product P234 has a standard direct labor cost per unit of:

0.5 hours × Rs.12 per direct labor hour = Rs.6 per unit.

During a particular month, 3,000 units of Product 234 were manufactured. These took 1,400 hours to make and the direct labor cost was Rs. 16,200.

The total direct labor cost variance, the direct labor rate variance and the direct labor efficiency variance for the month, would be calculated as follows

Total direct labor cost variance	**Rs.**	
3,000 units of output should cost (×Rs.6)	18,000	
They did cost	16,200	
Direct labor total cost variance	1,800	(F)

The variance is favorable, because actual costs were less than the standard cost.

The direct labor rate variance is calculated by taking the actual number of hours worked (and paid for).

Direct labor rate variance	**Rs.**	
1,400 hours should cost (×Rs.12)	16,800	
They did cost	16,200	
Direct labor rate variance	600	(F)

The rate variance is favorable because the labor hours worked cost less than they should have done.

The labor efficiency variance, like a materials usage variance, is calculated for the actual number of units produced. The variance in hours is converted into a money value at the standard rate of pay per hour.

Direct labor efficiency variance	**hours**	
3,000 units of Product P234 should take (× 0.5 hours)	1,500	
They did take	1,400	
Efficiency variance in hours	100	(F)
Standard direct labor rate per hour	Rs.12	
Direct labor efficiency variance in Rs.	Rs.1,200	(F)

The efficiency variance is favorable because production took less time than expected, which has reduced costs.

Labor cost variances: summary	**Rs.**	
Labor rate variance	600	(F)
Labor efficiency variance	1,200	(F)
Total direct labor cost variance	1,800	(F)

3.4 Idle time variance

Idle time occurs when the direct labor employees are being paid but have no work to do. The causes of idle time may be:

- A breakdown in production, for example a machine breakdown that halts the production process

- Time spent waiting for work due to a bottleneck or hold-up at an earlier stage in the production process
- Time spent rearranging the production line for a new batch
- Running out of a vital direct material, and having to wait for a new delivery of the materials from a supplier.
- A lack of work to do due to a lack of customer orders.

A feature of idle time is that it is recorded, and the hours 'lost' due to idle time are measured. Idle time variance is part of the efficiency variance.

Sometimes idle time might be a feature of a production process for example where there may be bottlenecks in a process that might lead to idle time on a regular basis. In this case the expected idle time might be built into the standard cost.

- If idle time is not built into the standard cost the idle time variance is always adverse.
- If it is built into the standard cost the idle time variance might be favorable or adverse depending on whether the actual idle time is more or less than the standard idle time for that level of production.

Idle time not part of standard cost

As stated above if the idle time is not included in the standard cost, any idle time is unexpected and leads to an adverse variance.

▶ *Illustration:*

	Hours
Actual hours paid for	X
Actual hours worked	(X)
Idle time (hours)	X
Standard cost per hour (multiply by)	X
Idle time (Rs.)	X

Calculating the idle time variance will affect the calculation of the direct labor efficiency variance. If idle time occurs but is not recorded the idle time variance is part of the direct labor efficiency variance. (if record is maintained then idle time is separately recorded)

▶ *Example 17:*

For Marden Manufacturing Limited, standard labor cost per unit: (4 hours ×Rs. 500 per kg) = Rs. 2,000 per unit

Actual production in period = 1,000 units.

Labor hours paid for: 4,200 hours at a cost of Rs. 2,121,000

Labor hours worked: 4,100 hours

Direct labor idle time variance is calculated as follows:

	Hours
Actual hours paid for	4,200
Actual hours worked	(4,100)
Idle time (hours) (A)	100
Standard cost per hour (multiply by)	Rs. 500
Idle time (Rs.) (A)	Rs. 50,000

Direct labor efficiency variance is calculated as follows:

	Hours
Standard: Making 1,000 units should have used (@ 4 hours per unit)	4,000
Actual: Making 1,000 units did use	(4,100)
Efficiency variance (hours) (A)	100
Standard cost per hour	Rs. 500
Efficiency variance (Rs.) (A)	Rs. 50,000

3.5 Alternative calculations

The following shows the line by line approach for labor varices.

- *Formula:*

$AH_{\text{paid for}} \times AR$	X		
		X	Rate variance
$AH_{\text{paid for}} \times SR$	X		
		X	Idle time variance
$AH_{\text{worked}} \times SR$	X		
		X	Efficiency variance
$SH_{\text{worked}} \times SR$	X		

Where:

AH = Actual hours

AR = Actual rate per hour

SR = Standard rate per hour

SH = Standard hours needed to make actual production

- *Example 18:*

For Marden Manufacturing Limited, standard labor cost per unit: (4 hours @Rs. 500 per kg) = Rs. 2,000 per unit

Actual production in period = 1,000 units.

Labor hours paid for: 4,200 hours at a cost of Rs. 2,121,000

Labor hours worked: 4,100 hours

Alternate method for calculating labor variances would be

	Rs. '000	Rs. '000
$AH_{\text{paid for}} \times AR$		
4,200 hours ×Rs. X per hour	2,121	
$AH_{\text{paid for}} \times SR$		21 (A) Price variance
4,200 hours ×Rs. 500 per hour	2,100	
$AH_{\text{worked}} \times SR$		50 (A) Idle time
4,100 hours ×Rs. 500 per hour	2,050	
$SH_{\text{worked}} \times SR$		50 (A) Efficiency
4,000 hours ×Rs. 500 per hour	2,000	
SQ = 1,000 units × 4 hours per unit = 4,000 hours		

3.6 Idle time variance where idle time is included in standard cost

Methods of including idle time in standard costs

There are different ways of allowing for idle time in a standard cost.

- **Method 1**. Include idle time as a separate element of the standard cost, so that the standard cost of idle time is a part of the total standard cost per unit.
- **Method 2**. Allow for a standard amount of idle time in the standard hours per unit for each product. The standard hours per unit therefore include an allowance for expected idle time. This is feasible when the idle time is a necessary feature of the production process such as in batch processing.

▶ *Example 19:*

For Marden Manufacturing Limited, standard labor rate = Rs. 500 per hour

A unit of production should take 3.6 hours to produce.

Expected idle time is 10% of total time paid for.

Therefore 3.6 hours is 90% of the time that must be paid for to make 1 unit.

4 hours must be paid for (3.6/90%) to make 1 unit).

Expected idle time is 0.4 hours (10% of 4 hours).

Idle time can be built into the standard as follows:

Method 1		**Rs.**
Labor	3.6 hours ×Rs. 500 per hour	1,800
Idle time	0.4 hours ×Rs. 500 per hour	200
		2,000
Method 2		
Labor	4 hours ×Rs. 500 per hour	2,000

The two methods will result in the identification of the same overall variance for idle time plus labor efficiency but the split of the number may differ.

For Marden Manufacturing, standard labor rate = Rs. 500 per hour

A unit of production should take 3.6 hours to produce.

Expected idle time is 10% of total time paid for.

Therefore 3.6 hours is 90% of the time that must be paid for to make 1 unit.

4 hours must be paid for (3.6/90%) to make 1 unit).

Expected idle time is 0.4 hours (10% of 4 hours).

Method 1

Idle time can be built into the standard as follows:

		Rs.
Labor	3.6 hours ×Rs. 500 per hour	1,800
Idle time	0.4 hours ×Rs. 500 per hour	200
		2,000

Actual production in period = 1,000 units.

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Labor hours paid for: 4,200 hours at a cost of Rs. 2,121,000

Labor hours worked: 4,100 hours

Direct labor idle time variance is calculated as follows:

	Hours	
Expected idle time (1,000 units × 0.4 hours per unit)	400	
Actual idle time (4,200 hours – 4,100 hours)	(100)	
Idle time (hours)	300	F
Standard cost per hour (multiply by)	Rs. 500	
Idle time (Rs.)	Rs. 150,000	F

Direct labor efficiency variance is calculated as follows:

	Hours	
Standard: Making 1,000 units should have used (@ 3.6 hours per unit)	3,600	
Actual: Making 1,000 units did use	(4,100)	
Efficiency variance (hours)	(500)	A
Standard cost per hour	Rs. 500	
Efficiency variance (Rs.)	Rs. 250,000	A

Method 2

Idle time can be built into the standard as follows:

		Rs.
Labor	4 hours ×Rs. 500 per hour	2,000
Actual production in period = 1,000 units.		
Labor hours paid for: 4,200 hours at a cost of Rs. 2,121,000		
Labor hours worked: 4,100 hours		

Direct labor idle time variance is calculated as follows:	Hours	
Expected idle time (10% of 4,200 hours paid for)	420	
Actual idle time (4,200 hours – 4,100 hours)	(100)	
Idle time (hours)	320	F
Standard cost per hour (multiply by)	Rs. 500	
Idle time (Rs.)	Rs. 160,000	F

Direct labor efficiency variance is calculated as follows:	Hours	
Standard: Making 1,000 units should have used (4 hours per unit less 10% of the hours paid for = 4,000 – (10% of 4,200))	3,580	
Actual: Making 1,000 units did use	(4,100)	
Efficiency variance (hours)	(520)	**A**
Standard cost per hour	Rs. 500	
Efficiency variance (Rs.)	Rs. 260,000	**A**

In summary the idle time variance is part of the efficiency variance. Different methods result in a different split of the idle time variance and efficiency variance but the figures always sum to the same total.

Revisiting the previous examples:

Sum of idle time and efficiency variances (Marden Manufacturing Limited)

	Idle time variance	Efficiency variance	Total
Idle time not recorded	–	100 (A)	100 (A)
Idle time recorded:			
not part of standard cost	50 (A)	50 (A)	100 (A)
part of standard cost (method 1)	150 (F)	250 (A)	100 (A)
part of standard cost (method 2)	160 (F)	260 (A)	100 (A)

3.7 Direct labor: possible causes of variances

When labor variances appear significant, management should investigate the reason why they occurred, and take control measures where appropriate to improve the situation in the future. Possible causes of labor variances include the following.

Possible causes of favorable labor rate variances include:

- Using direct labor employees who were relatively inexperienced and new to the job (favorable rate variance, because these employees would be paid less than 'normal').
- Actual pay increase turning out to be less than expected.

Possible causes of adverse labor rate variances include:

- An increase in pay for employees.
- Working overtime hours paid at a premium above the basic rate.
- Using direct labor employees who were more skilled and experienced than the 'normal' and who are paid more than the standard rate per hour (adverse rate variance).

Possible causes of favorable labor efficiency variances include:

- More efficient methods of working.
- Good morale amongst the workforce and good management with the result that the work force is more productive.
- If incentive schemes are introduced to the workforce, this may encourage employees to work more quickly and therefore give rise to a favorable efficiency variance.
- Previously unaccounted for learning and experience curves
- Using employees who are more experienced than 'standard', resulting in favorable efficiency variances as they are able to complete their work more quickly than less-experienced colleagues.

Possible causes of adverse labor efficiency variances include:

- Using employees who are less experienced than 'standard', resulting in adverse efficiency variances.
- An event causing poor morale.

4. VARIABLE PRODUCTION OVERHEAD VARIANCES

4.1 Variable production overhead: total cost variance

The total variable production overhead cost variance is the difference between the actual variable production overhead cost in producing units in the period and the standard variable production overhead cost of producing those units.

- *Illustration:*

	Rs.
Standard variable production overhead cost of actual production:	
Actual units produced × Standard hrs per unit × Standard rate per hr	X
Actual variable production overhead cost of actual production:	
Actual units produced × Actual hours per unit × Actual rate per hour	(X)
	X

The variance is adverse (A) if actual cost is higher than the standard cost, and favorable (F) if actual cost is less than the standard cost.

- *Example 20:*

Variable production overhead – Total cost variance (Marden Manufacturing Limited)

Standard variable production overhead cost per unit: (4 hrs@Rs. 200 per hr) = Rs. 800 per unit

Actual production in period = 1,000 units.

Variable production overhead = Rs. 945,000.

Labor hours paid for: 4,200 hours

Direct variable production overhead total cost variance is calculated as follows:

	Rs. '000
Standard: 1,000 units should cost (@ Rs. 800 per unit)	800
Actual: 1,000 units did cost	(945)
Total cost variance (A)	145

The variable production overhead total cost variance can be analyzed into an expenditure variance (spending rate per hour variance) and an efficiency variance.

- The expenditure variance is similar to a materials price variance or a labor rate variance. It is the difference between actual variable overhead spending in the hours worked and what the spending should have been (the standard rate).
- The variable overhead efficiency variance in hours is the same as the labor efficiency variance in hours (excluding any idle time variance), and is calculated in a very similar way. It is the variable overhead cost or benefit from adverse or favorable direct labor efficiency variances.

4.2 Variable production overhead expenditure variance

It is normally assumed that variable production overheads are incurred during hours actively worked, but not during any hours of idle time.

- The variable production overhead expenditure variance is calculated by taking the actual number of hours worked.
- The actual variable production overhead cost of the actual hours worked is compared with the standard cost for those hours. The difference is the variable production overhead expenditure variance.

A variable production overhead expenditure variance is calculated as follows. Like the direct labor rate variance, it is calculated by taking the actual number of labor hours worked, since it is assumed that variable overhead expenditure varies with hours worked.

- *Illustration:*

	Rs.
Standard variable production overhead cost of actual production:	
Actual hours worked × Standard rate per hour	X
Actual variable production overhead cost of actual purchases	
Actual hours worked × Actual rate per hour	(X)
	X

- *Example 21:*

Variable production overhead expenditure variance (Marden Manufacturing Limited)

Standard variable production overhead cost per unit: (4 hrs×Rs. 200 per hr) = Rs. 800 per unit

Actual production in period = 1,000 units.

Labor hours paid for: 4,200 hours

Labor hours worked: 4,100 hours at a variable overhead cost of Rs. 945,000.

Variable production overhead rate variance is calculated as follows:

	Rs. '000
Standard: 4,100 hours should cost (@ Rs. 200 per hour)	820
Actual: 4,100 hours did cost	(945)
Labor rate variance (A)	(125)

4.3 Variable production overhead efficiency variance

The variable production overhead efficiency variance in hours is exactly the same as the direct labor efficiency variance in hours.

It is converted into a money value at the standard variable production overhead rate per hour.

- *Illustration:*

	Hours
Standard hours used to make the actual production	X
Actual hours used to make the actual production	(X)
Efficiency variance (hours)	X
Standard cost per hour (multiply by)	X
Efficiency variance (Rs.)	X

- *Example 22:*

Variable production overhead efficiency variance (Marden Manufacturing Limited)

Standard variable production overhead cost per unit: (4 hrs@Rs. 200 per kg) = Rs. 800 per unit

Actual production in period = 1,000 units.

Labor hours paid for: 4,200 hours

Labor hours worked: 4,100 hours at a variable overhead cost of Rs. 945,000.

Variable production overhead efficiency variance is calculated as follows:

	Hours
Standard: Making 1,000 units should have used (@ 4 hours per unit)	4,000
Actual: Making 1,000 units did use	(4,100)
Efficiency variance (hours) (A)	100
Standard cost per hour	Rs. 200
Efficiency variance (Rs.) (A)	Rs. 20,000

- *Example 23:*

Product P123 has a standard variable production overhead cost per unit of: 1.5 hours × Rs.2 per direct labor hour = Rs.3 per unit.

During a particular month, 2,000 units of Product 123 were manufactured. These took 2,780 hours to make and the variable production overhead cost was Rs.6,550.

The total variable production overhead cost variance, the variable production overhead expenditure variance and the variable production overhead efficiency variance for the month would be calculated as follows.

Total variable production overhead cost variance	**Rs.**	
2,000 units of output should cost (×Rs.3)	6,000	
They did cost	6,550	
Total variable production overhead cost variance	550	(A)
Variable production overhead expenditure variance	**Rs.**	
2,780 hours should cost (×Rs.2)	5,560	
They did cost	6,550	
Variable production overhead expenditure variance	990	(A)

The expenditure variance is adverse because the expenditure on variable overhead in the hours worked was more than it should have been.

Variable production overhead efficiency variance	**hours**	
2,000 units of Product P123 should take (× 1.5 hours)	3,000	
They did take	2,780	
Efficiency variance in hours	220	(F)
Standard variable production overhead rate per hour	Rs.2	
Variable production overhead efficiency variance in	Rs.440	(F)

The efficiency variance is favorable because production took less time than expected, which has reduced costs.

Variable production overhead cost variances: summary	**Rs.**	
Variable production overhead expenditure variance	990	(A)
Variable production overhead efficiency variance	440	(F)
Total variable production overhead cost variance	550	(A)

4.4 Alternative calculations

The following shows the line by line approach for variable production overhead variances.

- *Formula:*

$AH_{\text{worked}} \times AR$	X		
		X	Rate variance
$AH_{\text{worked}} \times SR$	X		
		X	Efficiency variance
$SH_{\text{worked}} \times SR$	X		

Where:

AH = Actual hours

AR = Actual rate per hour

SR = Standard rate per hour

SH = Standard hours needed to make actual production

- *Example 24:*

Alternative method for calculating variable production overhead variances (Marden Manufacturing Limited) would involve:

Standard variable production overhead cost per unit: (4 hrs@Rs. 200 per kg) = Rs. 800 per unit

Actual production in period = 1,000 units.

Labor hours paid for: 4,200 hours

Labor hours worked: 4,100 hours at a variable overhead cost of Rs. 945,000.

	Rs. '000	Rs. '000
$AH_{\text{worked}} \times AR$		
4,100 hours ×Rs. X per hour	945	
$AH_{\text{worked}} \times SR$		125 (A) Expenditure
4,100 hours ×Rs. 200 per hour	820	
$SH_{\text{worked}} \times SR$		20 (A) Efficiency
4,000 hours ×Rs. 200 per hour	800	
SH = 1,000 units × 4 hours per unit = 4,000 hours		

4.5 Variable production overhead: possible causes of variances

Possible causes of favorable variable production overhead expenditure variances include:

- Forecast increase in costs not materializing

Possible causes of adverse variable production overhead variances include:

- Unexpected increases in energy prices

Anything that causes labor efficiency variance will have an impact on variable production overhead efficiency variances as variable production overhead is incurred as the labor force carries out production.

Possible causes of favorable variable production overhead efficiency variances include:

- More efficient methods of working.
- Good morale amongst the workforce and good management with the result that the work force is more productive.
- If incentive schemes are introduced to the workforce, this may encourage employees to work more quickly and therefore give rise to a favorable efficiency variance.
- Using employees who are more experienced than 'standard', resulting in favorable efficiency variances as they are able to complete their work more quickly than less-experienced colleagues.

Possible causes of adverse variable production overhead efficiency variances include:

- Using employees who are less experienced than 'standard', resulting in adverse efficiency variances.
- An event causing poor morale.

5. FIXED PRODUCTION OVERHEAD COST VARIANCES: ABSORPTION COSTING

5.1 Over/under absorption

Variances for fixed production overheads are different from variances for variable costs.

With standard absorption costing, the standard cost per unit is a full production cost, including an amount for absorbed fixed production overhead. Every unit produced is valued at standard cost.

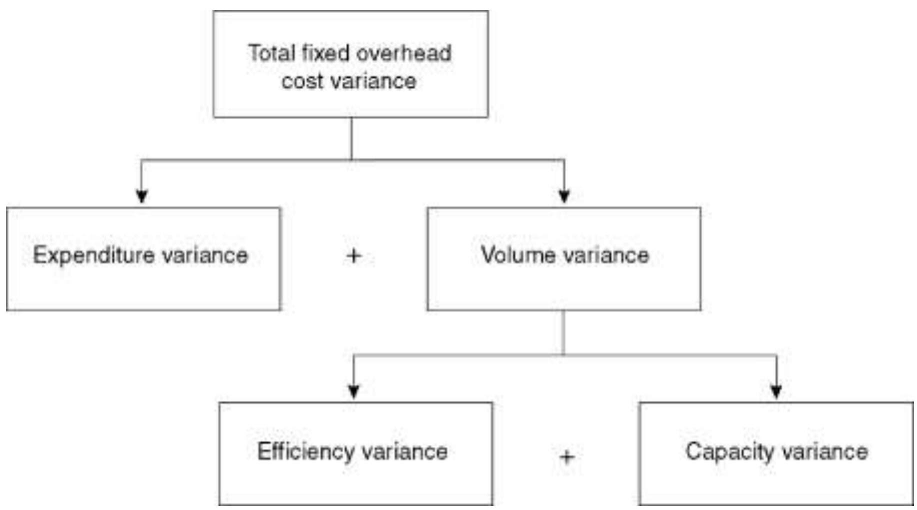
This means that production overheads are absorbed into production costs at a standard cost per unit produced. This standard fixed cost per unit is derived from a standard number of direct labor hours per unit and a fixed overhead rate per hour.

The total fixed overhead cost variance is the total amount of under-absorbed or over-absorbed overheads, where overheads are absorbed at the standard fixed overhead cost per unit.

As mentioned in an earlier chapter, the total under- or over-absorption of fixed overheads can be analyzed into an expenditure variance and a volume variance.

The total volume variance can be further analyzed in standard absorption costing, into a fixed overhead capacity variance and a fixed overhead efficiency variance.

▶ *Illustration:*



5.2 Total fixed production overhead cost variance

The total fixed overhead cost variance is the amount of:

- under-absorbed fixed production overhead (= adverse variance) or
- over-absorbed fixed production overhead (= favorable variance).

▶ *Illustration:*

Fixed production overhead absorbed in the period:	Rs.
Actual units produced × Fixed production overhead per unit	X
Actual fixed production overhead incurred in the period	(X)
Total fixed production overhead variance (Over/(under) absorption)	X/(x)

The total fixed production overhead cost variance can be analyzed into an expenditure variance and a volume variance. Together, these variances explain the reasons for the under- or over-absorption.

▶ *Example 25:*

For Marden Manufacturing Limited, over/under absorption is required based on the following information

Budgeted fixed production overhead	Rs.2,880,000
Budgeted production hours: = Budgeted production volume × Standard hours per unit = 1,200 units × 4 hours per unit	4,800 hours
Overhead absorption rate $^{\text{Rs. 2,880,000}}/_{\text{4,800 hours}}$	Rs. 600 per hour
Standard fixed production overhead per unit = 4 hours ×Rs. 600 per hour	Rs. 2,400 per unit
Actual fixed production overhead	Rs. 2,500,000
Actual production	1,000 units

The total cost variance for fixed production overhead (over/under absorption) is calculated as follows:

	Rs. '000
Fixed production overhead absorbed in the period: = Actual units produced × Fixed production overhead per unit = 1,000 units ×Rs. 2,400 per unit	2,400
Actual fixed production overhead incurred in the period	(2,500)
Under absorption (adverse cost variance)	100

The amount of fixed production overhead absorption rate is a function of the budgeted fixed production overhead expenditure and the budgeted production volume.

The total variance can be explained in these terms.

5.3 Fixed production overhead expenditure variance

A fixed production overhead expenditure variance is very easy to calculate. It is simply the difference between the budgeted fixed production overhead expenditure and actual fixed production overhead expenditure.

▶ *Illustration:*

	Rs.
Budgeted fixed production overhead	X
Actual fixed production overhead incurred	(X)
Fixed production overhead expenditure variance	X

An adverse expenditure variance occurs when actual fixed overhead expenditure exceeds the budgeted fixed overhead expenditure.

A favorable expenditure variance occurs when actual fixed overhead expenditure is less than budget.

▶ *Example 26:*

For Marden Manufacturing Limited, fixed production overhead – expenditure variance would be as follows:

	Rs. '000
Budgeted fixed production overhead	2,880
Actual fixed production overhead	(2,500)
Fixed production overhead expenditure variance (F)	380

Fixed overhead expenditure variances can be calculated, for control reporting, for other overheads as well as production overheads. For example:

- an administration fixed overheads expenditure variance is the difference between budgeted and actual fixed administration overhead costs
- a sales and distribution fixed overhead expenditure variance is the difference between budgeted and actual fixed sales and distribution overhead costs

5.4 Fixed production overhead volume variance

The fixed production overhead volume variance measures the amount of fixed overheads under- or over-absorbed because of the fact that actual production volume differs from the budgeted production volume.

The volume variance is measured first of all in either units of output or standard hours of the output units.

The volume variance in units (or standard hours of those units) is converted into a money value, as appropriate, at the standard fixed overhead cost per unit (or the standard fixed overhead rate

▶ *Illustration:*

	Units
Actual production volume (the number of units produced)	X
Budgeted production volume	(X)
Fixed production overhead volume variance (units)	X
Standard absorption rate per unit	X
Fixed production overhead volume variance(Rs.)	X

When actual activity volume exceeds the budget, there will be over-absorption of fixed overheads, which is a 'favorable' variance. When actual activity volume is less than budget, there will be under-absorption of fixed overhead, which is an 'adverse' variance.

When overheads are absorbed on the basis of direct labor hours or machine hours, the actual hours worked might be higher or lower than budgeted. The reasons for a favorable or an adverse volume variance might therefore be any of the following.

- Working more hours than budgeted might be caused by working overtime, or taking on additional direct labor employees.
- Working fewer hours than budgeted might be caused by staff shortages (due to employees leaving or absence from work), hold-ups in production or lack of customer orders.

▶ *Example 27:*

For Marden Manufacturing Limited, fixed production overhead – volume variance would be as follows:

Budgeted fixed production overhead	Rs.2,880,000
Budgeted production hours: = Budgeted production volume × Standard hours per unit = 1,200 units × 4 hours per unit	4,800 hours
Overhead absorption rate Rs. 2,880,000/4,800 hours	Rs. 600 per hour
Standard fixed production overhead per unit = 4 hours ×Rs. 600 per hour	Rs. 2,400 per unit
Actual fixed production overhead	Rs. 2,500,000
Actual production	1,000 units

The volume variance is calculated as follows:

	Units
Actual number of units produced	1,000
Budgeted production	(1,200)
Fixed production overhead volume variance(units) (A)	(200)
Fixed production overhead per unit	Rs. 2,400
Fixed production overhead volume variance(Rs.) (A)	Rs. 480,000

The under-absorption has been analyzed into an expenditure and a volume variance.

Analysis of under absorption

Summary	Rs.	
Expenditure variance	380,000	Favourable
Volume variance	(480,000)	Adverse
Total under -absorbed overhead	100,000	Adverse

▶ *Example 28:*

A company budgeted to make 5,000 units of a single standard product in Year 1.

Budgeted direct labor hours are 10,000 hours.

Budgeted fixed production overhead is Rs.40,000.

Actual production in Year 1 was 5,200 units, and fixed production overhead was Rs.40,500.

The total fixed production overhead cost variance, the fixed overhead expenditure variance and the fixed overhead volume variance for the year, would be as follows

Standard fixed overhead cost per unit = Rs.8 (Rs.40,000/Rs.5,000 units)

Fixed production overhead total cost variance	Rs.	
5,200 units: standard fixed cost (×Rs.8) = fixed overhead absorbed	41,600	
Actual fixed overhead cost expenditure	40,500	
Fixed production overhead total cost variance	1,100	(F)

The variance is favorable, because fixed overhead costs have been over absorbed.

Fixed overhead expenditure variance	Rs.	
Budgeted fixed production overhead expenditure	40,000	
Actual fixed production overhead expenditure	40,500	
Fixed overhead expenditure variance	500	(A)

This variance is adverse because actual expenditure exceeds the budgeted expenditure.

Fixed overhead volume variance	units of production	
Budgeted production volume in units	5,000	
Actual production volume in units	5,200	
Fixed overhead volume variance in units	200	(F)
Standard fixed production overhead cost per unit	Rs.8	
Fixed overhead volume variance in Rs.	Rs.1,600	(F)

This variance is favorable because actual production volume exceeded the budgeted volume

Summary	Rs.	
Fixed overhead expenditure variance	500	(A)
Fixed overhead volume variance	1,600	(F)
Fixed overhead total cost variance	1,100	(F)

▶ *Example 29:*

In its annual financial plan for Year 1, a manufacturing company budgets that production overhead expenditure will be Rs.800,000 and that there will be 100,000 direct labor hours of work. It uses a single absorption rate, which is a rate per direct labor hour.

Actual production overhead during Year 1 was Rs.805,000 and 105,000 direct labor hours were worked.

The production overhead absorption rate for the year is Rs.800,000/100,000 = Rs.8 per direct labor hour. All cost units produced during the year are charged with production overheads at the rate of Rs.8 for each direct labor hour.

	Rs.
Overheads absorbed (105,000 hours × Rs.8) (Overheads included in product costs)	840,000
Actual overhead expenditure	805,000
Over-absorbed overheads	35,000

This is added to profit when calculating the actual profit for Year 1.

Explaining the over-absorbed overhead

The over-absorbed overhead of Rs.35,000 can be explained by a combination of an expenditure variance and a volume variance.

	Rs.	
Budgeted overhead expenditure	800,000	
Actual overhead expenditure	805,000	
Expenditure variance	5,000	Adverse

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The expenditure **variance is** adverse because actual expenditure was more than planned expenditure, and this has resulted in some **under-absorption** of overhead.

	Hours	
Budgeted volume (direct labor hours)	100,000	
Actual volume (direct labor hours)	105,000	
Volume variance (direct labor hours)	5,000	Favourable
Absorption rate/direct labor hour	Rs.8	
Volume variance in Rs.	Rs.40,000	Favourable

The volume **variance is favorable** because actual hours worked exceeded the planned hours, and this has resulted in some **over-absorption** of overhead.

Summary	Rs.	
Expenditure variance	5,000	Adverse
Volume variance	40,000	Favourable
Total over-absorbed overhead	35,000	Favourable

5.5 Fixed production overhead efficiency and capacity variances

Any volume variance might be due to two reasons:

- The company has worked a different number of hours than budgeted for a variety of reasons. They have operated at a different capacity.
- During the hours worked the company has operated at a different level of efficiency to that budgeted.

The fixed production overhead volume variance can be analyzed into a fixed overhead efficiency variance and a fixed overhead capacity variance.

Fixed production overhead efficiency variance

This is exactly the same, in hours, as the direct labor efficiency variance and the variable production overhead efficiency variance.

It is converted into a money value at the standard fixed overhead rate per hour.

► *Illustration:*

	Hours
Standard hours used to make the actual production	X
Actual hours used to make the actual production	(X)
Efficiency variance (hours)	X
Standard cost per hour (multiply by)	X
Efficiency variance (Rs.)	X

► *Example 30:*

For Marden Manufacturing Limited, standard fixed production overhead cost per unit: (4 hrs×Rs. 600 per hr) = Rs. 2,400 per unit

Actual production in period = 1,000 units.

Labor hours paid for: 4,200 hours

Labor hours worked: 4,100

Fixed production overhead efficiency variance is calculated as follows:

	Hours
Standard: Making 1,000 units should have used (@ 4 hours per unit)	4,000
Actual: Making 1,000 units did use	(4,100)
Efficiency variance (hours) (A)	100
Standard cost per hour	Rs. 600
Efficiency variance (Rs.) (A)	Rs. 60,000

Fixed production overhead capacity variance

This is the difference between the budgeted and actual hours worked (excluding any idle time hours). It is converted into a money value at the standard fixed overhead rate per hour.

- *Illustration:*

	Hours
Actual number of hours worked	X
Budgeted hours to be worked	(X)
Capacity variance (hours)	X
Standard cost per hour (multiply by)	X
Capacity variance (Rs.)	X

- *Example 31:*

Fixed production overhead capacity variance (Marden Manufacturing Limited)

Budgeted fixed production overhead	Rs.2,880,000
Budgeted production hours: = Budgeted production volume × Standard hours per unit = 1,200 units × 4 hours per unit	4,800 hours
Overhead absorption rate $^{\text{Rs. 2,880,000}}/_{\text{4,800 hours}}$	Rs. 600 per hour
Standard fixed production overhead per unit = 4 hours ×Rs. 600 per hour	Rs. 2,400 per unit
Actual fixed production overhead	Rs. 2,500,000
Actual production	1,000 units

The fixed production overhead capacity variance is calculated as follows:

	Hours
Actual number of hours worked	4,100
Budgeted hours to be worked	(4,800)
Capacity variance (hours) (A)	700
Standard cost per hour (multiply by)	Rs. 600
Capacity variance y variance (Rs.) (A)	Rs. 420,000

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▶ *Example 32:*

A company budgeted to make 5,000 units of a single standard product in Year 1.

Budgeted direct labor hours are 10,000 hours.

Budgeted fixed production overhead is Rs.40,000.

Actual production in Year 1 was 5,200 units in 10,250 hours of work, and fixed production overhead was Rs.40,500.

Calculate the fixed overhead efficiency variance and the fixed overhead capacity variance for the year.

The standard direct labor hours per unit = 10,000 hours/5,000 units = 2 hours per unit.

The standard fixed overhead rate per hour = Rs.40,000/10,000 hours = Rs.4 per hour.

The standard fixed overhead cost per unit is 2 hours × Rs.4 per hour = Rs.8 (or Rs.40,000/5,000 units).

Fixed overhead efficiency variance	**hours**	
5,200 units should take (× 2 hours)	10,400	
They did take	10,250	
Efficiency variance in hours	150	(F)
Standard fixed overhead rate per hour	Rs.4	
Fixed overhead efficiency variance in Rs.	Rs.600	(F)
Fixed overhead capacity variance	hours	
Budgeted hours of work	10,000	
Actual hours of work	10,250	
Capacity variance in hours	250	(F)
Standard fixed overhead rate per hour	Rs.4	
Fixed overhead capacity variance in Rs.	Rs.1,000	(F)

The capacity variance is favorable because actual hours worked exceeded the budgeted hours (therefore more units should have been produced).

Summary	**Rs.**	
Fixed overhead efficiency variance	600	(F)
Fixed overhead capacity variance	1,000	(F)
Fixed overhead volume variance	1,600	(F)

5.6 Fixed production overheads: possible causes of variances

Some of the possible causes of fixed production overhead variances include the following.

Fixed overhead expenditure variance

- Poor control over overhead spending (adverse variance) or good control over spending (favorable variance).
- Poor budgeting for overhead spending. If the budget for overhead expenditure is unrealistic, there will be an expenditure variance due to poor planning rather than poor expenditure control.
- Unplanned increases or decreases in items of expenditure for fixed production overheads, for example, an unexpected increase in factory rent.

Fixed overhead volume variance

A fixed overhead volume variance can be explained by anything that made actual output volume different from the budgeted volume. The reasons could be:

- Efficient working by direct labor: a favorable labor efficiency variance results in a favorable fixed overhead efficiency variance.
- Working more hours or less hours than budgeted (capacity variance).
- An unexpected increase or decrease in demand for a product, with the result that shorter/longer hours were worked (adverse/favorable capacity variance)
- Strike action by the workforce, resulting in a fall in output below (adverse capacity variance).
- Extensive breakdowns in machinery, resulting in lost production (adverse capacity variance).

6. INTERRELATIONSHIPS BETWEEN VARIANCES

6.1 The nature of interrelationships between variances

Some causes of individual variances have already been listed.

The reasons for variances might also be connected, and two or more variances might arise from the same cause. This is known as an interrelationship between two variances.

For example, one variance might be favorable and another variance might be adverse. Taking each variance separately, the favorable variance might suggest good performance and the adverse variance might suggest bad performance. However, the two variances might be inter-related, and the favorable variance and the adverse variance might have the same cause. When this happens, management should look at the two variances together, in order to assess their significance and decide whether control action is needed.

Interrelationships between variances are given below.

6.2 Materials price and usage

A materials price variance and usage variance might be inter-related. For example, if a company decides to use a material for production that is more expensive than the normal or standard material, but easier to use and better in quality, there will be an adverse price variance. However, a consequence of using better materials might be lower wastage. If there is less wastage, there will be a favorable material usage variance. Therefore, using a different quality of material can result in an adverse price variance and a favorable usage variance.

6.3 Labor rate and efficiency

If there is a change in the grade of workers used to do some work, both the rate and efficiency variances may be affected.

For example, if a lower grade of labor is used instead of the normal higher grade:

- there should be a favorable rate variance because the workers will be paid less than the standard rate
- however, the lower grade of labor may work less efficiently and take longer to produce goods than the normal higher grade of labor would usually take. If the lower grade of labor takes longer, then this will give rise to an adverse efficiency variance.

Therefore, the change in the grade of labor used results in two 'opposite' variances, an adverse efficiency variance and a favorable rate variance.

When inexperienced employees are used, they might also waste more materials than more experienced employees would, due to mistakes that they make in their work. The result might be not only adverse labor efficiency, but also adverse materials usage.

6.4 Labor rate and variable overhead efficiency

When a production process operates at a different level of efficiency the true cost of that difference is the sum of any costs associated with labor hours. Therefore, the issues described above also affect the variable overhead efficiency variance.

6.5 Capacity and efficiency

If a production process operates at a higher level of efficiency that might mean that it does not have to operate for as long to produce the budgeted production volume. The favorable fixed production overhead efficiency variance would cause an adverse fixed production overhead capacity variance.

The reverse is also true. If a production process operates at a lower level of efficiency that might mean that it has to operate for longer than was budgeted. The adverse efficiency fixed production overhead variance would cause a favorable fixed production overhead capacity variance.

6.6 Footnote: the importance of reliable standard costs

It is important to remember that the value of variances as control information for management depends on the reliability and accuracy of the standard costs. If the standard costs are inaccurate, comparisons between actual cost and standard cost will have no meaning. Adverse or favorable variances might be caused by inaccurate standard costs rather than by inefficient or efficient working.

7. STANDARD MARGINAL COSTING

7.1 Standard marginal costing

The Marden Manufacturing Limited example used in the earlier sections was based on the company using standard total absorption costing.

This sections looks at what happens when a company uses standard marginal costing instead.

Under marginal costing units produced and finished goods inventory are valued at standard variable production cost, not standard full production cost. This means that the budgeted profit will differ from that found for the same scenario under total absorption costing.

Marginal costing variances are calculated exactly as before with two important differences:

- the sales volume variance is expressed as a monetary amount by multiplying the volume variance expressed in units by the standard contribution per unit rather than the standard profit per unit; and
- there is no fixed overhead volume variance.

The Marden Manufacturing Limited example will be used to illustrate the approach.

▶ *Example 33:*

		Rs.
Direct materials	5 kg @ Rs.1,000 per kg	5,000
Direct labor	4 hours @ Rs. 500 per hour	2,000
Variable overhead	4 hours @ Rs. 200 per hour	800
Marginal production cost		7,800

Fixed budget

Here is the fixed budget to show the detailed calculation of the budgeted profit.

Marden Manufacturing Limited has budgeted to make 1,200 units and sell 1,000 units in January.

The selling price per unit is budgeted at Rs. 15,000.

The standard costs of production are as given in the previous example.

The budget prepared for January is as follows:

Unit sales		1,000
Unit production		1,200
Budget		**Rs. '000**
Sales	(1,000 units ×15,000)	15,000

Cost of sales:		**Rs. '000**
Materials	(1,200 units ×Rs. 5,000 per unit)	6,000
Labor	(1,200 units ×Rs. 2,000 per unit)	2,400
Variable overhead	(1,200 units ×Rs. 800 per unit)	960
		9,360
Closing inventory	(200 units ×Rs. 7,800 per unit)	(1,560)
Cost of sales	(1,000 units ×Rs. 7,800 per unit)	(7,800)
		7,200
Fixed overhead		(2,880)
Profit		4,320

This figure could have been calculated more easily as follows:

	Rs. '000
Budgeted contribution (1,000 units × (Rs. 15,000–Rs. 7,800)	7,200
Less: Budgeted fixed production overhead	(2,880)
Profit	4,320

Flexed budget

Here are profit statements redrafted to marginal cost basis.

For Marden Manufacturing Limited, fixed budget, flexed budget and actual results for a period, would require following calculations

	Fixed budget	Flexed budget	Actual
Unit sales	1,000	900	900
Unit production	1,200	1,000	1,000

	Budget	Actual	Actual
Budget	**Rs. '000**	**Rs. '000**	**Rs. '000**
Sales	15,000	13,500	12,600
Cost of sales:			
Materials	6,000	5,000	4,608
Labor	2,400	2,000	2,121
Variable overhead	960	800	945
	9,360	7,800	7,674
Closing inventory	(1,560)	(780)	(780)
Cost of sales	(7,800)	(7,020)	(6,894)
	7,200	6,480	5,706
Fixed overhead	(2,880)	(2,400)	(2,500)
Profit	4,320	4,080	3,206

Note: The actual closing inventory of 100 units is measured at the standard marginal production cost of Rs. 7,800 per unit. This is what happens in standard costing systems. (in exam if question is silent about inventory measurement then actual closing inventory shall be measured at actual marginal cost)

7.2 Standard marginal costing variances

Identical variances

All variable cost variances are the same under standard total absorption costing and standard marginal costing.

Sales price variance is the same under standard total absorption costing and standard marginal costing.

Fixed overhead variances

Only the fixed production overhead expenditure variance is relevant and this is calculated in the same way as seen previously.

There is no fixed production overhead volume variance

Sales volume variance

The sales volume variance shows the effect on contribution of the difference between the actual sales volume and the budgeted sales volume.

The variance is calculated by comparing the actual number of units sold (actual sales volume) to the number of units expected to be sold when the original budget was drafted (budgeted sales volume).

This is then expressed as a money value by multiplying it by the standard contribution per unit.

- *Illustration:*

	Units
Budgeted sales volume	X
Actual sales volume	(X)
Sales volume variance (units)	X
Standard contribution per unit (multiply by)	Rs. X
Sales volume variance (Rs.)	X

- *Example 34:*

Sales volume variance (Marden Manufacturing Limited)

Budgeted sales volume	1,000 units
Budgeted selling price per unit	Rs. 15,000
Standard cost per unit (from the standard cost card)	Rs. 7,800
Therefore, standard contribution per unit	Rs. 7,200

Sales volume variance is calculated as follows:	Units
Budgeted sales volume	1,000
Actual sales volume	900
Sales volume variance (units) (A)	100
Standard contribution per unit (multiply by)	Rs. 7,200
Sales volume variance (A)	Rs. 720,000

7.3 Standard marginal costing operating statement

With standard marginal costing, an operating statement is presented in a different way from an operating statement with standard absorption costing.

Budgeted contribution is reconciled with actual contribution, by means of the sales price variance, sales volume variance and variable cost variances.

Fixed cost expenditure variances are presented in a separate part of the operating statement.

- *Example 35:*

Operating statement for Marden Manufacturing Limited (standard marginal costing)

	Rs. '000	Rs. '000	Rs. '000	
Budgeted contribution			7,200	
Sales price variance			(900)	(A)
Sales volume variance			(720)	(A)
			5,580	

	Rs. '000	Rs. '000	Rs. '000	
Cost variances	(F)	(A)		
Direct materials price	242			
Direct materials usage	150			
Direct labor rate		21		
Direct labor efficiency		50		
Direct labor idle time		50		
Variable production o'head expenditure		125		
Variable production o'head efficiency		20		
Total cost variances	392	266	126	F
			5,706	
Budgeted fixed production overhead		2,880		
Fixed production overhead expenditure variance (F)		(380)		
Less: Actual fixed production overheads			(2,500)	
Actual Profit			3,206	

Now let's look at the absorption costing pro forma operating statement.

The format of the operating statement for a firm using absorption costing will have budgeted profit at the top, then sales variances then cost variances and finally actual profit.

	Rs. '000	Rs. '000	Rs. '000	
Budgeted Profit (1)			4,800	
Sales volume variance (2)			(480)	(A)
Standard Profit on actual sales				
Sales Price variance			(900)	(A)
Profit before cost variances			3,420	
Cost variances	(F)	(A)		
Direct materials price	242			
Direct materials usage	150			
Direct labor rate		21		
Direct labor efficiency		50		
Direct labor idle time		50		
Variable production o'head expenditure		125		
Variable production o'head efficiency		20		
Fixed production overhead expenditure variance (F)	380			
Fixed Production overhead volume variance		480		
	772	746	26	F
Actual Profit			3,446	

Tutorial Notes.

1. Budgeted Profit = Budgeted sales * Standard Profit
2. Sales volume variance = (Actual Sales – Budgeted sales) * Standard Profit

8. MATERIALS MIX AND YIELD VARIANCES

8.1 Total material Usage Variance

When standard costing is used for products which contain two or more items of direct material, the total materials usage variance can be calculated by calculating the individual usage variances in the usual way and adding them up (netting them off).

▶ *Example 36:*

Product X is produced from three direct materials, A, B and C, that are mixed together in a process. The following information relates to the budget and output for the month of January

Standard cost:				Actual:
Material	**Quantity**	**Standard price per kilo**	**Standard cost**	**Quantity used**
	kg	Rs.	Rs.	kg
A	1	20	20	160
B	1	22	22	180
C	8	6	48	1,760
	10		90	2,100
Output	1 unit			200 units

Usage variances can be calculated in the usual way:

Making 200 units should have used:	A (kgs)	B (kgs)	C (kgs)
200 × 1 kg of A	200		
200 × 1 kg of B		200	
200 × 8 kgs of C			1,600
Making 200 units did use:	(160)	(180)	(1,760)
Usage variance in kgs	40 (F)	20 (F)	(160) (A)
Standard cost per kg	20	22	6
Usage variance in Rs.	800 (F)	440 (F)	(960) (A)
Total usage variance = Rs. 280 (F) (800 + 440 -960)			

Substitutable materials

If the materials are substitutable (i.e. less of one type of material can be compensated for by more of another) the direct materials usage variance can be analyzed into:

- a materials mix variance; and
- a materials yield variance

The total of these two variances is the total material usage variance.

It is vital to understand that this further analysis should only be performed if the materials can be substituted for each other. Mix and yield variances have a useful meaning only when the proportions (or 'mix') of the different raw materials in the final product can be varied and so are subject to management control.

- In the above example fewer kilograms of A but more kilograms of B and C than expected were used to make 200 units. The mix changed and this had an effect on the yield.
- In contrast, if a company manufactured a car, no number of extra tyres could compensate for one less engine! Mix and yield variances are irrelevant in this case.

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8.2 Direct materials mix variance

The materials mix variance measures how much of the total usage variance is attributable to the fact that the actual combination or mixture of materials that was used was more expensive or less expensive than the standard mixture for the materials.

The mix component of the usage variance therefore indicates the effect on costs of changing the combination (or mix or proportions) of material inputs in the production process.

The material mix variance indicates the effect on profits of having an actual materials mix that is different from the standard material mix.

The materials mix variance is calculated as follows (making reference to the example above):

i. Take the total quantity of all the materials used (2,100 kg in the example) and calculate what the quantities of each material in the mix should be if the total usage had been in the standard proportions or standard mix (1:1:8 in the above example).

ii. Compare the actual quantities of each individual material that were used, and the standard quantities that would have been used (the standard mix) if the total usage had been in the standard proportions or standard mix.

iii. The mix variance for each material (expressed in kgs) is the difference between the quantity of each material actually used and the quantity of that material that should have been used in the standard mix. The total mix variance in material quantities is always zero.

iv. Convert the mix variance for each individual material into a money value by multiplying by the standard price per unit of the material.

v. These figures are summed to give the total mix variance

► *Example 37:*

Material	Actual mix (kgs)	Standard mix	Mix variance (kgs)	Std. cost per kg	Mix variance (Rs.)
A	160	(10% × 2,100) 210	50 (F)	20	1,000 (F)
B	180	(10% × 2,100) 210	30 (F)	22	660 (F)
C	1,760	(80% × 2,100) 1,680	(80) (A)	6	(480) (A)
	2,100	2,100	0		1,180 (F)

For each individual item of material, the mix variance is favorable when the actual mix is less than the standard mix, and the mix variance is adverse when actual usage exceeds the standard mix.

The total mix variance is favorable in this example because the actual mix of materials used is cheaper than the standard mix.

8.3 Direct materials yield variance

The materials yield variance is the difference between the actual yield from a given input and the yield that the actual input should have given in standard terms. It indicates the effect on costs of the total materials inputs yielding more or less output than expected.

The yield variance can be calculated in several ways. No one method is better than any other (use the one that makes most sense to you).

Working

Based on the above example note that:

- The standard cost of each unit (kg) of input = Rs. 90/10kg = Rs. 9 per kg
- The standard cost of each unit of output = Rs. 90 per unit

Method 1: Based on output

This compares the actual yield to the expected yield from the material used. The difference is then valued at the standard cost of output.

In the above example 10 kg of material in should result in 1 unit of output.

Therefore, 2,100 kg of material in should result in 210 units of output.

The difference between this figure and the actual output is the yield variance as a number of units. This is then multiplied by the expected cost of a unit of output.

► *Example 38:*

	Units	
2,100 kgs of input should yield (@10 kg per unit)	210	
2,100 kgs of input did yield	200	
Yield variance (units)	10	(A)
Standard cost of output	Rs. 90	
Materials yield variance (Rs.)	Rs. 900	(A)

Method 2: Based on inputs

This compares the actual usage to achieve the yield to the expected usage to achieve the actual yield. The difference is then valued at the standard cost of input.

In the above example 1 unit should use 10 kg of input.

Therefore, 200 units should use 2,000 kg of input.

The difference between this figure and the actual input is the yield variance as a number of units. This is then multiplied by the expected cost of a unit of output.

► *Example 38 (Contd.):*

	Units	
200 units of product X should use (× 10 kgs)	2,000	
did use	2,100	
Yield variance in quantities	100	(A)
Standard cost of input	Rs. 9/kg	
Yield variance in money value	Rs. 900	(A)

Summary

Mix variance + yield variance = usage variance

	Rs.	
Mix variance	1,180	(F)
Yield variance	(900)	(A)
Usage variance (= mix + yield variances)	280	(F)

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8.4 Alternative method

An alternative approach is to use a line by line method.

This starts with the standard cost of the actual quantity used in the actual mix.

This figure is made up as:

- Actual Quantity (AQ) in the Actual Mix (AM) at the Standard Cost per unit (SC)
- Elements of this are then changed in sequence to identify the variances. In the table below the element that changes have been written in bold.

► *Example 39:*

	AQ in AM	**@**	**SC**			
	kgs		Rs.	Rs.		
A	160	×	20	3,200		
B	180	×	22	3,960		
C	1,760	×	6	10,560		
	2,100			17,720		
	AQ in **SM**	@	SC			
A (0.1)	**210**	×	20	4,200	**1,180 F**	**MIX**
B (0.1)	**210**	×	22	4,620		
C (0.8)	**1,680**	×	6	10,080		
	2,100			18,900		
	SQ in SM	@	SC			
A (0.1)	**200**	×	20	4,000	**900 A**	**YIELD**
B (0.1)	**200**	×	22	4,400		
C (0.8)	**1,600**	×	6	9,600		
	2,000[1]			18,000		

[1] This figure is the number of kgs that making 200 units should have used.

8.5 Factors to consider when changing the mix

Analysis of the material usage variance into the mix and yield components is worthwhile if management have control of the proportion of each material used. Management will seek to find the optimum mix for the product and ensure that the process operates as near to this optimum as possible.

Identification of the optimum mix involves consideration of several factors:

- Cost. The cheapest mix may not be the most cost effective. Often a favorable mix variance is offset by an adverse yield variance and the total cost per unit may increase.
- Quality. Using a cheaper mix may result in a lower quality product and the customer may not be prepared to pay the same price. A cheaper product may also result in higher sales returns and loss of repeat business.
- The fall in quality would make the company vulnerable to reputational risk.

9. CALCULATING ACTUAL COSTS OR STANDARD COSTS FROM VARIANCES

9.1 Calculating actual cost from variances and standard cost

In your examination, you might be given a question where you are required to:

- calculate actual costs, given information about variances and standard costs, or
- calculate standard cost, given information about variances and actual costs.

This type of problem does not occur in practice, but it is a useful way of testing knowledge of variances.

This type of problem can be solved by using the tables to calculate variances, described in this chapter. You can enter into a table all the data given by the question. The 'missing figure' for actual cost or standard cost can then be calculated.

Some examples will be used to illustrate the technique.

► *Example 40:*

The standard direct materials cost of making Product B is Rs.20, consisting of 4 kilos of material at Rs.5 per kilo.

During one period, 1,250 kilos of the material were purchased and the direct materials price variance was Rs.250 (A).

The actual costs of direct materials purchased and used in the period, would be calculated as follows

A table should be prepared showing how the total materials cost variance is calculated, and the figures that are available should be entered in the table.

	Rs.	
1,250 kilos of material should cost (× Rs.5)	6,250	
The materials did cost	?	
Total materials cost variance	250	(A)

Actual purchase costs were higher than standard cost because the price variance is adverse. Actual purchase costs were therefore Rs.6,250 + Rs.250 = Rs.6,500.

► *Example 41:*

The standard direct material cost of Product C is Rs.21 (6 kilos of material at Rs.3.50 per kilo). During a period when 400 units of Product C were made, the direct material usage variance was Rs.630 (F).

The actual quantity of direct materials used in the period, would be calculated as follows:

A table should be prepared showing how the materials usage variance is calculated, and the figures that are available should be entered in the table.

Materials usage variance	kilos	
400 units of Product C should use (× 6 kilos)	2,400	
They did use	?	
Material usage variance in kilos	?	
Standard price per kilo	Rs.3.50	
Material usage variance in Rs.	Rs.630	(F)

From this information we can calculate the material usage variance in kilos. A usage variance is valued at the standard cost per unit of material; therefore, the usage variance in Rs. can be converted into a usage variance in kilos:

Usage variance = Rs.630(F)/Rs.3.50 per kilo = 180 kilos (F).

The variance is favorable, which means that actual usage was less than the standard (expected) usage. We know that the standard usage is 2,400 kilos.

Actual material usage was therefore:

2,400 kilos – 180 kilos = 2,220 kilos.

- *Example 42:*

In the standard cost of Product D, the cost of Grade A labor is Rs.24 per unit (= 1.5 hours per unit at Rs.16 per hour). During a month when 500 units of Product D were made and 780 hours were worked, the labor rate variance for Grade A labor was Rs.1,500 (F).

The actual cost of Grade A labor in the month, would be calculated as follows

A table should be prepared showing how the labor rate variance is calculated, and the figures that are available should be entered in the table.

Direct labor rate variance	**Rs.**	
780 hours should cost (×Rs.16)	12,480	
They did cost	?	
Direct labor rate variance	1,500	(F)

The rate variance was favorable, which means that actual costs were less than standard.

Actual cost of Grade A labor = Rs.12,480 – Rs.1,500 = Rs.10,980.

- *Example 43:*

In a standard absorption costing system, the standard fixed production overhead cost per unit of Product E is Rs.36. This represents 3 direct hours at Rs.12 per hour.

The budgeted production volume in the period was 6,000 units of Product E. The fixed production overhead volume variance was Rs.12,600 (F).

The actual quantity of Product E that was produced, would be calculated as follows

A table should be prepared showing how the production overhead volume variance is calculated, and the figures that are available should be entered in the table.

Fixed overhead volume variance	**units of production**	
Budgeted production volume in units	6,000	
Actual production volume in units	?	
Fixed overhead volume variance in units	?	(F)
Standard fixed production overhead cost per unit	Rs.36	
Fixed overhead volume variance in Rs.	Rs.12,600	(F)

We know the volume variance in Rs. The volume variance is valued at the standard fixed overhead cost per unit. The volume variance in Rs. can therefore be converted into a volume variance in units as follows:

Rs. 12,600(F)/Rs.36 per unit = 350 units (F).

Actual production volume is higher than the budgeted volume, because the volume variance is favorable. The budgeted production volume was 6,000 units.

Actual production volume = 6,000 units + 350 units = 6,350 units.

9.2 Calculating standard cost from variances and actual cost

The same approach can be used to calculate a standard cost or budget amount if you are given a variance and data about actual costs (or sales revenues). Some further examples will illustrate the technique.

► *Example 44:*

Product F uses a direct material, material M. The standard price of material M is Rs.4 per kilo. During one month, 2,500 units of Product F were manufactured. These required 12,000 kilos of material M and the material usage variance was Rs.2,000 (A).

We know the standard price of material M, but we need to calculate the standard material usage. This can be obtained from the data provided. A table should be prepared showing how the material usage variance is calculated, and the figures that are available should be entered in the table.

Materials usage variance	kilos	
2,500 units of Product F should use	?	
They did use	12,000	
Material usage variance in kilos	?	
Standard price per kilo	Rs.4	
Material usage variance in Rs.	2,000	(A)

We know the material usage variance in Rs.. The variance is valued at the standard price per unit of material. From the information provided we can therefore calculate the material usage variance in kilos:

Usage variance = Rs.2,000(A)/Rs.4 per kilo = 500 kilos (A).

The variance is adverse, which means that actual usage was more than the standard (expected) usage. The standard material usage is therefore:

12,000 kilos – 500 kilos = 11,500 kilos.

This is the standard usage for 2,500 units of Product F, so the standard usage per unit is 11,500/2,500 = 4.60 kilos per unit.

The standard material cost for Product F is therefore:

4.6 kilos of material M at Rs.4 per kilo = Rs.18.40.

► *Example 45:*

The standard time required to make one unit of Product G is 1.25 hours of direct labor. During one month, total direct labor costs were Rs.119,000. The company made 6,800 units of Product G. These took 9,100 direct labor hours and the direct labor rate variance was Rs.8,400 (F).

The standard direct labor cost per unit of Product G, would be calculated as follows

We know the standard direct labor time, which is 1.25 hours per unit, but we need to calculate the standard direct labor rate per hour. This can be obtained from the data provided. A table should be prepared showing how the labor rate variance is calculated, and the figures that are available should be entered in the table.

Direct labor rate variance	Rs.	
9,100 hours should cost	?	
They did cost	119,000	
Direct labor rate variance	8,400	(F)

The rate variance is favorable, which means that actual costs were lower than standard costs. The actual labor cost for the 9,100 hours was Rs.119,000. Expected costs are higher.

The 9,100 hours should therefore cost Rs.119,000 + Rs.8,400 = Rs.127,400.

The standard rate per hour is Rs.127,400/9,100 hours = Rs.14 per hour.

The standard direct labor cost of Product G is:

1.25 hours at Rs.14 per hour = Rs.17.50

Tutorial note: It is easy to get confused about whether variances should be added or subtracted in this type of calculation. You need to think carefully and logically, to avoid making a mistake.

10. COMPREHENSIVE EXAMPLES

- *Example 01:*

A company makes a single product and uses standard absorption costing. The standard cost per unit is as follows:

	Rs. per unit
Direct materials	8
Direct labor	6
Fixed production overheads	12
	26

Budgeted production is 14,000 units per month. Last month, actual production was 14,800 units, and actual costs were as follows:

Total costs	Rs.
Direct materials	125,000
Direct labor	92,000
Fixed production overheads	170,000
	387,000

A statement for the month that reconciles budgeted costs, standard costs and actual costs would be prepared as follows

Reconciliation statement	Rs.	
Budgeted costs for the month (14,000 units × Rs.26)	364,000	
Extra standard costs of additional production (800 units × Rs.26)	20,800	
Standard costs of actual production (14,800 units × Rs.26)	384,800	
Cost variances		
Direct materials total cost variance	6,600	(A)
Direct labor total cost variance	3,200	(A)
Fixed overheads expenditure variance	2,000	(A)
Fixed overheads volume variance	9,600	(F)
Actual total costs in the month	387,000	

Workings: Direct materials total cost variance	Rs.	
14,800 units should cost (× Rs.8)	118,400	
They did cost	125,000	
Direct materials total cost variance	6,600	(A)

Direct labor total cost variance	Rs.	
14,800 units should cost (× Rs.6)	88,800	
They did cost	92,000	
Direct labor total cost variance	3,200	(A)

Fixed production overheads total cost variance	Rs.	
14,800 units: standard fixed overhead cost (× Rs.12)	177,600	
Actual fixed overhead cost	170,000	
Fixed production overheads total cost variance	7,600	(F)

Note: The fixed overhead total cost variance can be divided into:

a) an expenditure variance

b) a volume variance

Fixed production overheads expenditure variance	Rs.	
Budgeted fixed overhead expenditure (14,000 × Rs.12)	168,000	
Actual fixed overhead expenditure	170,000	
Fixed production overheads expenditure variance	2,000	(A)

Fixed production overheads volume variance	units	
Budgeted units of production	14,000	
Actual units produced	14,800	
Fixed production overheads volume variance in units	800	(F)
Standard fixed overheads per unit	Rs.12	
Fixed production overheads volume variance in Rs.	Rs.9,600	(F)

- *Example 02:*

a) Z Company uses a standard costing system and has the following labor cost standard in relation to one of its products:

4 hours of skilled labor at Rs.6.00 per hour: Rs.24.00

During October, 3,350 units of this products were made, which was 150 units less than budgeted. The labor cost incurred was Rs.79,893 and the number of direct labor hours worked was 13,450.

The direct labor rate and efficiency variances for the month, would be as follows:

Direct labor rate variance	Rs.	
13,450 hours should cost (× Rs.6)	80,700	
They did cost	79,893	
Labor rate variance	807	(F)

Direct labor efficiency variance	hours	
3,350 units should take (× 4 hours)	13,400	
They did take	13,450	
Efficiency variance in hours	50	(A)
Standard rate per hour	Rs.6	
Direct labor efficiency variance in Rs.	Rs.300	(A)

b) Company J uses a standard costing system and has the following data relating to one of its products:

	Rs. per unit	Rs. per unit
Selling price		9.00
Variable cost	4.00	
Fixed cost	3.00	
		7.00
Profit		2.00

The budgeted sales for October Year 5 were 800 units, but the actual sales were 850 units. The revenue earned from these sales was Rs.7,480.

The sales price and sales volume variances for October using standard absorption costing and standard marginal costing, would be as follows:

Sales price variance	**Rs.**	
850 units should sell for (× Rs.9)	7,650	
They did sell for	7,480	
Sales price variance	170	(A)

Sales volume variance, absorption costing	**units**	
Actual sales volume (units)	850	
Budgeted sales volume (units)	800	
Sales volume variance in units	50(F)	
Standard profit per unit	Rs.2	
Sales volume variance (profit variance) in Rs.	Rs.100	(F)

Sales volume contribution variance, marginal costing		
Sales volume variance in units	50 (F)	
Standard contribution per unit (Rs.9 - Rs.4)	Rs.5	
Sales volume variance (contribution variance)	Rs.250	(F)

c) The budget was to produce 15,000 units. The standard fixed production cost of a product is Rs.20, which is 4 hours at a rate of Rs.5 per direct labor hour. Actual production was 14,600 units and actual fixed production overhead expenditure was Rs.325,000. The production output was manufactured in 58,000 hours of work.

Calculations for the following variances are given below:

i. the fixed production overhead total cost variance

ii. the fixed production overhead expenditure variance and volume variance

iii. the fixed production overhead efficiency variance and capacity variance

(i) Fixed production overhead total cost variance	Rs.	
Standard fixed overhead cost of 14,600 units (× Rs.20)	292,000	
Actual fixed overhead expenditure	325,000	
Fixed overhead total cost variance (under-absorption)	33,000	(A)

(ii) Fixed production overhead expenditure variance	Rs.	
Budgeted fixed overhead expenditure (15,000 × Rs.20)	300,000	
Actual fixed overhead expenditure	325,000	
Fixed overhead expenditure variance	25,000	(A)

Fixed production overhead volume variance	units	
Budgeted production volume	15,000	
Actual production volume	14,600	
Volume variance in units	400	(A)
Standard fixed overhead rate per unit	Rs.20	
Fixed production overhead volume variance in Rs.	Rs.8,000	(A)

(iii) Fixed production overhead efficiency variance	hours	
14,600 units should take × 4 hours)	58,400	
They did take	58,000	
Efficiency variance in hours	400	(F)
Standard fixed overhead rate per hour	Rs.5	
Fixed production overhead efficiency variance in Rs.	Rs.2,000	(F)

Fixed production overhead capacity variance	hours	
Budgeted hours of work (15,000 × 4 hours)	60,000	
Actual hours of work	58,000	
Capacity variance in hours	2,000	(A)
Standard fixed overhead rate per hour	Rs.5	
Fixed production overhead capacity variance in Rs.	10,000	(A)

▶ *Example 03:*

A company operates a standard overhead absorption costing system. The standard fixed overhead rate per hour is Rs.25. The following data relate to last month:

Actual hours worked	8,250
Budgeted hours	9,000
Standard hours of actual production	7,800
Actual fixed overhead expenditure	Rs.211,000

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For the month, calculations of the following variances are given below

- the fixed overhead capacity variance
- the fixed overhead efficiency variance
- the fixed overhead expenditure variance.

Fixed production overhead capacity variance	**hours**	
Budgeted production hours of work	9,000	
Actual production hours of work	8,250	
Capacity variance inhours	750	(A)
Standard fixed overhead rate per hour	Rs.25	
Fixed production overhead capacity variance in Rs.	Rs.18,750	(A)
Fixed production overhead efficiency variance	**hours**	
Standard hours produced	7,800	
Actual hours worked	8,250	
Efficiency variance in hours	450	(A)
Standard fixed overhead rate per hour	Rs.25	
Fixed production overhead efficiency variance in Rs.	Rs.11,250	(A)
Fixed production overhead expenditure variance	**Rs.**	
Budgeted fixed overhead expenditure (9,000 hours × Rs.25)	225,000	
Actual fixed overhead expenditure	211,000	
Fixed overhead expenditure variance	14,000	(F)

► *Example 04:*

A manufacturing company uses a standard absorption costing system in accounting for its production costs.

The standard cost of a unit of product is as follows:

	Standard quantity	**Standard price/rate**	**Standard cost**
		Rs.	**Rs.**
Direct materials	5 kilos	6.00	30.00
Direct labor	20 hours	4.00	80.00
Variable production overhead	20 hours	0.20	4.00
Fixed production overhead	20 hours	5.00	100.00

The following data relates to Period 1:

Budgeted output	25,000 units
Actual output - produced	20,000 units
Units sold	15,000 units
Materials put into production	120,000 kilos
Materials purchased	200,000 kilos
Direct labor hours paid	500,000 hrs

Due to a power failure 10,000 hours were lost.

Cost of materials used	Rs.825,000
Rate per direct labor hour	Rs.5
Variable production overhead	Rs.70,000
Fixed production overhead	Rs.2,100,000

For Period 1, calculations for the following variances are given below:

- the material price variance
- the material usage variance
- the direct labor rate variance
- the direct labor idle time variance
- the direct labor efficiency variance
- the variable overhead total cost variance
- the fixed overhead expenditure variance
- the fixed overhead volume variance
- the total manufacturing cost variance.

Material price variance	**Rs.**	
120,000 kilos of materials should cost (× Rs.6)	720,000	
They did cost	825,000	
Material price variance	105,000	(A)
Material usage variance	**kilos**	
20,000 units should use (× 5 kilos)	100,000	
They did use	120,000	
Material usage variance in kilos	20,000	(A)
Standard price per kilo of material	Rs.6	
Material usage variance in Rs.	Rs.120,000	(A)
Direct labor rate variance	**Rs.**	
500,000 hours should cost (× Rs.4)	2,000,000	
They did cost (× Rs.5)	2,500,000	
Labor rate variance	500,000	(A)
Direct labor idle time variance = 10,000 hours (A) × Rs.4 per hour = Rs.40,000 (A)		
Direct labor efficiency variance	**hours**	
20,000 units should take (× 20 hours)	400,000	
They did take (500,000 – 10,000)	490,000	
Efficiency variance in hours	90,000	(A)
Standard rate per hour	Rs.4	
Direct labor efficiency variance in Rs.	Rs.360,000	(A)

Variable overhead total cost variance	**Rs.**	
20,000 units should cost (× Rs.4)	80,000	
They did cost	70,000	
Variable overhead total cost variance	10,000	(F)
Fixed production overhead expenditure variance	**Rs.**	
Budgeted fixed overhead expenditure (25,000 units × Rs.100)	2,500,000	
Actual fixed overhead expenditure	2,100,000	
Fixed overhead expenditure variance	400,000	(F)
Fixed production overhead volume variance	**units**	
Budgeted production volume	25,000	
Actual production volume	20,000	
Volume variance in units	5,000	(A)
Standard fixed overhead rate per unit	Rs.100	
Fixed production overhead volume variance in Rs.	Rs.500,000	(A)

Summary	**Favourable**	**Adverse**		
Variance	**Rs.**	**Rs.**		
Material price		105,000		
Material usage		120,000		
Direct labor rate		500,000		
Direct labor idle time		40,000		
Direct labor efficiency		360,000		
Variable overhead cost	10,000			
Fixed overhead expenditure	400,000			
Fixed overhead volume		500,000		
	410,000	1,625,000		
Manufacturing cost total variance			Rs.1,215,000	(A)

- *Example 05:*

A production manager is studying the cost report for the six-month period that has just ended. The production department incurred overhead costs of Rs.680,000 and had under-absorbed overheads of Rs.46,400. The actual direct labor hours worked in the department were 48,000 hours, which was 2,000 hours less than budgeted. Actual hours and standard hours are same,

For the given example, the budgeted absorption rate per direct labor hour, would be:

	Rs.
Actual overhead expenditure	680,000
Under-absorbed overhead	(46,400)
Absorbed overhead	633,600
Hours worked	48,000
Therefore budgeted absorption rate per hour (Rs.633,600/48,000)	Rs.13.20

The budgeted overhead expenditure, would be calculated as follows:

	hours
Actual hours worked	48,000
This was less than budget by	2,000
Budgeted hours	50,000
Absorption rate per hour	Rs.13.20
Budgeted overhead expenditure	
(50,000 hours × Rs.13.20)	Rs.660,000

The overhead expenditure and overhead volume variances in the period, would be,

Volume variance in hours	2,000 hours	Adverse
Absorption rate per hour	Rs.13.20	
Volume variance in Rs.	Rs.26,400	Adverse

	Rs.	
Actual overhead expenditure	680,000	
Budgeted overhead expenditure	660,000	
Expenditure variance	20,000	Adverse

- *Example 06:*

Lettuce makes a product – the vegetable guard. It is the organic alternative to slug pellets and chemical sprays.

For the forthcoming period budgeted fixed costs were Rs.6,000 and budgeted production and sales were 1,300 units.

The vegetable guard has the following standard cost:

	Rs.
Selling price	50
Materials 5kg × Rs.4/kg	20
Labor 3hrs × Rs.4/hr	12
Variable overheads 3hrs × Rs.3/hr	9

Actual results for the period were as follows:

1,100 units were made and sold, earning revenue of Rs.57,200.

6,600kg of materials were bought at a cost of Rs.29,700 but only 6,300 kg were used

3,600 hours of labor were paid for at a cost of Rs.14,220. The total cost for variable overheads was Rs.11,700 and fixed costs were Rs.4,000.

The company uses marginal costing and values all inventory at standard cost.

a) Assuming now that the company uses absorption costing, recalculating the fixed production overhead variances, would be as follows:

Tutorial note: If the company uses absorption costing with a direct labor hour absorption rate, we can calculate an expenditure, capacity and efficiency variance for fixed production overheads.

The first step is to calculate a budgeted absorption rate per hour

Budgeted labor hours: 1,300 × 3 = 3,900 hrs

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Budgeted fixed cost Rs.6,000

Budgeted absorption rate: Rs.6,000 /3,900 = Rs.1.54

Fixed overhead expenditure variance

Same as in (a): Rs.2,000 (F).

Fixed overhead capacity variance

	hours	
Budgeted hours of work	3,900	
Actual hours worked	3,600	
Capacity variance in hours	300	(A)
Standard fixed overhead rate per hour	Rs.1.54	
Fixed overhead capacity variance in Rs.	Rs.462	(A)

Fixed overhead efficiency variance

Efficiency variance in hours = 300 hours (A) – see answer to (a).

Fixed overhead efficiency variance = 300 hours (A) × Rs.1.54 = Rs.462 (A).

b) Possible causes for the labor variances that have been calculated are discussed below:

Labor rate

The labor rate variance is favorable indicating a lower rate per hour was paid than expected. This is perhaps because more junior or less experienced staff were used during production. Though less likely, it is possible that staff had a pay cut imposed upon them. Finally, an incorrect or outdated standard could have been used.

Labor efficiency

This is significantly adverse, indicating staff took much longer than expected to complete the output. This may relate to the favorable labor rate variance, reflecting employment of less skilled or experienced staff. Staff demotivated by a pay cut are also less likely to work efficiently.

It may also relate to the reliability of machinery as staff may have been prevented from reaching full efficiency by unreliable equipment

- *Example 07:*

Carat plc, a premium food manufacturer, is reviewing operations for a three-month period. The company operates a standard marginal costing system and manufactures one product, ZP, for which the following standard revenue and cost data per unit of product is available:

Selling price	Rs. 12.00
Direct material	A 2.5 kg at Rs. 1.70 per kg
Direct material	B 1.5 kg at Rs. 1.20 per kg
Direct labor	0.45 hrs at Rs. 6.00 per hour

Fixed production overheads for the three-month period were expected to be Rs. 62,500.

Actual data for the three-month period was as follows:

Sales and production	48,000 units of ZP were produced and sold for Rs. 580,800
Direct material A	121,951 kg were used at a cost of Rs. 200,000
Direct material B	67,200 kg were used at a cost of Rs. 84,000
Direct labor	Employees worked for 18,900 hours, but 19,200 hours were paid at a cost of Rs. 117,120
Fixed production overheads	Rs. 64,000

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Budgeted sales for the three-month period were 50,000 units of Product ZP.

a) The following variances are required to be calculated for the given example:

i. price, mix and yield variances for each material;

ii. labor rate, labor efficiency and idle time variances.

Sales volume contribution per unit

	Rs. /unit	Rs. /unit
Standard sales price		12·00
Material A (Rs. 1·70 × 2·5)	4·25	
Material B (Rs. 1·20 × 1·5)	1·80	
Labor (Rs. 6·00 × 0·45)	2·70	
	8·75	
Standard contribution		3·25

Direct material price variances

Material A price variance	Rs.	
Actual quantity × actual price	200,000	
Actual quantity × standard price (Rs. 1·70 × 121,951)	207,317	
Price variance	7,317	(F)
Material B price variance	**Rs.**	
Actual quantity × actual price	84,000	
Actual quantity × standard price (Rs. 1·20 × 67,200)	80,640	
Price variance	3,360	(A)

Materials mix and yield variances

Standard cost of input and output

	kg	Rs. /kg	Standard cost
Material A = Rs. 1·70 × 2·5 =	2.5	Rs. 1.7	4·25
Material B = Rs. 1·20 × 1·5 =	1.5	Rs. 1.2	1·80
	4.0		6·05

Standard cost of input = Rs. 6.05/4kg

Standard cost of output = Rs. 6.05/unit

Material mix

	Actual mix	Standard ratio	Standard mix	Mix variance (kg)	Standard cost per kg	Mix variance (Rs.)
A	121,951	2.5	118,220	3,731	1.7	6,343 (A)
B	67,200	1.5	70,931	(3,731)	1.2	(4,477) (F)
	189,151		189,151			1,866 (A)

Material yield variance

	Units	
189,151 did yield	48,000	
189,151 should have yielded (÷ 4kg)	47,288	
Extra yield	712	
Standard cost of a unit	Rs. 6.05	
Yield variance	Rs. 4,309	(F)

Alternative calculation

AQ AM SC					
A	121,951	× Rs. 1.7/kg	207,317		
B	67,200	× Rs. 1.2/kg	80,640		
	189,151			287,957	
					MIX
					(1,866) (A)
AQ SM SC					
189,151 × Rs. 6.05/4kg				286,091	
					YIELD
					4,309 (F)
SQ SM SC					
192,000 × Rs. 6.05/4kg				290,400	
	48,000 × 4kg				
or 48,000 units × 6.05					

Labor variances

Labor rate	Rs.	
Actual hrs × actual rate	117,120	
Actual hrs × standard rate (19,200 × Rs. 6)	115,200	
Rate:	1,920	(A)
Labor efficiency	**Rs.**	
Actual hrs worked × standard rate		
18,900 hours × Rs. 6	113,400	
Standard hrs × standard rate		
48,000 units × .45 hrs × Rs. 6	129,600	
Efficiency:	16,200	(F)
Labor idle time	**Hours**	
Actual hrs paid for	19,200	
Actual hrs worked	18,900	
Idle time (hours)	300	
Standard rate	Rs. 6	
Idle time (Rs.)	1,800	(A)

b) Possible explanations for the following variances are also discussed below:

i. material price, mix and yield variances for material A;

ii. labor rate, labor efficiency and idle time variances.

The favorable material A price variance indicates that the actual price per kilogram was less than standard. Possible explanations include buying lower quality material, buying larger quantities of material A and thereby gaining bulk purchase discounts, a change of supplier, and using an out-of-date standard.

The adverse material A mix variance indicates that more of this material was used in the actual input than indicated by the standard mix. The favorable material price variance suggests this may be due to the use of poorer quality material (hence more was needed than in the standard mix), or it might be that more material A was used because it was cheaper than expected.

The favorable material A yield variance indicates that more output was produced from the quantity of material used than expected by the standard. This increase in yield is unlikely to be due to the use of poorer quality material: it is more likely to be the result of employing more skilled labor, or introducing more efficient working practices.

It is only appropriate to calculate and interpret material mix and yield variances if quantities in the standard mix can be varied. It has also been argued that calculating yield variances for each material is not useful, as yield is related to output overall rather than to particular materials in the input mix. A further complication is that mix variances for individual materials are inter-related and so an explanation of the increased use of one material cannot be separated from an explanation of the decreased use of another.

The unfavorable labor rate variance indicates that the actual hourly rate paid was higher than standard. Possible explanations for this include hiring staff with more experience and paying them more (this is consistent with the favorable overall direct material variance), or implementing an unexpected pay increase. The favorable labor efficiency variance shows that fewer hours were worked than standard. Possible explanations include the effect of staff training, the use of better quality material (possibly on Material B rather than on Material A), employees gaining experience of the production process, and introducing more efficient production methods. The adverse idle time variance may be due to machine breakdowns; or a higher rate of production arising from more efficient working (assuming employees are paid a fixed number of hours per week).

▶ *Example 08:*

Hexa Limited uses a standard costing system. The following profit statement summarizes the performance of the company for August 20X3:

		Rupees
Budgeted profit		3,500
Favorable variance:		
Material price	16,000	
Labor efficiency	11,040	27,040
Adverse variance:		
Fixed overheads expenditure	(16,000)	
Material usage	((6,000)	
Labor rate	(7,520)	(29,520)
Actual profit		1,020

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The following information is also available:

Standard material price per unit (Rs.)	4.0
Actual material price per unit (Rs.)	3.9
Standard wage rate per hour (Rs.)	6.0
Standard wage hours per unit	10
Actual wages (Rs.)	308,480
Actual fixed overheads (Rs.)	316,000
Fixed overheads absorption rate	100% of direct wages

a) Budgeted output in units, actual number of units purchased, actual units produced, actual hours worked and actual wage rate per hour would be calculated as follows:

(i)	**Budgeted output in units**		
	Actual Fixed Overhead	Rs. 316,000	
	Less: Adverse Fixed Overhead Variance	Rs. 16,000	
	Budgeted Fixed Overhead	Rs. 300,000	
	Direct wages per unit (Rs. 6 x 10 hours)	Rs. 60	
	Budgeted output in units (Rs. 300,000/60)	5,000	units
(ii)	**Actual number of units purchased**		
	Material Price Variance – Total	Rs. 16,000	
	Price Variance per unit (Rs. 4.0 – Rs. 3.9)	Re. 0.1	
	Units purchased (Rs. 16,000 / 0.1)	160,000	
(iii)	**Actual units produced**		
	Standard Wages (308,480 – 7,520 + 11,040)	Rs. 312,000	
	Standard Labor Cost (Rs. 6 x 10 hours)	Rs. 60	
	Units produced (Rs. 312,000 / Rs. 60)	5,200	
(iv)	**Actual hours worked**		
	Actual Labor Costs	Rs. 308,480	
	Less: Labor Rate Variance	7,520	
	Actual Labor Costs at Standard Rate	300,960	
	Standard Rate per hour	Rs. 6.00	
	Actual hours worked (300,960 / 6)	50,160	
(v)	**Actual Wages / Actual Hours = Rs. 308,480 / 50,160 = Rs. 6.15**		

b)

Possible causes of favorable material price variance
Fortunate buy
Inferior quality materials
Unusual discount due to bulk quantity purchase
Drop in market price
Less costly method of transportation

Possible causes of unfavorable material quantity variance
Carelessness
Poorly adjusted machines
Unskilled workers
New equipment
Inferior quality materials
Possible causes of favorable labor efficiency variance
Use of better skilled workers
High quality material
New equipment
Possible causes of unfavorable labor rate variance
Use of workers with better skills
Change in pay scales
Overtime

- *Example 09:*

Excellent Limited makes and sells a single product. The standard cost card for the product, based on normal capacity of 45,000 units per month is as under:

	Rupees
Material 60 kgs at Rs. 0.60 per kg	36.00
Labor ½ hour at Rs. 50.00 per hour	25.00
Variable factory overheads, 30% of direct labor cost	7.50
Fixed factory overheads	6.50
Total	**75.00**

Actual data for the month of August 20X3 is as under:

Work in process on August 1, 20X3 (60% converted)	Units	10,000
Started during the month	Units	50,000
Transferred to finished goods	Units	48,000
Work in process on August 31, 20X3 (50% converted)	Units	10,000
Material purchased at Rs. 0.50 per kg	Rs.	1,750,000
Material issued to production	Kgs	3,100,000
Direct labor at Rs. 52 per hour	Rs.	1,300,000
Factory overheads (including fixed costs of Rs. 290,000)	Rs.	600,000

The company uses FIFO method for inventory valuation.

All materials are added at the beginning of the process. Conversion costs are incurred evenly throughout the process. Inspection takes place when the units are 80% complete. Under normal conditions, no spoilage should occur.

a) A quantity and equivalent production schedules for material and conversion costs would be prepared as follows:

Preliminary working	Rs.
Units in process at beginning	10,000
Units started during the month	50,000
Total possible units	60,000
Normal loss	–
Expected good output:	60,000
Actual good output:	
Started in the previous period but finished in this period	10,000
Started and finished in this period (balance)	38,000
Finished in this period (given)	(48,000)
Closing WIP	(10,000)
Loss of units (Balance quantity)	2,000

Units made in period	Total units	Percentage complete	Materials	Conversion cost
Started last period				
Opening WIP	10,000			
Materials		0%		
Conversion		40%		4,000
Started and finished in period	38,000	100%	38,000	38,000
Good output	48,000			
Started but not finished				
Closing WIP	10,000			
Materials		100%	10,000	
Conversion		50%		5,000
Abnormal loss	2,000			
Materials		100%	2,000	
Conversion		80%		1,600
Units made in period			50,000	48,600

b) Material, labor and variable overhead variances are calculated below. (Assuming that the material price variance is calculated as materials are used rather than as they are purchased).

Material, labor and variable overhead variances		
1)	Material price variance	Rs.
	3,100,000 kgs should cost (@ 0.6 per kg)	1,860,000
	3,100,000 kgs did cost (@ 0.5 per kg)	1,550,000
	Material price variance (F)	310,000

2)	**Material quantity variance**	**Kgs.**
	Making 50,000 units should use (@60 kg per unit)	3,000,000
	Making 50,000 units did use	3,100,000
	Material quantity variance in kgs (A)	(100,000)
	Standard cost per kg (Rs.)	0.6
	Material quantity variance in Rs. (A)	(60,000)
3)	**Labor rate variance**	**Rs.**
	25,000 hrs should cost (@ 50 per hr)	1,250,000
	25,000 hrs did cost (@ 52 per hr)	1,300,000
	Labor rate variance (A)	(50,000)
	W: Labor hours worked = Rs.1,300,000 ÷ Rs. 52 = 25,000 hrs	
4)	**Labor efficiency variance**	**hrs.**
	Making 48,600 units should use (@ 0.5 hrs per unit)	24,300
	Making 48,600 units did use	25,000
	Labor efficiency variance in hrs (A)	(700)
	Standard rate per hr (Rs.)	50
	Labor efficiency variance in Rs. (A)	(35,000)
5)	**Variable overhead rate variance**	**Rs.**
	25,000 hrs should cost (@ 15 per hr)	375,000
	25,000 hrs did cost (Rs.600,000 less Rs.290,000)	310,000
	Variable overhead rate variance (F)	65,000
6)	**Variable overhead efficiency variance**	**hrs.**
	Making 48,600 units should use (@ 0.5 hrs per unit)	24,300
	Making 48,600 units did use	25,000
	Variable overhead efficiency variance in hrs (A) **(as above)**	(700)
	Standard rate per hr (Rs.)	15
	Variable overhead efficiency variance in Rs. (A)	(10,500)

c) The over (under) absorption of fixed production overhead and analyze it into expenditure variance and volume variance would be calculated below:

	Over(under) absorption of fixed production overhead	
	Note: Fixed overhead absorption rate is Rs.6.5 per unit. Each unit takes 0.5 hrs. Therefore, the fixed overhead absorption rate is Rs. 13 per hour.	
1)	**Over(under) absorption**	**Rs.**
	Amount absorbed (48,600 units at Rs. 6.5 per unit)	315,900
	Actual expenditure	290,000
	Over absorption (F)	25,900
2)	**Fixed production overhead expenditure variance**	**Kgs.**
	Budgeted expenditure (45,000 units @ Rs. 6.5 per unit)	292,500
	Actual expenditure	290,000
	Expenditure variance in Rs. (F)	2,500

3)	Fixed production overhead volume variance	Rs.
	Budgeted volume	45,000
	Actual volume	48,600
	Volume variance in units (F)	3,600
	Standard rate per unit (Rs.)	6.5
	Labor efficiency variance in Rs. (F)	23,400

d) Analyze the fixed production overhead volume variance into efficiency and capacity variances.

1)	Fixed overhead efficiency variance	hrs.
	Making 48,600 units should use (@ 0.5 hrs per unit)	24,300
	Making 48,600 units did use	25,000
	Fixed overhead efficiency variance in hrs (A) **(as above)**	(700)
	Standard rate per hr (Rs.)	13
	Fixed overhead efficiency variance in Rs. (A)	(9,100)
2)	**Fixed overhead capacity variance**	**Rs.**
	Budgeted hours (45,000 hours at 0.5 hr per unit)	22,500
	Actual hours worked	25,000
	Capacity variance in hrs (F)	2,500
	Standard rate per hr (Rs.)	13
	Capacity variance in Rs. (F)	32,500

▶ *Example 10:*

You have recently been appointed as the Financial Controller of Watool Limited. Your immediate task is to prepare a presentation on the company's performance for the recently concluded year. You have noticed that the records related to cost of production have not been maintained properly. However, while scrutinizing the files you have come across certain details prepared by your predecessor which are as follows:

i. Annual production was 50,000 units which is equal to the designed capacity of the plant.

ii. The standard cost per unit of finished product is as follows:

Raw material X	6 kg at Rs. 50 per kg
Raw material Y	3 kg at Rs. 30 per kg
Labor- skilled	1.5 hours at Rs. 150 per hour
Labor- unskilled	2 hours at Rs. 100 per hour
Factory overheads	Variable overheads per hour are Rs. 100 for skilled labor and Rs. 80 for unskilled labor. Fixed overheads are Rs. 4,000,000.

iii. Data related to variation in cost of materials is as under:

Material X price variance	Rs. 95,000 (Adverse)
Material Y actual price	6% below the standard price
Material X quantity variance	Nil
Material Y quantity variance	Rs. 150,000 (Adverse)

iv. Opening raw material inventories comprised of 25 days of standard consumption whereas closing inventories comprised of 20 days of standard consumption.

v. Actual labor rate for skilled and unskilled workers was 10% and 5% higher respectively.

vi. Actual hours worked by the workers were 168,000 and the ratio of skilled and unskilled labor hours was 3:4 respectively.

vii. Actual variable overheads during the year amounted to Rs. 16,680,000. Fixed overheads were 6% more than the budgeted amount.

a) Actual purchases of each type of raw materials is calculated as follows:

Actual quantity purchased: Material X	
Standard consumption quantities (50,000 units × 6kg per unit)	300,000
Usage variance	0
Actual usage	300,000
Opening inventory (300,000 kgs × 25/365)	(20,548)
Closing inventory (300,000 kgs × 20/365)	16,438
Inventory movement	(4,110)
Actual purchase quantity (kgs)	295,890

Actual cost of purchase:	
Standard rate (Rs. per kg)	50
Actual quantity purchased at standard rate (Rs.)	14,794,500
Price paid above / (below) the standard rate	
{adverse / (favorable) price variance}	95,000
Actual cost of purchase	14,889,500

Actual quantity purchased: Material Y	
Standard consumption quantities (50,000 units × 3kg per unit)	150,000
Usage variance (Rs.150,000 @Rs.30 per kg)	5,000
Actual usage	155,000
Opening inventory (150,000 kgs × 25/365)	(10,274)
Closing inventory (150,000 kgs × 20/365)	8,219
Inventory movement	(2,055)
Actual purchase quantity (kgs)	152,945

Actual cost of purchase:	
Standard rate (Rs. per kg)	30
Actual quantity purchased at standard rate (Rs.)	4,588,350
Price paid above / (below) the standard rate (6%)	(275,301)
Actual cost of purchase	4,313,049

b) Labor rate and efficiency variances, variable overhead rate and efficiency variances and fixed overhead expenditure variance, would be calculated as follows:

Labor and overhead variances:		
Labor rate variances:	**Skilled labor**	**Unskilled labor**
Actual hours at standard rate		
168,000×3/7	72,000	
168,000×4/7		96,000
Standard rates per hour	150	100
Actual hours at standard rate	10,800,000	9,600,000
Price variances		
10% (A)	**(1,080,000)**	
5% (A)		**(480,000)**
Labor efficiency variance:		
50,000 units should use		
@1.5 hours	75,000	
@2 hours		100,000
50,000 units did use	72,000	96,000
Labor efficiency variance (hours) (F)	3,000	4,000
Standard rate per hour (Rs.)	150	100
Labor efficiency variance (Rs.) (F)	**450,000**	**400,000**

Variable overhead rate variances:		
168,000 hours should cost		**Rs.**
168,000 × 3/7 × Rs.100		7,200,000
168,000 × 4/7 × Rs.80		7,680,000
		14,880,000
168,000 hours did cost		16,680,000
Variable overhead rate variance (A)		**1,800,000**
Variable overhead efficiency variance:	**Skilled**	**Unskilled**
50,000 units should use	**Hrs**	**Hrs**
@1.5 hours	75,000	
@2 hours		100,000
50,000 units did use	72,000	96,000
Labor efficiency variance (hours) **(as before)**	3,000	4,000
Standard rate per hour (Rs.)	100	80
Variable overhead efficiency variance (Rs.) (F)	**300,000**	**320,000**
Total (Rs.) (F)		**620,000**
Fixed overhead expenditure variance		**Rs.**
Budgeted fixed overhead		4,000,000
Variance (6%)		240,000

▶ *Example 11:*

The following data relates to actual output, actual costs and variances for the four-weekly accounting period number 4 of a company which makes only one product.

The value of work-in-progress at the end of period 4 was the same as the value of work-in-progress at the beginning of the month.

Actual production of Product XY	18,000 units
Actual costs incurred:	Rs.000
Direct materials purchased and used (150,000 kg)	210
Direct labor costs (32,000 hours)	136
Variable production overhead	38

Variances:	Rs.000	
Direct materials price	15	Favourable
Direct materials usage	9	Adverse
Direct labor rate	8	Adverse
Direct labor efficiency	16	Favourable
Variable production overhead expenditure	6	Adverse
Variable production overhead efficiency	4	Favourable

Variable production overhead varies with labor hours worked.

A standard marginal costing system is operated.

A standard product cost sheet for one unit of Product XY, showing how the standard marginal production cost of the product is made up is presented below:

Standard marginal production cost – Product XY		Rs.
Direct materials	(8 kilos at Rs.1.50 per kilo)	12.0
Direct labor	(2 hours at Rs.4 per hour)	8.0
Variable production overhead	(2 hours at Rs.1 per hour)	2.0
Standard marginal production cost		22.0

Tutorial note: This problem tests your understanding of the formulae for calculating variances. Here, you are given the actual costs and the variances, and have to work back to calculate the standard cost. The answer can be found by filling in the balancing figures for each variance calculation.

Workings

Materials price variance	Rs.	
150,000 kilos of materials did cost	210,000	
Material price variance	15,000	(F)
150,000 kilos of materials should cost	225,000	

(The variance is favorable, so the materials did cost less to buy than they should have cost.)

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Therefore, the standard price for materials is Rs. 225,000/150,000 kilograms = Rs.1.50 per kilo.

Materials usage variance		
Materials usage variance in Rs. = Rs.9,000 (A)		
Standard price for materials = Rs.1.50		
Materials usage variance in kilograms = 9,000/1.50 = 6,000 kilos (A)		
	kilos	
18,000 units of the product did use	150,000	
Material usage variance in kilos	6,000	(A)
18,000 units of the product should use	144,000	

Therefore, the standard material usage per unit of product = 144,000 kilos/18,000 units = 8 kilos per unit.

Direct labor rate variance	Rs.	
32,000 hours of labor did cost	136,000	
Direct labor rate variance	8,000	(A)
32,000 hours of labor should cost	128,000	

Therefore, the standard direct labor rate per hour = Rs. 128,000/32,000 hours = Rs.4 per hour.

Direct labor efficiency variance

Labor efficiency variance in Rs. = Rs.16,000 (F)

Standard rate per hour = Rs.4

Labor efficiency variance in hours = 16,000/4 = 4,000 hours (F)

	hours	
18,000 units of the product did take	32,000	
Labor efficiency variance in hours	4,000	(F)
18,000 units of the product should take	36,000	

Therefore, the standard time per unit of product = 36,000 hours/18,000 units = 2 hours per unit.

This number of hours per unit also applies to variable production overheads.

Variable overhead expenditure variance	Rs.	
32,000 hours did cost	38,000	
Variable overhead expenditure variance	6,000	(A)
32,000 hours should cost	32,000	

Therefore, the variable production overhead rate per hour = Rs. 32,000/32,000 hours = Rs.1 per hour.

▶ *Example 12:*

MZ Limited (MZL) manufactures a single product X and uses standard marginal costing system. The standard cost card of product X is as follows:

	Rupees
Raw material (13 kg @ Rs. 135 per kg)	1,755
Labor (14 hours @ Rs. 100 per hour)	1,400
Variable production overheads (Rs. 75 per labor hour)	1,050

Following data is available in respect of operations for the month of February 2018:

i. 55,000 units were put into process. 1,500 units were lost in process which were considered to be normal loss. Process losses occur at the end of the process.

ii. 698,000 kg of material was purchased at Rs. 145 per kg. Material is added at the start of the process and conversion costs are incurred evenly throughout the process.

iii. 755,000 labor hours were worked during the month. However, due to certain labor related issues, wages were paid at Rs. 115 per hour.

iv. Fixed production overheads are budgeted at Rs. 40 million for the month of February 2018. Total actual production overheads amounted to Rs. 95 million.

v. Actual fixed production overheads exceeded budgeted fixed overheads by Rs. 1.1 million.

vi. Inventory balances were as under:

	01 February 2018	28 February 2018
Raw material (kg)	15,000	17,000
Work in process (units)	5,000 (60% converted)	6,000 (80% converted)
Finished goods (units)	10,000	12,000

vii. MZL uses FIFO method for valuing the inventories.

Material, labor and overhead variances are computed as follows

Material, labor, overhead variances		**Rs. in '000**
Cost variances under marginal costing		
Material price variance [(135–145)×696,000]	Adv.	(6,960.00)
Material usage variance {(53,500**(W.3)**×13)– 696,000**(W.1)}**×135	Adv.	(67.50)
Labor rate variance (100–115)×755,000	Adv.	(11,325.00)
Labor efficiency variance {(14×54,300)**(W.3)–**755,000}×100	Fav.	520.00
Variable overheads expenditure variance (755,000×75)–Rs. 53,900,000**(W.4)**	Fav.	2,725.00
Variable overheads efficiency variance {(54,300**(W.3)**×14)–755,000}×75	Fav.	390.00
Fixed overhead expenditure variance (40,000–41,100) **(W.4)**)	Adv.	(1,100.00)

W-1:		
Actual material usage (kg)	(698,000+15,000–17,000)	696,000.00

W-2: Quantity schedule	Units
WIP (opening)	5,000.00
Units started	55,000.00
Total units in production	60,000.00
Normal loss	(1,500.00)
WIP (End)	(6,000.00)
Finished goods/Transferred out	**52,500.00**

W-2: Quantity schedule		Material	Conversion cost
		---------- Units ----------	
Finished goods/Transferred out **(W-2)**		52,500.00	52,500.00
Less: WIP (Opening)		(5,000.00)	(5,000.00)
Started and finished in this period		47,500.00	47,500.00
Add: WIP (Opening)	(5,000×40%)		2,000.00
Add: WIP (Closing)	(6,000×80%)	6,000.00	4,800.00
Equivalent production units		**53,500.00**	**54,300.00**

W-4: Actual variable and fixed overheads		Rs. in '000
Budgeted fixed overheads	***Given***	40,000.00
Actual fixed overheads exceeded applied overheads	***Given***	1,100.00
Actual fixed overheads		41,100.00
Less: Total actual variable and fixed overheads	***Given***	95,000.00
Actual variable overheads		**53,900.00**

- *Example 13:*

Jack and Jill (JJ) manufactures various products. The following information pertains to one of its main products:

i. Standard cost card per unit

	Rupees
Direct material (5 kg at Rs. 40 per kg)	200
Direct labor (1.5 hours at Rs. 80 per hour)	120
Factory overheads	130% of direct labor

ii. Fixed overheads are budgeted at Rs. 3 million based on normal capacity of 75,000 direct labor hours per month.

iii. Actual data for the month of June 2015

	Units
Opening work in process (80% converted)	8,000
Started during the month	50,000
Transferred to finished goods	48,000
Closing work in process (60% converted)	7,000
	Rupees
Material issued to production at: Rs. 38 per kg	1,900,000
Rs. 42 per kg	8,400,000
Direct labor at Rs. 84 per hour	6,048,000
Variable factory overheads	6,350,000
Fixed factory overheads	2,850,000

iv. Materials are added at the beginning of the process. Conversion costs are incurred evenly throughout the process. Losses up to 3% of the input are considered as normal. However, losses are determined at the time of inspection which takes place when units are 90% complete.

v. JJ uses FIFO method for inventory valuation.

a) Equivalent production units is calculated as follows

Equivalent units using FIFO:	Quantity schedule (Units)	Equivalent production units	
		Material (Units)	Conversion (Units)
Opening WIP **(80% conversion)**	8,000	(8,000)	(6,400)
Units started during the month	50,000		
	58,000		
Units transferred to finished goods	48,000	48,000	48,000
Closing WIP **(60% conversion)**	7,000	7,000	4,200
Normal loss 3% of input (58,000-7,000) × 3%	1,530	-	-
Abnormal loss (90% conversion) **Bal.**	1,470	1,470	1,323
	58,000	**48,470**	**47,123**
	A	**B**	**(A×B)**

b) Computation for the following variances for the month of June 2015 are given below

- Material rate and usage
- Labor rate and efficiency
- Variable factory overhead expenditure and efficiency
- Fixed factory overhead expenditure and volume

Variances:		kg/Hrs. /Rs.	(Standard-Actual)	Fav./ (adv.)
				Rupees
Material price variance:				
Actual material usage	**W.2**	50,000	40 - 38 = Rs. 2.00	100,000
Actual material usage	**W.2**	200,000	40 - 42 = (Rs. 2.00)	(400,000)
				(300,000)
Material usage variance:				
Standard material rate per kg		40.00	242,350 - 250,000 = (7,650 kgs)	**(306,000)**
Labor rate variance:				
Actual labor hours	**W.2**	72,000	80 - 84 = (Rs. 4.00)	**(288,000)**
Labor efficiency variance:				
Standard labor rate per hour		80.00	70,685 - 72,000 = (1,315 Hrs.)	**(105,200)**
Variable overhead expenditure variance:				
Actual labor hours at standard rate		72,000	**(W.1)** 64.00	4,608,000
Actual variable overheads				(6,350,000)
				(1,742,000)
Variable overhead efficiency variance:				
Standard variable overhead rate per hour	**W.1**	64.00	70,685 - 72,000 = (1,315 Hrs.)	**(84,160)**
Fixed overhead expenditure variance:				
Budgeted fixed production overhead				3,000,000
Actual fixed production overhead				(2,850,000)
				150,000
Fixed overhead volume variance:				
Standard fixed overhead rate per hour	**W.1**	40.00	70,685 - 75,000 = (4,315 Hrs.)	**(172,600)**

W.1: Statement of standard factory overhead rate per hour:		**Rs.**
Standard factory overhead rate per hour	(120×130%)÷1.5	104.00
Standard fixed factory overhead rate per hour	3,000,000÷75,000	40.00
Standard variable factory overhead rate per hour	104-40	64.00

W.2:	**Standard usage of material/labor**			**Actual usage of material /labor/overheads**		
	Eq. units	**Per unit**	**Kg/ hrs.**	**Amount**	**Per kg/ hrs. (Rs.)**	**Kg /hrs.**
Material	48,470	5.0 kg	242,350	1,900,000	38.00	50,000
				8,400,000	42.00	200,000
				10,300,000		**250,000**
D. labor	47,123	1.5 hrs.	70,685	6,048,000	84.00	**72,000**
V. overheads				6,350,000	88.1944	**72,000**

▶ *Example 14:*

Hexal Limited is a manufacturer of various machine parts. Following information has been extracted from the cost records of one of its products AXE for the month of June 2014:

i. Standard cost per unit:

	Rupees
Raw material	170.00
Direct labor (1.25 hours)	150.00
Overheads	137.50

ii. Based on normal capacity of 128,000 direct labor hours, fixed overheads are estimated at Rs. 2,560,000.

iii. Following information pertains to production of 100,000 units of product AXE:

Actual direct labor hours worked		130,000
Unfavorable material usage variance	Rs.	820,000
Unfavorable material price variance	Rs.	600,000
Actual direct labor cost	Rs.	16,250,000
Actual fixed and variable overheads	Rs.	15,500,000

For the month of June 2014, actual material cost and labor variances are computed as follows

Actual direct material cost		Rupees
Standard material cost	100,000*170	17,000,000
Un-favorable material usage variance		820,000
Un-favorable material price variance		600,000
		18,420,000

Direct labor variances		Favorable/ (Adverse)
1	**Direct labor rate variance**	
	(Standard rate per hour-Actual rate per hour)*Actual hours	
	[(150/1.25)-(16,250,000/130,000)]*130,000	(650,000)
2	**Direct labor efficiency variance**	
	(Standard hours-Actual hours)*Standard rate per hour	
	(100,000*1.25)-130,000)*120	(600,000)

W-1		
Standard total overheads rate per labor hour	137.5/1.25	110.00
Standard fixed overhead rate per labor hour	2,560,000/128,000	20.00
Standard variable overhead rate per labor hour	**Rs.**	90.00

Example 15:

Zamil Industries (ZI) produces and markets an industrial product Zeta. ZI uses standard absorption costing system. The break-up of Zeta's standard cost per unit is as under:

		Rupees
Materials:	Axe – 1 kg	160
	Zee – 2 kg	210
Direct labor – 0.8 hours		200
Overheads – 0.8 hours		180

Production of Zeta for the month of August 2016 was budgeted at 15,000 units. Information pertaining to production of Zeta for August 2016 is as under:

i. Raw material inventory is valued at lower of cost and net realizable value. Cost is determined under FIFO method. Stock cards of materials Axe and Zee are reproduced below:

Date	Description	Axe		Zee	
		kg	Cost per kg (Rs.)	kg	Cost per kg (Rs.)
1-Aug	Opening balance	9,000	150	4,000	120
				8,000	122
3-Aug	Purchase returns	-	-	(2,000)	122
4-Aug	Purchases	17,000	148	35,000	125
6-Aug	Issues to production	(16,000)	-	(29,000)	-

ii. Actual direct wages for the month were Rs. 3,298,400 consisting of 11,780 direct labor hours.

iii. Fixed overheads were estimated at Rs. 540,000 based on budgeted direct labor hours.

iv. The actual fixed overheads for the month were 583,000.

Actual sales of Zeta for the month of August 2016 was 12,000 units. Opening and closing finished goods inventory of Zeta was 5,000 and 8,500 units respectively.

a) Following variances are calculated as follows:

i. Material price, mix and yield variances

ii. Labor rate and efficiency variances

Material price variance:						
Actual material usage at actual price using FIFO						
Axe			**Zee**			**Net adverse variance Rs.**
Issues (kg)	**Actual rate**	**Rs.**	**Issues (kg)**	**Actual rate**	**Rs.**	
9,000	150	1,350,000	4,000	120	480,000	
7,000	148	1,036,000	6,000	122	732,000	
-	-	-	19,000	125	2,375,000	
16,000		2,386,000	**29,000**		3,587,000	

Actual material usage at standard price:						
16,000	160	2,560,000	**29,000**	(210÷2) **105**	3,045,000	
Fav./(Adverse) variance		**174,000**			**(542,000)**	**(368,000)**

Material mix variance					
	Actual mix (kg)	**Actual usage at std. mix ratio (kg)**	**Mix quantity variance (Adv.)/Fav.**	**Std. cost per (kg)**	**Rs.**
Axe	16,000	15,000	(1,000)	160	(160,000)
Zee	29,000	30,000	1,000	105	105,000
	45,000	**45,000**			
Material mix variance – **adverse**					**(55,000)**

Material yield variance				
	Yield (no. of units)		**Per unit Std. raw material usage at Std. price**	**Rs.**
Standard yield	(45,000÷3)	15,000	(160+210) 370	5,550,000
Actual yield	(12,000+8,500–5,000)	15,500	370	5,735,000
Yield variance – **favorable**				**185,000**

Labor variance		**Rs.**
Labor rate variance		
Actual hours at standard rate	11,780×(200÷0.8)	2,945,000
Actual hours at actual		(3,298,400)
Labor rate variance – **adverse**		**(353,400)**
Labor efficiency variance		
Allowable hours at standard rate	(15,500×0.8)×(200÷0.8)	3,100,000
Actual hours at standard rate	11,780×(200÷0.8)	(2,945,000)
Labor efficiency variance – **favorable**		**155,000**

a) Computation of applied fixed overheads and analysis 'under/over applied fixed factory overheads' into expenditure, efficiency and capacity variances are as follows:

Analyses of under/over applied fixed overheads		**Rs.**
Standard fixed overhead rate per hour	(540,000÷15,000×0.8)	**45**
Applied fixed overheads	(15,500×0.8×45)	558,000
Actual fixed overheads		(583,000)
Under applied overheads		**(25,000)**
Fixed overhead expenditure variance		
Budgeted fixed overheads		540,000
Actual fixed overheads		(583,000)
Fixed overhead expenditure variance – **adverse**	**(A)**	**(43,000)**

Fixed overhead efficiency variance		**Rs.**
Allowable hrs. for actual production at standard cost	15,500×0.8×45	558,000
Actual hours worked at standard rate	11,780×45	(530,100)
Fixed overhead efficiency variance – **favorable**	**(B)**	**27,900**
Fixed overhead capacity variance		
Actual hours worked at standard rate	11,780×45	530,100
BU hours at standard rate	12,000×45	(540,000)
Fixed overhead capacity variance – **adverse**	**(C)**	**(9,900)**
Under applied fixed overheads	**(A)+(B)+(C)**	**(25,000)**

Example 16:

Hexo Limited is using a standard absorption costing system to monitor its costs. The management is considering to adopt a marginal costing system. In this respect, following information has been extracted from the records for the month of December 2016:

i. Actual as well as budgeted sale was 10,500 units at Rs. 2,000 per unit.

ii. Standard cost per unit is as follows:

		Rupees
Direct material	5 kg @ Rs. 158	790
Direct labor	3 hours @ Rs. 150	450
Production overheads (fixed & variable)	Rs. 120 per labor hour	360
		1,600

iii. Budgeted fixed overheads were Rs. 1,650,000.

iv. Production and actual costs were as under:

	Units
Production: Budgeted	11,000
Actual	12,000

Actual variable costs:	**Rupees**
Direct material (58,000 kg @ Rs. 160)	9,280,000
Direct labor (35,000 hours @ Rs. 155)	5,425,000
Variable overheads	2,975,000

v. Applied fixed overheads exceeded actual overheads by Rs. 200,000.

vi. There was no opening finished goods inventory. Closing finished goods inventory was 1,500 units.

AT A GLANCE SPOTLIGHT STIKCY NOTES

a) The profit for the month of December 2016, using standard marginal costing, would be computed as follows:

Profit for the month of December 2016 - Standard marginal costing		
		Rupees
Sales	10,500×2,000	21,000,000
Production cost	12,000×(790+450+(**W.1**) 210)	(17,400,000)
Closing stock	1,500×(790+450+(**W.1**) 210)	2,175,000
Variable cost of sales at standard rate		(15,225,000)
Contribution margin		5,775,000
Budgeted fixed overheads		(1,650,000)
Profit at standard rate		**4,125,000**

W-1: Production overhead rate:	Per unit	Per hour
	----------- Rupees -----------	
Standard overhead rate (fixed & variable)	360	(360÷3) 120
Less: Standard fixed overhead rate (1,650,000÷11,000)	150	(150÷3) 50
Standard variable overhead rate per hour	**210**	**70**

b) Reconciliation for the profit computed above with actual profit under marginal costing, by incorporating the related variances is given below:

Reconciliation of standard and actual profit under marginal costing:		Rupees
Standard profit as above	**(A)**	4,125,000
(Adverse)/favorable cost variances:		
Direct material price (SR–AR)×AQ=(158–160)×58,000		(116,000)
Direct material usage (Allowable Qty.–AQ)×SR=[(5×12,000)–58,000]×158		316,000
Direct labor rate (SR–AR)×AH= (150–155)×35,000		(175,000)
Direct labor efficiency (Allowable Hrs. –AH)×SR= [(3×12,000)–35,000]×150		150,000
Variable overheads expenditure Actual cost – (SR×AH)=2,975,000-(70×35,000)		(525,000)
Variable overheads efficiency (Allowable Hrs.–AH)×SR=(36,000–35,000)×70		70,000
Fixed overheads expenditure variance (BU overheads – Actual overheads) [1,650,000–(12,000 ×150–200,000)]		50,000
Net adverse variance	**(B)**	**(230,000)**
Closing stock (Difference of standard and actual variable costs)		
[(9,280,000+5,425,000+2,975,000)÷12,000×1,500]-[(1,600-150)×1,500]**(C)**		35,000
Actual profit under marginal costing	**A+B+C**	**3,930,000**

c) Reconciliation for the actual profit under marginal and absorption costing, is given below:

Actual profit under absorption costing:	Rupees
Actual profit under marginal costing – as above	3,930,000
Fixed cost carried forward to the next year with closing inventory under absorption costing whereas under marginal costing fixed costs are charged in the year of incurrence (1,800,000-200,000)÷12,000)×1,500	200,000
Actual profit under absorption costing	**4,130,000**

► *Example 17:*

Sigma Limited (SL) is a manufacturer of Product A. SL operates at a normal capacity of 90% against its available annual capacity of 50,000 machine hours and uses absorption costing. The following summarized profit statements were extracted from SL's budget for the year ending 31 December 2015.

	Actual - 2014		Budget - 2015	
	Units	Rs. In '000	Units	Rs. In '000
Sales	4,125	49,500	4,600	56,580
Opening inventory	400	(3,400)	600	(5,400)
Cost of production	4,325	(38,925)	4,500	(44,325)
Closing inventory	600	5,400	500	4,925
Under absorbed production overheads		(100)	-	
Selling and administration cost (30% fixed)		(3,000)		(5,250)
Net profit		9,475		6,530

Other relevant information is as under:

	2014	Budget - 2015
Standard machine hours per unit	**10 hours**	**10 hours**
Standard production overhead rate per unit	Rs. 2,000	Rs. 2,250
Estimated fixed production overheads at normal capacity	Rs. 3,600,000	Rs. 4,050,000
Actual production overheads (Actual machine hours 44,000)	Rs. 8,750,000	-

a) Under/over absorbed production overheads can be understood as:

Production overhead rate is predetermined at beginning of the year based on budgeted annual overheads and budgeted annual production. Overhead are applied to actual hours/units using predetermined overhead rate. However, actual overheads and actual production may differ from the budgeted overheads and production, therefore, it would result in under/over absorption of production overheads.

b) Analysis for the under absorbed production overheads of SL for the year ended 31 December 2014, into spending and volume variances. Give two probable reasons for each variance, would be as follows

(i) Spending variance		
Hours allowed for actual production of 4,325 units	4,325×10	43,250
		Rs. in '000
Budgeted variable overheads for hours allowed	43,250×0.12*1	5,190
Standard fixed overheads		3,600
		8,790
Actual overheads		8,750
Favorable spending variance	**A**	**40**
(ii) Volume variance		
Estimated fixed overheads at normal capacity	45,000×0.08*2	3,600
Fixed overheads for hours allowed for actual production	43,250×0.08*2	3,460
Adverse volume variance	**B**	**(140)**
Under absorbed production overheads	**(A+B)**	**(100)**
***1Variable cost per hour [(2,000÷10)–(3,600,000÷(50,000×90%)]=120**		
***2Fixed cost per hour [(2,000÷10) –120]=80**		

Reasons for favorable spending variance:	
(i)	Lesser spending/decrease in price of overhead items as compared to budget.
(ii)	Over-estimating overhead expenditure while preparing the budget.
Reasons for adverse volume variance:	
(i)	Under-utilization of available capacity
(ii)	In-efficient use of machine hours

c) A budgeted Profit and Loss Statement for the year ending 31 December 2015, using marginal costing would be prepared as follows:

For the year ending 31 December 2015		**Rs. in '000**
Sales		56,580
Variable cost of sales:		
Opening inventory	5,400-(600×0.8*3)	(4,920)
Cost of production	(44,325–4,050)	(40,275)
Closing inventory	4,925-(500×0.9*4)	4,475
		(40,720)
Gross contribution margin		15,860
Variable selling and administration cost	5,250×70%	(3,675)
Net contribution margin		12,185
Fixed production overheads		(4,050)
Fixed selling and distribution overheads	5,250×30%	(1,575)
Net profit		**6,560**
***3 Fixed cost per unit – 2014 [3,600,000÷(50,000×90%÷10)=800**		
***4 Fixed cost per unit – 2015 [4,050,000÷(50,000×90%÷10)=900**		

d) Analysis of the difference between budgeted profit determined under absorption and marginal costing, for the year ending 31 December 2015, is given below.

		Rs. in '000
Net profit under marginal costing		6,560
Under absorption costing:		
▪ fixed overheads brought from the last year as included in the opening inventory	(600×0.8) *3	(480)
▪ fixed overheads carried forward to the next year as included in the closing inventory	(500×0.9) *4	450
Net profit under absorption costing		**6,530**

► *Example 18:*

Daisy Limited (DL) manufactures and markets product Zee. DL uses standard absorption costing.

Following information pertains to product Zee for the month of February 2019.

i. Data extracted from the budget for the month of February 2019:

Production Units		27,000
Cost of production:		**Rs. In '000**
Direct material	X:16,000 kg @ Rs. 400 per kg	6,400
	Y:14,000 kg @ Rs. 300 per kg	4,200
Direct Labor	10,000 hours @ Rs. 220 per hour	2,200
Factory overheads (including fixed overheads of Rs. 900,000) Rs. 250 per labor hour		2,500

ii. Actual input ratio of X and Y was 55:45 respectively.

iii. Direct materials are added at the beginning of the process. Actual process losses were 6% of the output. There is no change in the direct material prices during the month.

iv. DL increased wages by 12% as against the budgeted increase of 8% which improved labor efficiency by 5%.

v. Due to higher than expected inflation, actual factory overhead rate was 6% higher than the budgeted rate.

vi. Conversion costs were incurred evenly throughout the process.

vii. 27,400 units of Zee were transferred to finished goods. There was no opening or closing work in process. Finished goods inventory at the beginning and closing of the month was 1,000 units and 1,500 units respectively.

Computation for the following variances is given below

- Material price, mix and yield variances
- Labor rate and efficiency variances
- Over/under applied overheads and analyze it into:
  - variable overhead expenditure and efficiency variances
  - fixed overhead expenditure and volume variances

Variances for the month of February 2019			Units
Budgeted production		A	27,000
Actual production		B	27,400
Allowable production from actual input	A÷D×E	C	26,140
			kg
Total budget input quantity	X 16,000+Y 14,000	D	30,000
Total actual input quantity	B×1.06	E	29,044
			Rs.
Standard material cost per finished unit	(6,400,000+4,200,000)÷A	F	392.59
			Hours
Allowable hours for actual production	10,000÷A×B	G	10,148
Actual hours	G×0.95	H	9,641
			Rs.
Standard Fixed overhead rate per hour	900,000÷10,000	J	90
Standard variable overhead rate per hour	250–90	K	160

Material mix variance

Description	Actual input in standard mix ratio (kg)		Actual input in 55:45 ratio (kg)		Rate per kg (Rs.)	Fav/ (Adverse) variance (Rs. in '000)
X	16,000÷D×E	15,490.13	E×0.55	15,974.20	400.00	(193.63)
Y	14,000÷D×E	13,553.87	E×0.45	13,069.80	300.00	145.22
Total	E	29,044.00	E	29,044.00		(A) (48.41)

Material yield variance:	
(Actual yield - Allowable yield from actual input)×Standard material cost per unit	
[(B–C)×F]	**(F)** 494.66
Material price variance:	
No variance as there is no change in prices of material.	-

Labor rate variance:		
(Standard rate - Actual rate) × Actual hours [220–(220÷1.08×1.12)]×H		**(A)** (78.56)
Labor efficiency variance:		
(Allowable hours - Actual hours) × Standard rate	[G–H×220]	**(F)** 111.54
Overheads over/(under) applied		
Applied overheads	G×250	2,537.00
Actual overheads:		
- Variable overheads	H×K×1.06	1,635.11
- Fixed overheads	900×1.06	954.00
		2,589.11
Overheads under applied		**(A)** (52.11)

Analysis of under applied overheads:			
(i)	**Variable overhead expenditure variance:**		
	(Standard variable overheads rate – Actual variable overhead rate) × Actual hours		
		[K–(K×1.06)×H]	**(A)** (92.55)
	Variable overhead efficiency variance		
	(Allowable hours – Actual hours) × Standard variable overhead rate per hour		
		(G–H)×K	**(F)** 81.12
(ii)	**Fixed overhead expenditure variance**	900,000×6%	**(A)** (54.00)
	Fixed overhead volume variance:		
	(Allowable hours – Budgeted hours)×Standard fixed overhead rate per hour		
		(G–10,000)×J	**(F)** 13.32

► *Example 19:*

Seema Enterprises (SE) produces various leather goods. It operates a standard marginal costing system. For one of its products Bela, following information was extracted for the month of December 2015 from SE's budget document for the year 2015.

	Rs. In million
Sales 9,800 units	25.00
Cost of production of 10,000 units	
Direct material 5,000 kg.	9.00
Direct Labor 24,000 hrs	3.60
Variable overheads 2,000 machine hrs	4.40
Fixed overheads	3.80

Actual production for the month of December 2015 was 12,000 units whereas SE earned revenue of Rs. 30 million by selling 11,000 units of Bela. Following information pertains to actual cost of production for the month:

i. 5,700 kg material was issued to production. Raw materials are valued using FIFO method. Other details relating to the raw material used for Bela are as follows:

		Kg	**Rs. In million**
1-Dec-2015	Opening balance	3,000	5.70
10-Dec-2015	Purchases	15,000	26.25

ii. To minimize labor turnover, SE increased production wages by 10% above the standard rate, effective 1 December 2015. This improved labor efficiency by 5% as compared to budget.

iii. 2,100 machine hours were worked. Details of overheads are as under:

- Depreciation amounted to Rs. 1.6 million (same as budgeted)
- Factory building rent amounted to Rs. 1.20 million (same as budgeted)
- All other overheads were 4% in excess of the budget

iv. Variances are treated as period cost and charged to cost of sales.

v. There was no opening finished goods inventory of Bela. Actual closing inventory may be valued at standard marginal production costs.

AT A GLANCE
SPOTLIGHT
STIKCY NOTES

a) Budgeted and actual profits of Bela for the month of December 2015 using marginal costing is computed below:

		Rs. in million
Budgeted profit:		
Sales **(9,800 units)**		25.00
Variable costs	(9+3.6+4.4)	(17.00)
Closing finished goods inventory at standard cost 17÷10,000×200		0.34
Contribution margin		8.34
Fixed cost		(3.80)
		4.54
Actual profit:		
Sales **(11,000 units)**		30.00
Variable costs	**(W-1)**	(19.74)
Closing finished goods inventory at standard cost 17×1,000÷10,000		1.70
Contribution margin		11.96
Fixed cost	1.6+1.2+(3.8-1.6-1.2)×1.04	(3.84)
		8.12

W-1: Actual variable cost			
Material cost using FIFO	3,000		5.70
	2,700	(2,700×26.25÷15,000)	4.73
Kg	**5,700**		10.43
Labor cost; Actual labor hours		(24,000÷10,000×12,000×0.95) **27,360**	
Actual hrs. at actual rate		27,360×(3.6÷24,000×1.1)	4.51
Variable overheads:			
Actual machine hrs. at actual rate		2,100×(4.4÷2,000×1.04)	4.80
			19.74

b) The budgeted profit with actual profit using relevant variances under marginal costing would be reconciled as follows

Reconciliation of budgeted profit with actual profit		**Rs. in million**
Budgeted profit	**(As computed in (a) above)**	**4.54**
Favorable/(adverse) variances:		
Sales volume (contribution margin) variance:		
Actual sale quantity at standard contribution margin	8.34÷9,800×11,000	9.36
BU sale quantity at standard contribution margin		8.34
		1.02

Sales price variance		**Rs. in million**
Actual sale quantity at actual price		30.00
Actual sale quantity at standard price	25÷9,800×11,000	28.06
		1.94
Material price variance:		
Actual usage at actual price	**(W-1)**	10.43
Actual usage at standard price	5,700×(9÷5,000)	10.26
		(0.17)
Material usage variance		
Actual usage at standard rate		10.26
Allowable usage at standard rate	(5,000÷10,000×12,000)×(9÷5,000)	10.80
		0.54
Labor rate variance		
Actual hours at actual rate	**(W-1)**	4.51
Actual hours at standard rate	27,360**(W-1)**×(3.6÷24,000)	4.10
		(0.41)
Labor efficiency variance		
Actual hours at standard rate		4.10
Allowable hours at standard rate	24,000÷10,000×12,000×(3.6÷24,000)	4.32
		0.22
Variable overhead expenditure variance		
Actual machine hours at actual rate	**(W-1)**	4.80
Actual machine hours at standard rate	2,100**(W-1)**×(4.4÷2,000)	4.62
		(0.18)
Variable overhead efficiency variance		
Actual machine hours at standard rate		4.62
Allowable machine hours at standard rate	2,000÷10,000×12,000×(4.4÷2,000)	5.28
		0.66
Fixed overhead expenditure variance		
Actual fixed overheads	**(As computed in (a) above)**	3.84
Standard fixed overheads		3.80
		(0.04)
Fixed overhead volume variance		
Under marginal costing, **there is no fixed overhead volume variance** as fixed costs are treated as period cost and not allocated to products.		-
Actual profit		**8.12**

▶ *Example 20:*

Following information has been extracted from the records of Silver Industries Limited (SIL) for the month of June 2017:

	Production units	Direct labor hours	Variable & fixed overheads (Rs.)
Available capacity	10,000	30,000	-
Budget	8,000	24,000	3,600,000
Actual	8,600	25,000	3,900,000

Fixed overheads were budgeted at Rs. 1,200,000. Applied fixed overheads exceeded actual fixed overheads by Rs. 20,000.

SIL uses standard absorption costing. Over/under applied factory overheads are charged to profit and loss account.

i. Accounting entries to record the factory overheads would be prepared as follow:

Date	Description	Debit	Credit
		-------- Rupees --------	
30-Jun-17	Work in process/Finished goods [8,600×(24,000÷8,000)×150(W-1)	3,870,000	
	PL account (Under absorbed overheads) **(Bal.)**	30,000	
	Overhead control account		3,900,000
	(Under-absorbed overheads charged to profit & loss account)		

ii. Analysis for under/over applied overheads into expenditure, efficiency and capacity variances, would be as follows.

		Rupees
Variable overhead expenditure variance		
Actual hours at standard variable rate	25,000×100	2,500,000
Actual variable overheads	**(W-2)**	2,630,000
Adverse variance	**A**	**(130,000)**
Variable overhead efficiency variance		
Allowable hours at standard rate	8,600×3×100	2,580,000
Actual hours at standard variable rate	25,000×100	2,500,000
Favorable variance	**B**	**80,000**
Fixed overhead expenditure variance		
Budgeted fixed overheads		1,200,000
Actual fixed overheads	**(W.2)**	1,270,000
Adverse variance	**C**	**(70,000)**
Fixed overhead efficiency variance		
Allowable hours at standard rate	8,600×3×50	1,290,000
Actual hours at standard rate	25,000×50	1,250,000
Favorable variance	**D**	**40,000**

Fixed overhead capacity variance		
Budgeted hours at standard rate	24,000×50	1,200,000
Actual hours at standard rate	25,000×50	1,250,000
Favorable variance	**E**	**50,000**
	(A+B+C+D+E)	**(30,000)**

W-1: Standard fixed and variable overhead rate per hour		**Rupees**
Standard fixed and variable overhead rate per hour	3,600,000÷24,000	150
Less: Standard fixed overhead rate per hour	1,200,000÷24,000	50
Standard variable overhead rate per hour		**100**

W-2: Actual fixed overheads		
Applied fixed overheads	8,600×(24,000÷8,000)×50	1,290,000
Applied overheads exceeded actual overheads		(20,000)
Actual fixed overheads		1,270,000
Actual variable overheads (Balancing)		2,630,000
Total variable overheads		**3,900,000**

iii. Comments on the difference between overhead variances under marginal and absorption costing are given below:

All variable and fixed overhead variances under marginal and absorption costing are same, except for the fixed overhead volume (efficiency and capacity) variances which can be calculated only under absorption costing.

In **absorption costing**, fixed overheads are allocated to the products and these are included in the inventory valuations. Therefore, fixed overhead volume variances can be computed under absorption costing only.

In **marginal costing**, only variable overheads are assigned to the product; fixed overheads are regarded as period costs and written off as a lump sum to the profit and loss account. Therefore, fixed overhead volume variances cannot be computed under marginal costing.

STICKY NOTES

A budget is a plan expressed in money. It is prepared and approved prior to the budget period.

In a flexible budget the aim is to decide what total cost should be at different levels of output and sales. Fixed cost normally remain fixed, only variable costs and revenues vary with increase or decrease in the level of activity.

A Variance is the difference between planned or standard cost and actual cost. The process by which the total difference between standard and actual results is analyzed is known as variance analysis.

The direct material total cost variance is the difference between what the output actually cost and what it should have cost in terms of materials. It can be further divided in to material Price and Usage Variance.

The direct labor total cost variance is the difference between what the output actually cost and what it should have cost in terms of labor. It can be further divided in to labor rate and efficiency Variance.

The variable production overhead total variance can be subdivided in to the variable production overhead expenditure variance and the variable production overhead efficiency variance.

The fixed production overhead total variance can be subdivided in to an expenditure variance and a volume variance.

Mix variance can be divided in to price, mix and yield variances.

CHAPTER 12

TARGET COSTING

IN THIS CHAPTER

AT A GLANCE

Target costing involves setting a target cost by subtracting a desired profit margin from a Competitive Selling / market Price.

The target cost may be less than the planned initial product cost but it is a target to be achieved by the time the product reaches the maturity stage of the product life cycle.

A cost gap is to be calculated by comparing current cost and the target cost. This cost gap is to be reduced over time by applying effective cost reduction techniques, improving technologies and processes.

1. TARGET COSTING

1.1 Target Costing – Defined

Target costing involves setting a target cost by subtracting a desired profit margin from a competitive Selling/ market Price.

1.2 Target Costing – Explained

Target costing is used mainly for new product development. This is because whenever a new product is designed and developed for a competitive market, a company needs to know what the maximum cost of the new product must be so that it will sell at a profit.

A company might decide the price that it would like to charge for a new product under development, in order to win a target share of the market. The company then decides on the level of profitability that it wants to achieve for the product, in order to make the required return on investment. Having identified a target price and a target profit, the company then establishes a target cost for the product. This is the cost at which the product must be manufactured and sold in order to achieve the target profits and return at the strategic market price.

1.3 Target cost - Defined

Target cost is an estimate of a product cost which is determined by subtracting a desired profit margin from a competitive selling / market price. This target cost may be less than the planned initial product cost but it is expected to be achieved by the time the product reaches the maturity stage of the product life cycle.

1.4 Cost gap - Defined

Cost gap is the difference between the expected cost and the target cost. it can be calculated as:

Cost gap = Expected cost – Target cost

1.5 Origins of target costing

Target costing originated in Japan in the 1970s. It began with the recognition that customers were demanding more diversity in products that they bought, and the life cycles of products were getting shorter. This meant that new products had to be designed more frequently to meet customer demands.

Companies then became aware that a large proportion of the costs of making a product are committed at the design stage, before the product goes into manufacture. The design stage was therefore critical for ensuring that new products could be manufactured at a cost that would enable the product to make a profit for the company. It is not just a cost cutting exercise but rather holistically redesigning the entire production process to eliminate unnecessary costs, without reducing the value created by the product.

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2. IMPLEMENTING & DETERMINING TARGET COSTING

2.1 Implementing target costing

Steps involved in the implementation of target costing process are as follows:

Step 1 Determine a product specification of which an adequate sales volume is estimated.

Step 2 Determine a selling price at which the organization will be able to achieve a desired market share.

Step 3 Estimate the required profit based on return on sales or return on investment.

Step 4 Calculate Target cost = Estimated selling price – target price

Step 5 Compile an estimated cost for the product on the anticipated design specification and current cost levels.

Step 6 Calculate target cost gap = estimated cost – target cost

Step 7 Make efforts to close the gap by applying effective cost reduction techniques, improving technologies and processes.

2.2 Determining a Target cost

- *Illustration:*

New product design and development	Rs.
Decide: The target sales price	X
Deduct: The target profit margin	(X)
Equals: The target cost (maximum cost in order to meet or exceed the target profit)	X

- *Example 01:*

A construction company wants to calculate a target cost for a new flat, the expected market price is Rs. 5,000,000.

The company require a desired Profit Margin of 14%.

calculation of the target cost to achieve the desired Profit would be as follows:

Profit Required = Rs. 5,000,000 * 14% = 700,000/-

Target Cost = Rs. (5,000,000 – 700,000) = Rs. 4,300,000/-

3. TARGET COSTING AND COST GAP

3.1 Target costing and the target cost gap

► *Example 02:*

A company has designed a new product. NP8. It currently estimates that in the current market, the product could be sold for Rs.70 per unit. A gross profit margin of at least 30% on the selling price would be required, to cover administration and marketing overheads and to make an acceptable level of profit.

A cost estimation study has produced the following estimate of production cost for NP8.

Cost item	
Direct material M1	Rs.9 per unit
Direct material M2	Each unit of product NP8 will require three metres of material M2, but there will be loss in production of 10% of the material used. Material M2 costs Rs.1.80 per metre.
Direct labor	Each unit of product NP8 will require 0.50 hours of direct labor time. However it is expected that there will be unavoidable idle time equal to 5% of the total labor time paid for. Labor is paid Rs.19 per hour.
Production overheads	It is expected that production overheads will be absorbed into product costs at the rate of Rs. 60 per direct labor hour, for each active hour worked. (Overheads are not absorbed into the cost of idle time.)

a) The expected cost of Product NP8

	Rs.
Direct material M1	9.0
Direct material M2: 3 meters × 100/90 × Rs.1.80	6.0
Direct labor: 0.5 hours × 100/95 × Rs.19	10.0
Production overheads: 0.5 hours × Rs.60	30.0
Expected full cost per unit	55.0

b) Target cost for NP8

		Rs.
	Sales price	70.0
	Minimum gross profit margin (30%)	21.0
	Target cost	49.0

c) The size of the cost gap

		Rs.
	Expected cost per unit (a above)	55.0
	Target cost per unit (b above)	(49.0)
		6.0

The company needs to identify ways of closing this cost gap.

3.2 Closing the target cost gap

Target costs are rarely achievable when the product is first manufactured, target cost may be much lower than the current cost determined by current technology and processes.

Target costing should involve a multi-disciplinary approach to close the cost gap. The management accountant should be involved in measuring estimated costs. Ways of reducing costs might be in product design and engineering, manufacturing processes used, selling methods and raw materials purchasing. Ideas for reducing costs can therefore come from the sales, manufacturing, engineering or purchasing departments.

Common methods of closing the target cost gap are:

- To re-design products to make use of common processes and components that are already used in the manufacture of other products by the company.
- To discuss with key supplier's methods of reducing materials costs. Target costing involves the entire 'value chain' from original suppliers of raw materials to the customer for the end-product, and negotiations and collaborations with suppliers might be an appropriate method of finding important reductions in cost.
- To eliminate non-value added activities or non-value added features of the product design. Something is 'non-value added' if it fails to add anything of value for the customer. The cost of non-value added product features or activities can therefore be saved without any loss of value for the customer. Value analysis may be used to systematically examine all aspects of a product cost to provide the product at the required quality at the lowest possible cost. This is the crux of target costing.
- Using standardized components will reduce the cost but it might impact the innovation element for the product
- To train staff in more efficient techniques and working methods. Improvements in efficiency will reduce costs.
- To achieve economies of scale. Producing in larger quantities will reduce unit costs because fixed overhead costs will be spread over a larger quantity of products. However, production in larger quantities is of no benefit unless sales demand can be increased by the same amount.
- To achieve cost reductions as a result of the learning curve or the experience curve effect. The learning curve effect is often observed in labor tasks of a complex nature. It results in cost savings as workers become more familiar with performing a new and complex task and this can be modelled mathematically. The experience curve effect relates to cost savings made in costs other than labor costs as the company becomes more familiar with production of a new product. For example, management of the process and marketing may become more efficient as the company gains experience of making and selling the product.

▶ *Example 03:*

Scriba Company (SC) is trying to launch a new product into a competitive market in North America. Test marketing has revealed the following demand curve for the product:

P = 600 – 0.005Q

The estimated market for the product is 500,000 units per year. The company would like to capture 10% of this market.

The company has established a cost card based on 50,000 units of sales each year:

	Rs.
Direct materials	100
Direct labor	30
Fixed overhead	70
Total cost	200

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The company wishes to achieve a target profit of Rs. 10,000,000 for sales of this product per year.

a) What price will the company have to charge to capture its required market share and what is the target unit cost to achieve its target profit?

Tutorial note: The company will need to sell 50,000 units to gain 10% of the market.

The first step is to calculate the price that the item has to be sold at to achieve this market share. This can be calculated by using the demand curve:

P = 600 – 0.005Q

P = 600 – (0.005 × 50,000)

P = 600 – 250

P = Rs.350

Since the company wishes to generate Rs.10,000,000 profit in total, this equates to a unit profit of:

Rs.10,000,000 / 50,000 = Rs.200 per unit.

Once target price and target profit are available it is possible to calculate target cost:

Target price – target profit = target cost

Rs.350 – Rs.200 = Rs.150 per unit

b) What is the size of the target cost gap and how might Scriba Company seek to close this gap?

The target cost gap is calculated as:

	Rs.
Target unit cost	150
Current unit cost	200
Target cost gap	50

Currently actual cost is one third higher than it should be to reach the target profit.

The company can undertake various strategies to bring costs down to target:

Product redesign

This is the most effective way of reducing costs. Once the design of a product has been finalized it is difficult to reduce significantly the majority of a product's cost. If PC has not yet finalized the design and production of the product, it would be very worthwhile them revisiting the design and production planning stages of the product lifecycle.

Outsourcing

PC could seek a deal with a third party manufacturer to make the product. Complete outsourcing would not only remove the variable cost element of production but could also lead to huge fixed cost savings. This is a course of action worth exploring by the company. Suitable controls over any patents and quality would need to be in place, together with guarantees of delivery times and the ability to be flexible with production volumes.

Cost reduction

PC has to be careful with cost cutting. If applied badly the company could damage the value of the product, leading to a fall in market price. Cost reduction, however, seeks ways of lowering cost without reducing the value of the product. PC would seek to preserve those features of the product key to its customer value whilst seeking to reduce the cost of other areas. This, for instance, could involve cutting down on the quality of packaging.

4. IMPLICATIONS AND ADVANTAGES

4.1 Advantages of target costing

There are several possible advantages from the use of target costing.

- It helps to improve the understanding within a company of product costs.
- It recognizes that the most effective way of reducing costs is to plan and control costs from the product design stage onwards.
- It helps to create a focus on the final customer for the product or service, because the concept of 'value' is important: target costs should be achieved without loss of value for the customer.
- It is a multi-disciplinary approach, and considers the entire supply chain. It could therefore help to promote co-operation, both between departments within a company and also between a company and its suppliers and customers.
- Target costing can be used together with recognized methods for reducing costs, such as value analysis, value engineering, just in time purchasing and production, Total Quality Management and continuous improvement i.e. Kaizen costing.
- Target costing recognizes that process improvement and cost cutting is not a top down process but rather one where workers who actually work on the product could come up with valuable suggestions

4.2 The implications of using target costing

The use of a target costing system has implications for pricing, cost control and performance measurement.

Target costing can be used with pricing policy for a company's products or services. A company might decide on a target selling price for either a new or an existing product, which it considers necessary in order to win market share or achieve a target volume of sales. Having identified the selling price that it wants for the product, the company can then work out a target cost.

Cost control and performance measurement has a different emphasis when target costing is used.

- Cost savings are actively sought and made continuously over the life of the product
- There is joint responsibility for achieving benchmark savings. If one department fails to deliver the cost savings expected, other departments may find ways to achieve the savings
- Staff are trained and empowered to find new ways to reduce costs while maintaining the required quality.

Target costing is more likely to succeed in a company where a culture of 'continuous improvement' exists.

4.3 Target costing and services

Target costing can be used for services as well as products. Services vary widely in nature, and it is impossible to make general statements that apply to all types of services. However, features of some service industries that make them different from manufacturing are as follows.

- Some service industries are labor-intensive, and direct materials costs are only a small part of total cost. Opportunities for achieving reductions in materials costs may therefore be small.
- Overhead costs in many services are very high. Effective target costing will therefore require a focus on how to reduce overhead costs.

A service company might deliver a number of different services through the same delivery system, using the same employees and the same assets. Introducing new services or amendments to existing services therefore means adding to the work burden of employees and the diversity or complexity of the work they do.

- A system of target costing therefore needs to focus on quality of service and value for the customer. Introducing a new service might involve a loss of value in the delivery of existing services to customers. For example, adding a new service to a telephone call center could result in longer waiting times for callers.

- New services might be introduced without proper consideration being given to whether the service is actually profitable. For example, a restaurant might add additional items to its menu, in the belief that the only additional cost is the cost of the food. In practice there would be implications for the purchasing and preparation of the food and possibly also for the delivery of food from the kitchen to the restaurant dining area. New items added to the menu might therefore make losses unless all aspects of cost are properly considered.
- When a single delivery system is used for services, the cost of services will consist largely of allocated and apportioned overheads. For target costing to be successful, there must be a consistent and 'fair' method of attributing overhead costs to services (both existing services and new services).
- Services might be provided by not-for-profit entities. For example, health services might be provided free of charge by the government. When services are provided free of charge, target costing can be used for new services. However, it is doubtful whether concepts of 'target price' and 'target profit' can be used by a not-for-profit entity. This raises questions about how to decide what the target cost should be and will probably be some arbitrary figure.

► *Example 04:*

A company wishes to introduce a new product to the market.

The company estimates the market for the product to be 50,000 units.

The company uses target costing.

Current projected costs are as follows:

	Rs. '000
Manufacturing cost	
Bought in parts (100 components)	50,000
Direct labor (assembly of components) 10 hours × Rs. 500 per hour	5,000
Machine costs (750,000,000 ÷ 50,000)	15,000
Ordering and receiving (500 orders × 100 components ×Rs. 500 per order) ÷ 50,000 units	500
Quality assurance (10 hours × Rs. 800 per hour)	8,000
Rework costs 10% (probability of failure) × Rs. 10,000 (cost of rework)	1,000
Non-manufacturing costs	
Distribution	10,000
Warranty costs 10% (probability of recall) × Rs. 15,000 (cost to correct)	1,500
	91,000
Target selling price (Rs.)	100,000
Target margin	20%
Target profit (Rs.)	20,000
Target cost (Rs.)	80,000

The company has undertaken market research which found that several proposed features of the new product were not valued by customers. Redesign to remove the features leads to a reduction in the number of components down to 80 components and a direct material cost reduction of 12%.

The reduction in complexity has other impacts:

Assembly time will be reduced by 20%.

Quality assurance will only require 6 hours.

The probability of a failure at the inspection stage will fall to 5%.

The probability of an after-sales failure will also fall to 5%.

Cost of warranty corrections will fall by Rs. 2,000.

Reduced weight of the product will reduce shipping costs by Rs. 1,000 per unit.

The revised projected costs are as follows:

	Before	After
	Rs. '000	Rs. '000
Manufacturing cost		
Bought in parts (100 components)	50,000	
Bought in parts (80 components with 12% reduction)		44,000
Direct labor (assembly of components)		
10 hours × Rs. 500 per hour	5,000	
8 hours (20% reduction) × Rs. 500 per hour		4,000
Machine costs (750,000,000 ÷ 50,000)	15,000	15,000
Ordering and receiving		
500 orders × 100 components × Rs. 500 per order/50,000 units	500	
500 orders × 80 components × Rs. 500 per order/50,000 units		400
Quality assurance		
10 hours × Rs. 800 per hour	8,000	
6 hours × Rs. 800 per hour		4,800
Rework costs		
10% × Rs. 10,000	1,000	
5% × Rs. 10,000		500
Non-manufacturing costs		
Distribution	10,000	9,000
Warranty costs		
10% × Rs. 15,000	1,500	
5% × Rs. 13,000		650
	91,000	78,350
The target cost is achieved.		

5. COMPREHENSIVE EXAMPLES

- *Example 01*

Pollar Co assembles and sells a range of components for motor vehicles and it is considering a proposal to add a new component to its product range. This is a component for electric motor cars, which has been given the code number NP19. The company sees an opportunity to gain market share in a market that is expected to grow considerably over time, but already competition from rival producers is strong.

Component NP19 would be produced by assembling a number of parts bought in from external suppliers, and would then be sold on to manufacturers of electric cars. Pollar Co would use its current work force of assembly workers to make the component. Production overheads are currently absorbed into production costs on an assembly hour basis.

Pollar Co is considering the use of target costing for the new component.

a) Brief description for how target costing might be used in the development and production of a new product, is as follows

When a company identifies a product that it wishes to make and sell, it must design the product in a way that will appeal to customers. A product design and specification must be prepared, based on a combination of technical considerations and market research.

The component will also consider the price at which the product will be sold. The price that can be obtained will often depend on the price of similar rival products in the market, or on market research into customer attitudes to price. This may be called the target price.

The company should decide on the profit margin it would like to make from the product. The desired margin is subtracted from the target price to obtain a target cost.

A cost estimate is then produced for the product if it is made to the planned design and specification and this cost estimate is compared with the target cost. If the cost estimate is higher than the target cost, the difference is called a cost gap.

When a cost gap exists, the company should re-consider the planned product design and look for ways of reducing the estimated cost to the level of the target cost – in other words, the aim should be to eliminate the cost gap before actual production of the new product item begins.

b) The benefits of adopting a target costing approach at an early stage in the development of a new product would be

Target costing should begin at an early stage in the product design and development process because the opportunity for reducing production costs is greatest at the design stage. If there is a cost gap, the product design can be amended. Because the measures to reduce costs are made at an early stage, it is easier to find ways of reducing costs that do not take away significant value for the customer. (If costs are reduced in a way that reduces value for the customer, the target sales price will probably not be achievable.)

If target costing is introduced at a later stage in the product development, for example after the material components, product design features and production methods have been finally agreed, there are fewer opportunities for cost reduction.

Early adoption of target costing also helps to create a general awareness of the need for cost control, and it increases the probability that new products will be developed at a cost that allows the company to sell them at a competitive price whilst making an acceptable level of profit. It can therefore be argued that target costing improves the probability of commercial success (profitability) for new products.

c) If a target costing approach is used and a cost gap is identified for component NP19, possible measures that Pollar Co might take to reduce the gap are suggested below

If a cost gap is identified early in the product design process, the team responsible for the product development (which should include marketing staff as well as production and R&D staff) should consider every aspect of the product design and planned production method to consider ways of reducing the costs.

The aim should be to make changes in a way that does not remove significant value for the customer. For example some aspects of the product, such as the materials or parts used, could be changed and parts that are less expensive used instead. Some features of the product design might be removed without loss of significant value.

As an alternative (or in addition to) looking for cheaper or fewer parts to the product, cost savings might be achieved by identifying suppliers who are willing to provide parts at a lower cost. Prices from suppliers might be re-negotiated, such as the fixed costs of buying part 1922 in batches.

It might be possible to change the production process in some ways to reduce the assembly time required per unit, or different assembly workers might be hired at a lower rate of pay per hour.

Finding ways of reducing overhead costs can be difficult because indirect costs cannot be identified directly with specific products. However, if Pollar Co uses target costing for new products, it would be surprising if it did not also employ methods of looking for savings in overhead costs (such as total quality management and continuous improvement).

Now if Cost information for the new component NP19 is as follows:

1. Part 1922: Each unit of component NP19 requires one unit of part 1922. These bought-in parts are purchased in batches of 5,000 units, and the purchase cost is Rs.5.30 each plus delivery costs of Rs.2,750 per batch.
2. Part 1940: Each unit of component NP19 requires 20 cm of part 1940, which costs Rs.2.40 per meter to purchase. However, it is expected that there will be some waste due to cutting and that 5% of the purchased part will be lost in the assembly process.
3. Other parts for component NP19 will also be bought in and will cost Rs.7.20 per unit of the component.
4. Assembly labor. It is estimated that each unit of component NP19 will take 25 minutes to assemble. Assembly labor, which is not in short supply, is paid Rs.24 per hour. It is also estimated that 10% of paid labor time will be idle time.
5. Production overheads. Analysis of recent historical costs for production overheads shows the following costs:

	Total production overhead	Total assembly labor hours worked
	Rs.	
Month 1	912,000	18,000
Month 2	948,000	22,000

Fixed production overheads are absorbed at a rate per assembly hour based on normal activity levels. In a normal year, Pollar Co works 250,000 assembly hours.

Pollar Co estimates that it needs to sell component NP19 at a price of no more than Rs.56 per unit to be competitive, and it is considered that an acceptable gross profit margin on components sold by the company is 25%. Gross margin is defined as the sales price minus the full production cost of sales.

d) The expected cost per unit of component NP19 and any cost gap that exists, would be calculated as follows.

Workings: production overhead costs

Production overhead costs can be estimated using the high-low method.

Production overheads	hours	Rs.
Month 1: Total cost	18,000	912,000
Month 2: Total cost	22,000	948,000
Therefore variable cost	4,000	36,000

Variable production overhead cost per hour = Rs. 36,000/4,000 = Rs.9

Production overheads	Rs.
Month 1: Total cost of 18,000 hours	912,000
Variable cost (18,000 × Rs.9)	162,000
Therefore fixed costs per month	750,000

Annual fixed production overhead costs = Rs.750,000 × 12 = Rs.9,000,000.

Fixed production overhead absorption rate = Rs. 9,000,000 / 250,000 = Rs.36

Cost estimate and cost gap estimate	
Cost per unit of NP19	**Rs.**
Part 1922: Rs.5.30 + (Rs.2,750/5,000)	5.850
Part 1940: 0.20 × Rs.2.40 × 100/95	0.505
Other parts	7.200
Assembly labor cost: 25/60 × Rs.24 × 100/90	11.111
Variable overheads: 25/60 × Rs.9	3.750
Fixed overheads: 25/60 × Rs.36	15.000
Total estimated production cost	43.416
Target cost (75% of Rs.56)	42.000
Cost gap	(1.416)

► *Example 02:*

Hi-tech Limited (HL) assembles and sells various components of heavy construction equipment. HL is working on a proposal of assembling a new component EXV-99. Based on study of the product and market survey, the following information has been worked out:

Projected lifetime sale of the component EXV-99	Units	500,000
Selling price per unit	Rs.	11,000
Target gross profit percentage		40%

Information about cost of production of the new component is as follows:

i. One unit of EXV-99 would require:

Parts no.	Net quantity	Cost per unit/kg (Rs.)
XX	1 unit	2,350
YY	1.5 kg	1,400
ZZ	1 unit	1,200

The above parts would be imported in a lot, for production of 1,000 units of EXV-99. Custom duty and other import charges would be 15% of cost price. HL is negotiating with the vendor who has agreed to offer further discount.

ii. On average, assembling of one unit of EXV-99 would require 1.8 skilled labor hours at Rs. 200 per hour. The production would be carried out in a single shift of 8 hours. At the start of each shift, set-up of machines would require 30 minutes. 6% of the input quantity of YY and ZZ would be lost during assembly process.

iii. HL works at a normal annual capacity of 4,000,000 skilled hours. Actual production overheads and skilled labor hours for the last two quarters are as under:

Quarter ended	Total assembly hours	Production overheads (Rs)
30-Sep-2014	950,000	65,600,000
31-Dec-2014	1,050,000	68,000,000

iv. A special machine that would be used exclusively for the production of EXV-99 would be purchased at a cost of Rs. 1,500,000.

From the above information, determination of the discount that HL should obtain in order to achieve the target gross profit, would involve following:

Discount required from vendors to achieve target gross profit from sale of EXV-99		Rs. in million
Total cost estimated	W.1	3,624.27
Target cost	[11,000×60%×500,000]	3,300.00
Cost gap		324.27
Discount amount to be obtained from the vendor	[324.27÷1.15]	**281.97**
Required discount %	[(281.97÷2,931(W.1)×100	9.62%

W.1: Cost estimate for 500,000 units of EXV-99:		
Material XX (2,350×500,000)		1,175.00
Material YY (incl. process loss at 6%)(1.5÷0.94×1,400×500,000)		1,120.00
Material ZZ (incl. process loss at 6%)(1.0÷0.94×1,200×500,000)		636.00
		2,931.00
Custom duty and other import charges	[2,931×15%]	439.65

Direct labor:		
Labor cost	(1.8×200×500,000)	180.00
Labor set up cost	(1.8÷7.5×0.5×200×500,000)	12.00
Production overheads:		
Variable	[1.80×24.00**(W.2)**×500,000]	21.60
Fixed	[1.80×42.80**(W.3)**×500,000]	38.52
Fixed – cost of machine		1.50
Total cost		**3,624.27**

W.2: Variable overhead rate per hour:	**Hours**	**Rupees**
Quarter ended 31 December 2014	1,050,000	68,000,000
Quarter ended 30 September 2014	(950,000)	(65,600,000)
	100,000	2,400,000
Variable overhead rate per hour ***(using high-low method)***	(2,400,000÷100,000	**24.00**

W.3: Fixed overhead rate per hour:		
Cost for the quarter ended 30 September 2014		65,600,000
Less: Variable cost	[950,000×24**(W.3)**]	(22,800,000)
Fixed overheads per quarter		42,800,000
Fixed overheads per annum	[42,800,000×4]	171,200,000
Fixed overhead rate per hour at normal capacity of 4,000,000 hrs. [171,200,000÷4,000,000]		**42.80**

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Target costing involves setting a target cost by subtracting a desired profit margin from a Competitive Selling / market Price.

Target cost = Market Price – Desired Profit Margin

Cost gap = Expected Cost – Target cost

Cost gap can be bridged by effective cost reduction techniques, better technology and Improved Processes

Advantages of target costing are proactive approach towards cost reduction, achievement of desired profit and Quality product in accordance with customer requirements

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CHAPTER 13

RELEVANT COSTS

IN THIS CHAPTER

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Relevant costs are costs that will occur in the future. They include costs that have not been already occurred in the past. For decision making purposes only, relevant costs matters.

Identifying relevant costs would involve cost of materials, labor and overheads. In this respect, Relevant costs of materials are the additional cash flows that will be incurred (or benefits that will be lost) by using the materials for the purpose that is under consideration.

Relevant cost of labor would involve some considerations. If labor is not in restricted supply, the relevant cost of the labor is its variable cost. However, if labor is a fixed cost and there is spare labor time available.

Only variable overhead costs are considered relevant for decision making. This is because it is an estimate of cash spending per hour for each additional hour. Although, fixed overhead absorption rates are irrelevant, the only overhead fixed costs that are relevant costs for a decision are extra cash spending that will be incurred, or cash spending that will be saved, as a direct consequence of making the decision.

1. THE CONCEPT OF RELEVANT COSTING

1.1 Information for decision-making

Management make decisions about the future. When they make decisions for economic or financial reasons, the objective is usually to increase profitability or the value of the business, or to reduce costs and improve productivity.

When managers make a decision, they make a choice between different possible courses of action (options), and they need relevant and reliable information about the probable financial consequences of the different options available. A function of management accounting is to provide information to help managers to make decisions, by providing estimates of the consequences of selecting any option.

Traditionally, cost and management accounting information was derived from historical costs (a measurement of actual costs). For example, historical costs are used to assess the profitability of products, and control reporting typically involves a comparison of actual historical costs with a budget or standard costs.

Accounting information for decision-making is different, because decisions affect the future, not what has already happened in the past. Accounting information for decision-making should therefore be based on estimates of future costs and revenues.

- Decisions affect the future, but cannot change what has already happened. Decision-making should therefore look at the future consequences of a decision, and should not be influenced by historical events and historical costs.
- Decisions should consider what can be changed in the future. They should not be influenced by what will happen in the future that is unavoidable, possibly due to commitments that have been made in the past.
- Economic or financial decisions should be based on future cash flows, not future accounting measurements of costs or profits. Accounting conventions, such as the accruals concept of accounting and the depreciation of non-current assets, do not reflect economic reality while the cash flows, on the other hand, do reflect the economic reality of decisions. Managers should therefore consider the effect that their decisions will have on future cash flows, not reported accounting profits.

Relevant costs should be used for assessing the economic or financial consequences of any decision by management. Only relevant costs and benefits should be taken into consideration when evaluating the financial consequences of a decision.

As a relevant cost is a future cash flow that will occur as a direct consequence of making a particular decision, it is used for target profit analysis as well.

1.2 Concepts and terms used in relevant costing

The key concepts in this definition of relevant costs are as follows:

- Relevant costs are costs that will occur in the future. They cannot include any costs that have already occurred in the past.
- Relevant costs of a decision are costs that will occur as a direct consequence of making the decision. Costs that will occur anyway, no matter what decision is taken, cannot be relevant to the decision.
- Relevant costs are cash flows. Notional costs, such as depreciation charges, notional interest costs and absorbed fixed costs, cannot be relevant to a decision.

Several terms are used in relevant costing, to indicate how certain costs might be relevant or not relevant to a decision.

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Incremental cost

An incremental cost is an additional cost that will occur if a particular decision is taken. Provided that this additional cost is a cash flow, an incremental cost is a relevant cost.

- *Example 01:*

A company has identified that each cost unit it produces has the following costs:

	Rs. in '000
Direct materials	50
Direct labor	20
	70
Fixed production overhead	30
Total absorption cost	100

The incremental cost of making one extra unit is Rs. 70,000. Making one extra unit would not affect the fixed cost base.

Differential cost

A differential cost is the amount by which future costs will be different, depending on which course of action is taken. A differential cost is therefore an amount by which future costs will be higher or lower, if a particular course of action is chosen. Provided that this additional cost is a cash flow, a differential cost is a relevant cost.

- *Example 02:*

A company needs to hire a photocopier for the next six months. It has to decide whether to continue using a particular type of photocopier, which it currently rents for Rs.2,000 each month, or whether to switch to using a larger photocopier that will cost Rs.3,600 each month. If it hires the larger photocopier, it will be able to terminate the rental agreement for the current copier immediately.

The decision is whether to continue with using the current photocopier, or to switch to the larger copier. One way of analyzing the comparative costs is to say that the larger copier will be more expensive to rent, by Rs.1,600 each month for six months. The differential cost of hiring the larger copier for six months would therefore be Rs.9,600.

Avoidable and unavoidable costs

An avoidable cost is a cost that could be saved (avoided), depending whether or not a particular decision is taken. An unavoidable cost is a cost that will be incurred anyway.

Avoidable costs are relevant costs.

Unavoidable costs are not relevant to a decision.

- *Example 03:*

A company has one year remaining on a short-term lease agreement on a warehouse. The rental cost is Rs.100,000 per year. The warehouse facilities are no longer required, because operations have been moved to another warehouse that has spare capacity.

If a decision is taken to close down the warehouse, the company would be committed to paying the rental cost up to the end of the term of the lease. However, it would save local taxes of Rs.16,000 for the year, and it would no longer need to hire the services of a security company to look after the empty building, which currently costs Rs.40,000 each year.

The decision about whether to close down the unwanted warehouse should be based on relevant costs only.

Local taxes and the costs of the security services (Rs.56,000 in total for the next year) could be avoided and so these are relevant costs.

The rental cost of the warehouse cannot be avoided, and so should be ignored in the economic assessment of the decision whether to close the warehouse or keep it open for another year.

Committed cost

Committed costs are a category of unavoidable costs. A committed cost is a cost that a company has already committed to or an obligation already made, that it cannot avoid by any means.

Committed costs are not relevant costs for decision making.

▶ *Example 04:*

A company bought a machine one year ago and entered into a maintenance contract for Rs. 20,000 for three years.

The machine is being used to make an item for sale. Sales of this item are disappointing and are only generating Rs, 15,000 per annum and will remain at this level for two years.

The company believes that it could sell the machine for Rs. 25,000.

The relevant costs in this decision are the selling price of the machine and the revenue from sales of the item.

If the company sold the machine it would receive Rs. 25,000 but lose Rs. 30,000 revenue over the next two years – an overall loss of Rs. 5,000

The maintenance contract is irrelevant as the company has to pay Rs. 20,000 per annum whether it keeps the machine or sells it.

Leases normally represent a committed cost for the full term of the lease, since it is extremely difficult to terminate a lease agreement.

Sunk costs

Sunk costs are costs that have already been incurred (historical costs) or costs that have already been committed by an earlier decision. Sunk costs must be ignored for the purpose of evaluating a decision, and cannot be relevant costs.

▶ *Example 05:*

A company must decide whether to launch a new product on to the market.

It has spent Rs.900,000 on developing the new product, and a further Rs.80,000 on market research.

A financial evaluation for a decision whether or not to launch the new product should ignore the development costs and the market research costs, because the Rs.980,000 has already been spent and would not be recovered regardless to go ahead with the launch or not. The costs are sunk costs.

1.3 Opportunity costs

Relevant costs can also be measured as an opportunity cost. An opportunity cost is a benefit that will be lost by taking one course of action instead of the next-most profitable course of action.

▶ *Example 06:*

A company has been asked by a customer to carry out a special job. The work would require 20 hours of skilled labor time. There is a limited availability of skilled labor, and if the special job is carried out for the customer, skilled employees would have to be moved from doing other work that earns a contribution of Rs.60 per labor hour.

A relevant cost of doing the job for the customer is the contribution that would be lost by switching employees from other work. This contribution forgone (20 hours × Rs.60 = Rs.1,200) would be an opportunity cost. This cost should be taken into consideration as a cost that would be incurred as a direct consequence of a decision to do the special job for the customer. In other words, the opportunity cost is a relevant cost in deciding how to respond to the customer's request.

▶ *Example 07:*

Fazal Industries Limited is currently negotiating a contract to supply its products to K-Mart, a large chain of departmental stores. K-Mart finally offered to sign a one year contract at a lump sum price of Rs. 19,000,000.

The Cost Accountant of Fazal Industries Limited believes that the offered price is too low. However, the management has asked you to re-assess the situation. The cost accountant has provided you the following information:

Statement of Estimated Costs (Project: K-Mart)

	Notes	Rupees
Material:		
X (at historical cost)	(i)	1,500,000
Y (at historical cost)	(ii)	1,350,000
Z	(iii)	2,250,000
Labor:		
Skilled	(iv)	4,050,000
Supervisory	(v)	2,250,000
Overheads	(vii)	8,500,000
Total cost		**20,710,000**

You have analyzed the situation and gathered the following information:

i. Material X is available in stock. It has not been used for a long time because a substitute is currently available at 20% less than the cost of X.

ii. Material Y was ordered for another contract but is no longer required. Its net realizable value is Rs. 1,470,000.

iii. Material Z is not in stock.

iv. Skilled labor can work on other contracts which are presently operated by semi- skilled labor who have been hired on temporary basis at a cost of Rs. 325,000 per month. The company will need to give them a notice of 30 days before terminating their services.

v. Unskilled labor will have to be hired for this contract.

vi. Two new supervisors will be hired for this contract at Rs. 15,000 per month. The present supervisors will remain employed whether the contract is accepted or not.

vii. These include fixed overheads absorbed at the rate of 100% of skilled labor. Fixed production overheads of Rs. 875,000 which would only be incurred if the contract is accepted, have been included for determining the above fixed overhead absorption rate.

Preparation of a revised statement of estimated costs using the opportunity cost approach, for the management of Fazal Industries to state whether the contract should be accepted or not would involve following analysis

Revised Statement of Estimated Costs

Under the Opportunity Cost Approach

	Rupees
Materials	
X (1,500,000 x 80%)	1,200,000
Y (NRV)	1,470,000
Z (Purchase price)	2,250,000
Labor	
Skilled	4,050,000
Unskilled	2,250,000
Supervisory (Rs. 15,000 x 2 x 12)	360,000*
Overheads	
Avoidable fixed overhead	875,000
Variable overheads (Rs. 8,500,000 – Rs. 4,050,000)	4,450,000
	16,905,000

Conclusion:

The company should accept the order as it will give them incremental cash flows of Rs. 2,095,000 (Rs.19,000,000-Rs.16,905,000).

2. IDENTIFYING RELEVANT COSTS

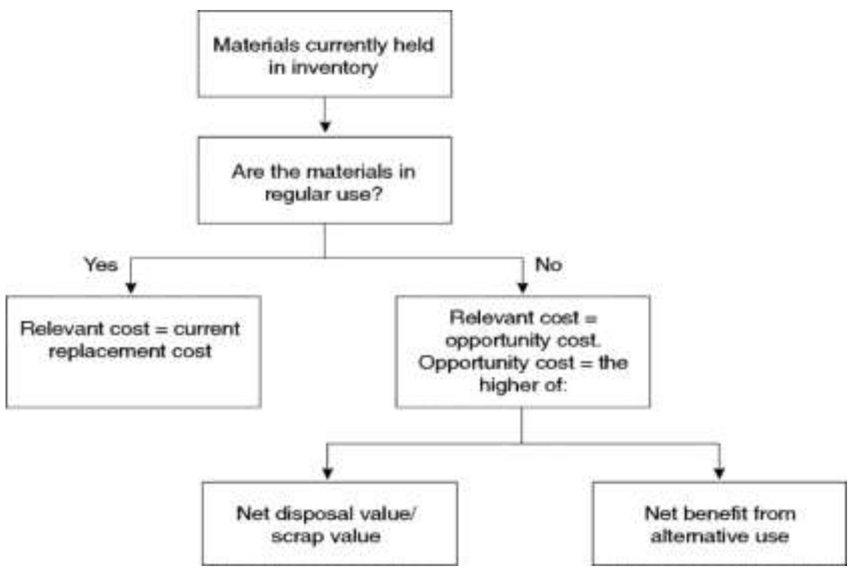
There are certain rules or guidelines that might help you to identify the relevant costs for evaluating any management decision.

2.1 Relevant cost of materials

The relevant costs of a decision to do some work or make a product will usually include costs of materials. Relevant costs of materials are the additional cash flows that will be incurred (or benefits that will be lost) by using the materials for the purpose that is under consideration.

If **none of the required materials are currently held as inventory**, the relevant cost of the materials is simply their purchase cost. In other words, the relevant cost is the cash that will have to be paid to acquire and use the materials.

If **the required materials are currently held as inventory**, the relevant costs are identified by applying the following rules:



Note that the historical cost of materials held in inventory cannot be the relevant cost of the materials, because their historical cost is a sunk cost.

The relevant costs of materials can be described as their 'deprival value'. The deprival value of materials is the benefit or value that would be lost if the company were deprived of the materials currently held in inventory.

- If the materials are regularly used, their deprival value is the cost of having to buy more units of the materials to replace them (their replacement cost).
- If the materials are not in regular use, their deprival value is either the net benefit that would be lost because they cannot be disposed of (their net disposal or scrap value) or the benefits obtainable from any alternative use. In an examination question, materials in inventory might not be in regular use, but could be used as a substitute material in some other work. Their deprival value might therefore be the purchase cost of another material that could be avoided by using the materials held in inventory as a substitute.

► *Example 08:*

A company has been asked to quote a price for a one-off contract.

The contract would require 5,000 kilograms of material X. Material X is used regularly by the company. The company has 4,000 kilograms of material X currently in inventory, which cost Rs.4 per kilogram. The price for material X has since risen to Rs.4.20 per kilogram.

The contract would also require 2,000 kilograms of material Y. There are 1,500 kilograms of material Y in inventory, but because of a decision taken several weeks ago, material Y is no longer in regular use by the company. The 1,500 kilograms originally cost Rs.14,400, and have a scrap value of Rs.3,600. New purchases of material Y would cost Rs.10 per kilogram.

For the relevant costs of the materials to assist management in identifying the minimum price to charge for the contract, please see below:

Material X

This is in regular use. Any units of the material that are held in inventory will have to be replaced for other work if they are used for the contract. The relevant cost is their replacement cost.

Relevant cost = replacement cost = 5,000 kilograms × Rs.4.20 = Rs.21,000.

Material Y

This is not in regular use. There are 1,500 kilograms in inventory, and an additional 500 kilograms would have to be purchased. The relevant cost of material Y for the contract would be:

	Rs.
Material held in inventory (scrap value)	3,600
New purchases (500 × Rs.10)	5,000
Total relevant cost of Material Y	8,600

▶ *Example 09:*

A company is considering whether to agree to do a job for a customer. It has sufficient spare capacity to take on this job.

To do the job, three different direct materials will be required, Material X, Material Y and Material Z. Data relating to these materials is as follows:

Material	Quantity needed for the job	Quantity currently held as inventory	Original cost of units currently held as inventory	Current purchase price	Current disposal value
	units	units	Rs. per unit	Rs. per unit	Rs. per unit
X	800	200	20	23	22
Y	600	400	15	19	12
Z	500	300	30	40	20

Material X is regularly used by the company for other work. Material Y is no longer in regular use, and the units currently held as inventory have no alternative use. Material Z is also no longer in regular use, but if the existing inventory of the material is not used for this job, they can be used as a substitute material on a different job, where the contribution would be Rs.25 per unit of Material Z used.

For calculation of the total relevant costs of the materials for this job for the customer, please see below:

Material X: This material is in regular use. Its relevant cost is therefore its current replacement cost, because any existing inventory will be replaced if it is used on the job.

Materials Y and Z: The relevant cost of the additional quantities that will have to be purchased is their current replacement cost.

Material Y: units already held in inventory. The relevant cost of these units is their opportunity cost, which is the cash that could be obtained by disposing of them.

Material Z: units already held in inventory. The relevant cost of these units is the higher value of their disposal value (Rs.20 per unit) and the contribution that they would earn if they are used as a substitute material on a different job (Rs.25 per unit)

Relevant costs	Rs.	Rs.
Material X: 800 units × Rs.23		18,400
Material Y:		
Opportunity cost of units in inventory = disposal value (400 units × Rs.12)	4,800	
Purchase cost of additional units (200 units × Rs.19)	3,800	
		8,600
Material Z:		
Opportunity cost of units in inventory = (300 units × Rs.25)	7,500	
Purchase cost of additional units (200 units × Rs.40)	8,000	
		15,500
Total relevant cost of materials		42,500

2.2 Relevant cost of labor

The relevant costs of a decision to do some work or make a product will usually include costs of labor.

The relevant cost of labor for any decision is the additional cash expenditure (or saving) that will arise as a direct consequence of the decision.

- **If the cost of labor is a variable cost**, and labor is not in restricted supply, the relevant cost of the labor is its variable cost. For example, suppose that part-time employees are paid Rs.18 per hour, they are paid only for the hours that they work and part-time labor is not in short supply. If management is considering a decision that would require an additional 100 hours of part-time labor, the relevant cost of the labor would be Rs.18 per hour or Rs.1,800 in total.
- **If labor is a fixed cost and there is spare labor time available**, the relevant cost of using labor is 0. The spare time would otherwise be paid for idle time, and there is no additional cash cost of using the labor to do extra work. For example, suppose that a new contract would require 30 direct labor hours, direct labor is paid Rs.20 per hour, and the direct workforce is paid a fixed weekly wage for a 40-hour week. If there is currently spare capacity, so that the labor cost would be idle time if it is not used for the new contract, the relevant cost of using 30 hours on the new contract would be Rs.0. The 30 labor hours must be paid for whether or not the contract work is undertaken.
- **If labor is in limited supply**, the relevant cost of labor should include the opportunity cost of using the labor time for the purpose under consideration instead of using it in its next-most profitable way.

▶ *Example 10:*

Department 1. The contract would require 200 hours of work in department 1, where the workforce is paid Rs.16 per hour for a fixed 40-hour week. There is currently spare labor capacity in department 1 and there are no plans to reduce the size of the workforce in this department.

Department 2. The contract would require 100 hours of work in department 2 where the workforce is paid Rs.24 per hour. This department is currently working at full capacity. The company could ask the workforce to do overtime work, paid for at the normal rate per hour plus 50% overtime premium. Alternatively, the workforce could be diverted from other work that earns a contribution of Rs.8 per hour.

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Department 3. The contract would require 300 hours of work in department 3 where the workforce is paid Rs.24 per hour. Labor in this department is in short supply and all the available time is currently spent making product Z, which earns the following contribution:

	Rs.	Rs.
Sales price		98
Labor (2 hours per unit)	48	
Other variable costs	30	
		78
Contribution per unit of product Z		20

In evaluating the relevant cost for the contract of labor in the three departments, following working may be helpful

Department 1. There is spare capacity in department 1 and no additional cash expenditure would be incurred on labor if the contract is undertaken.

Relevant cost = Rs.0.

Department 2. There is restricted labor capacity. If the contract is undertaken, there would be a choice between:

- overtime work at a cost of Rs.36 per hour (Rs.24 plus overtime premium of 50%) – this would be an additional cash expense, or
- diverting the labor from other work, and losing contribution of Rs.8 per hour – cost per hour = Rs.24 basic pay + contribution forgone Rs.8 = Rs.32 per hour.

It would be better to divert the workforce from other work, and the relevant cost of labor is therefore 100 hours × Rs.32 per hour = Rs.3,200.

Department 3. There is restricted labor capacity. If the contract is undertaken, labor would have to be diverted from making product Z which earns a contribution of Rs.20 per unit or Rs.10 per labor hour (Rs.20/2 hours). The relevant cost of the labor in department 3 is:

	Rs.
Labor cost per hour	24
Contribution forgone per hour	10
Relevant cost per hour	34

Relevant cost of 300 hours = 300 × Rs.34 = Rs.10,200.

Summary of relevant costs of labor:

	Rs.
Department 1	0
Department 2	3,200
Department 3	10,200
	13,400

▶ *Example 11:*

The manager of a small printing business has received enquires about printing three different types of advertising leaflet, type A, type B and type C. Selling price and cost information for these leaflets is shown below:

Leaflet type:	Type A	Type B	Type C
	Rs.	Rs.	Rs.
Selling price, per 1,000 leaflets	300	660	1,350
Estimate printing costs:			
Variable costs, per 1,000 leaflets	120	210	390
Specific fixed costs per month	7,200	12,000	28,500

In addition to the specific fixed costs, Rs.12,000 per month will be incurred in general fixed costs.

The printing business receives an enquiry from a customer about printing 30,000 of a different type of leaflet. The customer is willing to pay Rs.25,000. The variable labor and overhead costs of producing these leaflets would be Rs.80 per 1,000 leaflets.

The leaflets would be printed on a special type of paper. This costs Rs.500 per 1,000 leaflets. However, there are already sufficient quantities of the paper in inventory for 20,000 of the leaflets. This special paper was purchased three months ago for a customer who then cancelled his order. The material has a disposal value of Rs.1,500, but it could also be used to produce 20,000 units of leaflet C. The cost of normal paper for leaflet C is Rs.300 per 1,000 leaflets.

For calculation of the relevant costs of making the leaflets for this special order and profit increase as a result of undertaking the order would require following workings

Relevant costs	Rs.
Materials	
To be purchased: 10,000 × Rs.500/1,000	5,000
Currently held in inventory	6,000
(Relevant cost = higher of [Rs.1,500 and (20,000 × Rs.300/1,000)]	
Variable costs of labor/overheads	2,400
(30,000 × Rs.80/1,000)	
Total relevant costs	(13,400)
Contract price	25,000
Incremental profit	11,600

2.3 Relevant cost of overheads

Relevant costs of expenditures that might be classed as overhead costs should be identified by applying the normal rules of relevant costing. Relevant costs are future cash flows that will arise as a direct consequence of making a particular decision.

Fixed overhead absorption rates are therefore irrelevant, because fixed overhead absorption is not overhead expenditure and does not represent cash spending

However, it might be assumed that the overhead absorption rate for **variable** overheads is a measure of actual cash spending on variable overheads. It is therefore often appropriate to treat a variable overhead hourly rate as a relevant cost, because it is an estimate of cash spending per hour for each additional hour worked.

The only overhead fixed costs that are relevant costs for a decision are extra cash spending that will be incurred, or cash spending that will be saved, as a direct consequence of making the decision.

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- *Example 12:*

A company bought a machine six years ago for Rs.125,000. Its written down value is now Rs.25,000. The machine is no longer used for normal production work, and it could be sold now for Rs.17,500. A project is being considered that would make use of this machine for six months. After this time the machine would be sold for Rs.10,000.

Calculating the relevant cost of the machine to the project would involve:

Relevant cost = Difference between sale value now and sale value if it is used. This is the relevant cost of using the machine for the project.

Relevant cost = Rs.17,500 - Rs.10,000 = Rs.7,500.

- *Example 13:*

A contract is under consideration which would require 1,400 hours of direct labor. There is spare capacity of 500 hours of direct labor, due to the cancellation of another order by a customer. The other time would have to be found by asking employees to work in the evenings and at weekends, which would be paid at 50% above the normal hourly rate of Rs.15.

Alternatively, the additional hours could be found by switching labor from other work which earns a contribution of Rs.5 per hour.

Relevant cost of direct labor if the contract is accepted and undertaken would require:

A total of 900 hours would have to be found by either working overtime at a cost of Rs.15 × 150% = Rs.22.50 per hour, or diverting labor from other work that earns a contribution of Rs.5 per hour after labor costs of Rs.15 per hour. The opportunity cost of diverting labor from other work is therefore Rs.20 per hour. This is less than the cost of working overtime. If the contract is undertaken, labor will therefore be diverted from the other work.

It is assumed that the 500 hours of free labor time (idle time) available would be paid for anyway, even if the contract is not undertaken. The relevant cost of these hours is therefore Rs.0

Relevant cost of labor	Rs.
500 hours	0
900 hours (× Rs.20)	18,000
Total relevant cost of labor	18,000

- *Example 14:*

Tychy Limited (TL) is engaged in the manufacture of Specialized motors. The company has been asked to provide a quotation for building a motor for a large textile industrial unit in Punjab. Following information has been obtained by TL's technical manager in a one-hour meeting with the potential customer. The manager is paid an annual salary equivalent to Rs. 2,500 per eight-hour day.

i. The motor would require 120 ft. of wire-C which is regularly used by TL in production. TL has 300 ft. of wire-C in inventory at the cost of Rs. 65 per ft. The resale value of wire-C is Rs. 63 and its current replacement cost is Rs. 68 per ft.

ii. 50 kg of another material viz. Wire-D and 30 other small components would also be required by TL for the motor. Wire-D would be purchased from a supplier at Rs. 10 per kg. The supplier sells a minimum quantity of 60 kg per order. However, the remaining quantity of wire-D will be of no use to TL after the completion of the contract. The other small components will be purchased from the market at Rs. 80 per component.

iii. The manufacturing process would require 250 hours of skilled labor and 30 machine hours.

The skilled workers are paid a guaranteed wage of Rs. 20 per hour and the current spare capacity available with TL for such class of workers is 100 direct labor hours. However, additional labor hours may be obtained by either:

- Paying overtime at Rs. 23 per hour; or
- Hiring temporary workers at Rs. 21 per hour. These workers would require 5 hours of supervision by AL's existing supervisor who would be paid overtime of Rs. 20 per hour.

The machine on which the motor would be manufactured was leased by TL last year at a monthly rent of Rs. 5,000 and it has a spare capacity of 110 hours per month. The variable running cost of the machine is Rs. 15 per hour.

iv. Fixed overheads are absorbed at the rate of Rs. 25 per direct labor hour.

The relevant cost of producing textile motor, together with reasons for the inclusion or exclusion of any cost from your computation would be as follows

Tychy Limited (TL)	Note	Rs.
Technical manager – meeting	1	NIL
Wire – C	2	8,160
Wire – D	3	600
Components	4	2,400
Direct labor	5	3,250
Machine running cost	6	450
Fixed overhead	7	NIL
Total relevant cost		14,860

Notes:

1. In case of technical manager's meeting with the potential client, the relevant cost is NIL because it is not only a past cost but also the manager is paid an annual salary and therefore TL has incurred no incremental cost on it.
2. Since wire-C is regularly used by TL, its relevant value is its replacement cost. The historical cost is not relevant because it is a past cost and the resale value is not relevant since TL is not going to sell it.
3. Since wire-D is to be purchased for the contract therefore its purchase cost is relevant. TL only requires 50 kg of wire-D but due to the requirement of minimum order quantity TL will be purchasing 60 kg of the material and since TL has no other use for this material, the full cost of purchasing the 60 kg is the relevant cost.
4. Since the components are to be purchased from the market at a cost of Rs. 80 each. Therefore, the entire purchase price is a relevant cost.
5. The 100 hours of direct labor are presently idle and hence have zero relevant cost. The remaining 150 hours are relevant. TL has two choices: either use its existing employees and pay them overtime at Rs. 23 per hour which is a total cost of Rs. 3,450: or engage the temporary workers which would cost TL Rs. 3,250 including supervision cost of Rs. 100. The relevant cost is the cheaper of the two alternatives i.e. Rs. 3250.
6. The lease cost of machine will be incurred regardless of whether it is used for the manufacture of motors or remains idle. Hence, only the incremental running cost of Rs. 15 per hour is relevant.
7. Fixed overhead costs are incurred whether the work goes ahead or not so it is not a relevant cost.

3. COMPREHENSIVE EXAMPLES

- *Example 01:*

BB Company has received an enquiry from a customer for the supply of 500 units of a new product, product B22. Negotiations on the final price to charge the customer are in progress and the sales manager has asked you to supply relevant cost information.

The following information is available:

1) Each unit of product B22 requires the following raw materials:

   Raw material type

   X 4 kg

   Y 6 kg

2) The company has 5,000 kg of material X currently in stock. This was purchased last year at a cost of Rs.7 per kg. If not used to make product B22, this stock of X could either be sold for Rs.7.50 per kg or converted at a cost of Rs.1.50 per kg, so that it could be used as a substitute for another raw material, material Z, which the company requires for other production. The current purchase price per kilogram for materials is Rs.9.50 for material Z and Rs.8.25 per kg for material X.

3) There are 10,000 kilograms of raw material Y in inventory, valued on a FIFO basis at a total cost of Rs.142,750. Of this current inventory, 3,000 kilograms were purchased six months ago at a cost of Rs.13.75 per kg. The rest of the inventory was purchased last month. Material Y is used regularly in normal production work. Since the last purchase of material Y a month ago, the company has been advised by the supplier that the price per kilogram has been increased by 4%.

4) Each unit of product B22 requires the following number of labor hours in its manufacture:

   Type of labor:

   Skilled: 5 hours

   Unskilled: 3 hours

   Skilled labor is paid Rs.8 per hour and unskilled labor Rs.6 per hour.

5) There is a shortage of skilled labor, so that if production of B22 goes ahead it will be necessary to transfer skilled workers from other work to undertake it. The other work on which skilled workers are engaged at present is the manufacture of product B16. The selling price and variable cost information for B16 are as follows:

	Rs./unit	Rs./unit
Selling price		100
Less: variable costs of production		
Skilled labor (3 hours)	24	
Other variable costs	31	
		55
		45

6) The company has a surplus of unskilled workers who are paid a fixed wage for a 37-hour week. It is estimated that there are 900 hours of unused unskilled labor time available during the period of the contract. The balance of the unskilled labor requirements could be met by working overtime, which is paid at time and a half.

7) The company absorbs production overheads by a machine hour rate. This absorption rate is Rs.22.50 per hour, of which Rs.8.75 is for variable overheads and the balance is for fixed overheads. If production of product B22 is undertaken, it is estimated that an extra Rs.4,000 will be spent on fixed costs. Spare machining capacity is available and each unit of B22 will require two hours of machining time in its manufacture using the existing equipment. In addition, special finishing machines will be required for two weeks to complete the B22. These machines will be hired at a cost of Rs.2,650 per week, and there will be no overhead costs associated with their use.

8) Cash spending of Rs.3,250 has been incurred already on development work for the production of B22. It is estimated that before production of the B22 begins, another Rs.1,750 will have to be spent on development, making a total development cost of Rs.5,000.

The minimum price that the company should be prepared to accept for the 500 units of product B22 would be calculated as follows together with brief explanation:

(Note: The minimum price is the price that equals the total relevant costs of producing the items. Any price in excess of the minimum price will add to total profit).

Workings for relevant costs

Material X

The company has enough kilograms of material X in inventory for the contract. When it is used, the inventory of material X will not be replaced. The relevant cost of the material is therefore its opportunity cost, not its replacement cost. The opportunity cost is the higher of its current sale value (Rs.7.50 per kg) or the net saving obtained if it is used as a substitute for material Z (Rs.9.50 – Rs.1.50 = Rs.8 per kg). The relevant cost of material X is therefore Rs.8 per kg.

Material Y

Material Y is in regular use, so its relevant cost is its current replacement cost.

	kg		Rs.
Total inventory	10,000		142,750
Purchased six months ago	3,000	(× Rs.13.75)	41,250
Purchased last month	7,000		101,500

Purchase price last month = Rs.101,500/7,000 kg = Rs.14.50 per kg.

Current purchase price = 4% higher = Rs.14.50 × 1.04 = Rs.15.08.

Skilled labor

Skilled labor is in short supply. If it is used to make product B22, workers will have to be taken off other work. The relevant cost of skilled labor is the wages for the skilled workers for the time spent on B22, plus the lost contribution (net of skilled labor cost) from not being able to make units of product B16.

Opportunity cost of skilled labor

Skilled labor cost per unit of Product B16 = Rs.24

Number of hours per unit = 3 hours

Contribution per unit of B16 = Rs.45

Contribution per skilled labor hour from B16 = Rs.15

Opportunity cost of skilled labor if it is used to make B22 = (500 × 5) × Rs.15 = Rs.37,500

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Unskilled labor

900 unskilled labor will be available at no incremental cost to the company (as it is already being paid and is not fully employed). There is no relevant cost for these hours. The additional 600 hours required will involve extra wage payments, including overtime payments. The relevant cost of these 600 hours is Rs.6 per hour × 150% = Rs.9 per hour, including the overtime premium.

Overheads

Variable overheads are included as relevant costs because they will be additional costs if the units of B22 are made. The only incremental fixed costs, however, are the extra cash costs of Rs.4,000. The fixed overhead absorption rate is ignored. The additional costs of hiring special finishing machinery are also included as a relevant cost.

Development costs

Those costs already incurred are past costs (sunk costs) and are not relevant. The future development costs involve additional expenditure and are included as relevant costs.

Minimum price for making 500 units of B22

Materials:		**Rs.**
X	(500 units × 4kg) × Rs.8	16,000
Y	(500 units × 6kg) × Rs.15.08	45,240
Labor:		
Skilled wages	(500 units × 5 hours) × Rs.8	20,000
Opportunity cost	(500 units × 5 hours) × Rs.15	37,500
Unskilled	[(500 × 3) – 900] x 6 × 1.5	5,400
Overheads:		**Rs.**
Variable	(500 units × 2 hours) × Rs.8.75	8,750
Fixed	Incremental spending	4,000
Machine hire	(2 weeks × Rs.2,650)	5,300
Development costs		1,750
Minimum price		143,940

- *Example 02:*

Topaz Limited (TL) is the manufacturer of consumer durables. Pearl Limited, one of the major customers, has invited TL to bid for a special order of 150,000 units of product Beta.

Following information is available for the preparation of the bid.

i. Each unit of Beta requires 0.5 kilograms (kg) of material "C". This material is produced internally in batches of 25,000 kg each, at a variable cost of Rs. 200 per kg. The setup cost per batch is Rs. 80,000. Material "C" could be sold in the market at a price of Rs. 225 per kg. TL has the capacity to produce 100,000 kg of material "C"; however, the current demand for material "C" in the market is 75,000 kg.

ii. Every 100 units of product Beta requires 150 labor hours. Workers are paid at the rate of Rs. 9,000 per month. Idle labor hours are paid at 60% of normal rate and TL currently has 20,000 idle labor hours. The standard working hours per month are fixed at 200 hours.

iii. The variable overhead application rate is Rs. 25 per labor hour. Fixed overheads are estimated at Rs. 22 million. It is estimated that the special order would occupy 30% of the total capacity. The production capacity of Beta can be increased up to 50% by incurring additional fixed overheads. The fixed overhead rate applicable to enhanced capacity would be 1.5 times the current rate. The utilized capacity at current level of production is 80%.

iv. The normal loss is estimated to be 4% of the input quantity and is determined at the time of inspection which is carried out when the unit is 60% complete. Material is added to the process at the beginning while labor and overheads are evenly distributed over the process.

v. TL has the policy to earn profit at the rate of 20% of the selling price.

In calculating the unit price that TL could bid for the special order to Pearl Limited would require following working:

Calculation of unit price to be quoted to Pearl Limited:		
Material (25,000 × 200)+(53,125 × 225) + 80,000	W-1	17,033,125
Labor (20,000 ×45 × 40%) + (210,625 × 45)	W-2	9,838,125
Variable overhead (230,625 × Rs. 25)		5,765,625
Incremental fixed cost (22m / 10 ×1.5)		3,300,000
		35,936,875
Profit margin (25% of cost)		8,984,219
Sale price		44,921,094
Sale price per unit (Rs. 44,921,094 / 150,000)		299
W-1: Material		
Input units of material C (150,000 / 96%) × 0.5		78,125
W-2: Labor		
Labor hours – completed units 150,000 x 1.50		225,000
– lost units {[(150,000 / 0.96) – 150,000] × 1.5 × 60%}		5,625
		230,625

► *Example 03:*

JD is a small specialist manufacturer of electronic components and much of its output is used by the makers of aircraft. One of the small number of aircraft manufacturers has offered a contract to Company JD for the supply of 400 identical components over the next twelve months.

The data relating to the production of **each component** is as follows:

a) Material requirements:

3 kilograms material M1: see note 1 below

2 kilograms material P2: see note 2 below

1 Part No. 678: see note 3 below

Note 1: Material M1 is in continuous use by the company. 1,000 kilograms are currently held in stock at a carrying amount of Rs.4.70 per kilogram but it is known that future purchases will cost Rs.5.50 per kilogram.

Note 2: 1,200 kilograms of material P2 are held in inventory. The original cost of the material was Rs.4.30 per kilogram but as the material has not been required for the last two years it has been written down to Rs.1.50 per kilogram (scrap value). The only foreseeable alternative use is as a substitute for material P4 (in current use) but this would involve further processing costs of Rs.1.60 per kilogram. The current cost of material P4 is Rs.3.60 per kilogram.

Note 3: It is estimated that the Part No. 678 could be bought for Rs.50 each.

b) Labor requirements

Each component would require five hours of skilled labor and five hours of semi-skilled. An employee possessing the necessary skills is available and is currently paid Rs.5 per hour. A replacement would, however, have to be obtained at a rate of Rs.4 per hour for the work that would otherwise be done by the skilled employee. The current rate for semi-skilled work is Rs.3 per hour and an additional employee could be appointed for this work.

c) Overhead

JD absorbs overhead by a machine hour rate, currently Rs.20 per hour of which Rs.7 is for variable overhead and Rs.13 for fixed overhead. If this contract is undertaken it is estimated that fixed costs will increase for the duration of the contract by Rs. 3,200. Spare machine capacity is available and each component would require four machine hours.

A price of Rs.145 per component has been suggested by the large aircraft manufacturer.

In stating whether or not the contract should be accepted, please see below calculations with that supports conclusion with appropriate figures for presentation to management.

The contract should be accepted if the revenue from the contract will exceed the relevant costs of the contract.

Workings

Material M1. This material is in continuous/regular use. The relevant cost of the 1,000 kilograms is their replacement cost.

Relevant cost = 400 components × 3 kilos × Rs.5.50 per kilo = Rs.6,600.

Material P2. The material held in inventory has a relevant cost that is the higher of its scrap value (Rs.1.50) and the costs saved by putting it to an alternative use, which is Rs.2 (Rs.3.60 – Rs.1.60).

There are more units held in stock than are needed for the contract. The excess quantity should be ignored.

Relevant cost of material in stock = 400 components × 2 kilos × Rs.2 per kilo = Rs.1,600.

Part 678. Relevant cost = 400 components × Rs.50 = Rs.20,000.

Skilled labor. The relevant cost of skilled labor is the extra cash that would have to be spent to hire additional labor.

Relevant cost = 400 components × 5 hours per component × Rs.4 per hour = Rs.8,000.

Semi-skilled labor. Relevant cost = 400 components × 5 hours per component × Rs.3 per hour = Rs.6,000.

Variable overheads. It is assumed that the overhead absorption rate for variable overheads is the rate at which cash expenditure is incurred on variable overheads.

Relevant cost = 400 components × 4 machine hours per component × Rs.7 per machine hour = Rs.11,200.

Relevant cost statement	Rs.
Material M1	6,600
Material P2	1,600
Part 678	20,000
Skilled labor	8,000
Semi-skilled labor	6,000
Variable overheads	11,200
Incremental fixed costs	3,200
Total relevant costs	56,600
Contract sales value (400 × Rs.145)	58,000
Incremental profit	1,400

Undertaking the contract will add Rs.1,400 to total profit. On a purely financial basis, this means that the contract is worth undertaking. However, management might take the view that a higher profit margin is desirable, and the suggested price of Rs.145 per component might be negotiable.

▶ *Example 04:*

Rugby Limited (RL) is engaged in manufacturing of a product 'B1'. Presently, RL is considering to launch a new product B1–Extra which has a demand of 10,000 units per month. The estimated selling price of B1–Extra is Rs. 2,000 per unit. Other relevant information is as follows:

i. Each unit of B1-Extra would require 2 kg of material X and 1.5 labor hours. Material X is available in the market at Rs. 520 per kg. Alternatively, instead of material X, RL can use 2.5 kg of a substitute material Y which can be produced internally. Production of each kg of Y would require raw material costing Rs. 300 and 0.5 labor hour.

ii. Presently, about 14,000 labor hours remain idle each month and are paid at the rate of 50% of the normal wage rate of Rs. 250 per hour and such payments are charged to administration expenses.

iii. Any shortfall in required labor hours can be met through overtime at the rate of 40% above the normal wage rate.

iv. Records of last 4 months show the following factory overheads (variable and fixed) at different levels of direct labor hours:

	Month 1	Month 2	Month 3	Month 4
Direct labor (Hours)	174,000	172,000	170,000	168,000
Factory overheads (Rs. in '000)	58,280	57,840	57,400	56,960

The expected relevant cost per unit of B1-Extra and determine the cost gap (if any) if RL requires a margin of 30%, would be as follows:

Rugby Limited		
Cost gap per unit		Rs. per unit
Expected relevant cost per unit	(15,800,000/10,000)	1,580.00
Less: Target cost per unit	(2,000×70%)	1,400.00
Cost gap	(1,580–1,400)	180.00

Relevant costs of producing B1-Extra		
Material cost 10,000×1,040	(W-1)	10,400,000
Direct labor cost	(W-2)	2,100,000
Variable overheads 10,000×1.5×220	(W-4)	3,300,000
Total relevant cost		15,800,000

W-1: Decision to use X or Y		**Rs. per unit of B1-Extra**
<u>Cost of Y for each unit of B1-Extra</u>		
Material cost	(300×2.5)	750.00
Labor cost **(Without overtime)**	(250×50%)×(0.5×2.5)	156.25
Variable factory overheads	[(220**(W-4)**×0.5)×2.5]	275.00
Fixed (existing) **(Not relevant)**		-
Cost of Y for each unit of B1-Extra		1,181.25
Cost of material X for each unit of B1-Extra	(520×2.0)***(Given)***	1,040.00
Extra cost on producing Y internally (Not feasible)		**141.25**
W-2: Direct labor cost for B1-Extra		**Rupees**
Labor cost – hours	(14,000×250×50%)	1,750,000
Labor cost – overtime	(1,000(W-3)×1.4×250)	350,000
Total direct labor cost		2,100,000
W-3: Overtime hours required		**Labor hours**
Available labor hours		14,000
Labor hours required	(10,000×1.5)	15,000
Excess hours required - Overtime hours		(1,000)

W-4: Variable factory overhead rate by high-low method		**High**	**Low**	**Variable**
		(a)	**(b)**	**(a–b)**
Factory overheads (Rs.)	A	58,280,000	56,960,000	1,320,000
Labor hours	B	174,000	168,000	6,000
Variable factory overheads rate per hour (Rs.)	(A÷B)			220

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Relevant costs are cash flows that will occur in the future as a direct consequence of making the decision

Relevant costs include incremental costs (additional cost that will occur if a particular decision is taken), differential costs (amount by which future costs will be different), avoidable costs (cost that can be saved) and opportunity costs (a benefit that will be lost by taking a course of action).

Relevant costs of materials, labor or overheads are the additional cash flows that will be incurred (or benefits that will be lost) by using the materials for the purpose that is under consideration or arise as a direct consequence of the decision.

CHAPTER 14

COST-VOLUME-PROFIT (CVP) ANALYSIS

IN THIS CHAPTER

AT A GLANCE

Cost-volume-profit analysis is used to show how costs and profits change with changes in the volume of activity.

Contribution margin facilitates analysis of cost-volume-profit. It is equal to sales minus variable expenses. It also allows approximation of profit for decision making. The same can also be used in planning and evaluating profit resulting from change in volume or cost. Hence aids in selection of optimize product mix and sales target.

Break-even point is often required to calculate the volume of sales required in a period (such as the financial year) to 'break even' and make neither a profit nor a loss. The break-even point can therefore be calculated by dividing the total contribution required (total fixed costs) by the contribution per unit.

1. THE NATURE OF CVP ANALYSIS

1.1 Introduction to CVP analysis

CVP analysis stands for ***cost-volume-profit analysis***'. It is used to show how costs and profits change with changes in the volume of activity. CVP analysis is an application of marginal costing concepts.

1.2 Assumptions in CVP analysis

Costs are either fixed or variable. The variable cost per unit is the same at all levels of activity (output and sales). Whereas total fixed costs are a constant amount in each period.

Fixed costs are normally assumed to remain unchanged at all levels of output at least in the short term.

The contribution per unit is constant for each unit sold (of the same product).

The sales price per unit is constant for every unit of product sold; therefore, the contribution to sales ratio is also a constant value at all levels of sales.

If sales price per unit, variable cost per unit and fixed costs are not affected by volume of activity sales and profits are maximized by maximizing total contribution.

1.3 Contribution

Contribution is a key concept. Contribution is measured as sales revenue less variable costs.

Profit is measured as contribution minus fixed costs.

► *Illustration:*

	Rs.
Sales (Units sold × sales price per unit)	X
Variable costs (Units sold × variable cost price per unit)	(X)
Contribution	X
Fixed costs	(X)
Profit	X
Total contribution = Contribution per unit × Number of units sold.	

Many problems solved using CVP analysis use either contribution per unit (CPU) or the CS (Contribution/Sales) ratio.

Contribution per unit

It is assumed that contribution per unit (sales price minus variable cost) is a constant amount over all sales volumes.

► *Example 01:*

A company makes and sells a single product. The product has a variable production cost of Rs.8 per unit and a variable selling cost of Rs.1 per unit.

Total fixed costs (production, administration and sales and distribution fixed costs) are expected to be Rs. 500,000.

The selling price of the product is Rs.16.

The profit at sales volumes of 70,000, 80,000 and 90,000 units can be calculated as follows.

	70,000 units	80,000 units	90,000 units
	Rs.	Rs.	Rs.
Sales revenue (Rs.16/unit)	1,120,000	1,280,000	1,440,000
Variable cost (Rs.9/unit)	(630,000)	(720,000)	(810,000)
Contribution (Rs.7/unit)	490,000	560,000	630,000
Fixed costs	(500,000)	(500,000)	(500,000)
Profit/(loss)	(10,000)	60,000	130,000

Notes

A loss is incurred at 70,000 units of sales because total contribution is not large enough to cover fixed costs. Profit increases as sales volume increases, and the increase in profit is due to the increase in total contribution as sales volume increases.

Somewhere between 70,000 and 80,000 there is a number of units which if sold would result in neither a profit nor a loss. This is known as the breakeven position.

The contribution line could have been completed without calculating the sales and variable costs by simply multiplying the quantity sold by the CPU.

Considering facts as before, calculating total contribution as the number of units × contribution per unit, would be as follows:

Contribution per unit	Rs.
Sales price per unit	16
Variable production cost per unit	(8)
Variable selling cost per unit	(1)
Contribution per unit	7

	70,000 units	80,000 units	90,000 units
	Rs.	Rs.	Rs.
70,000 × Rs. 7 per unit	490,000		
80,000 × Rs. 7 per unit		560,000	
90,000 × Rs. 7 per unit			630,000
Fixed costs	(500,000)	(500,000)	(500,000)
Profit/(loss)	(10,000)	60,000	130,000

- *Example 02:*

Jimco makes and sells a single product, Product P. It is currently producing 112,000 units per month, and is operating at 80% of full capacity. Total monthly costs at the current level of capacity are Rs. 611,000. At 100% capacity, total monthly costs would be Rs. 695,000. Fixed costs would be the same per month at all levels of capacity between 80% and 100%.

At the normal selling price for Product P, the contribution/sales ratio is 60%.

The variable cost per unit of Product P and total fixed costs per month would be calculated as:

100% capacity each month = 112,000 units/0.80 = 140,000 units.

Using high/low analysis:

	units	Rs.
High: Total cost of	140,000	695,000
Low: Total cost of	112,000	611,000
Difference: Variable cost of	28,000	84,000

Therefore, variable cost per unit = Rs. 84,000/28,000 units = Rs.3.

Substitute in high equation	Cost (Rs)
Total cost of 140,000 units	695,000
Variable cost of 140,000 units (× Rs.3)	420,000
Therefore fixed costs per month	275,000

In addition, if it is required to calculate the current normal sales price per unit, and the contribution per unit at the price, the same would require following calculations:

Contribution/sales ratio = 60%

Therefore, variable cost/sales ratio = 40%

The normal sales price per unit = Rs.3/0.40 = Rs.7.50

The contribution per unit at the normal selling price is Rs.7.50 – Rs.3 = Rs.4.50 per unit.

CS (Contribution/Sales) ratio

The sales revenue in each case could be calculated by dividing the total contribution for a given level of activity by the CS ratio.

Formula:

CS ratio (contribution to sales ratio) $\dfrac{\text{Contribution per unit}}{\text{Selling price per unit}}$

Using data of Example 01:

Contribution to sales ratio:

Contribution per unit / Selling price per unit = $7/16$ = 0.4375

	70,000 units	80,000 units	90,000 units
	Rs.	Rs.	Rs.
Contribution (Rs.7/unit)	490,000	560,000	630,000
CS ratio	÷0.4375	÷0.4375	÷0.4375
Sales revenue	1,120,000	1,280,000	1,440,000

2. BREAK-EVEN ANALYSIS

2.1 Break-even analysis

CVP analysis can be used to calculate a break-even point for sales.

Break-even point is the volume of sales required in a period (such as the financial year) to 'break even' and make neither a profit nor a loss. At the break-even point, profit is 0.

Management might want to know what the break-even point is in order to:

- identify the minimum volume of sales that must be achieved in order to avoid a loss, or
- assess the amount of risk in the budget, by comparing the budgeted volume of sales with the break-even volume.
- estimate the inflow of cash required by the business before it starts generating its own funds.

2.2 Calculating the break-even point

The break-even point can be calculated using simple CVP analysis.

At the break-even point, the profit is Rs.0. If the profit is Rs.0, total contribution is exactly equal to total fixed costs.

We therefore need to establish the volume of sales at which fixed costs and total contribution are the same amount.

There are a number of methods of calculating the break-even point when the total fixed costs for the period are known:

Method 1: Breakeven point expressed as a number of units.

The first method is to calculate the break-even point using the contribution per unit. This method can be used where a company makes and sells just one product.

▶ *Formula:*

Breakeven point expressed as a number of units

$$\text{Break-even point in sales units} = \frac{\text{Total fixed costs}}{\text{Contribution per unit}}$$

Total fixed costs are the same as the total contribution required to break even, and the break-even point can therefore be calculated by dividing the total contribution required (total fixed costs) by the contribution per unit.

Remember to include any variable selling and distribution costs in the calculation of the variable cost per unit and contribution per unit.

Once the breakeven point is calculated as a number of units it is easy to express it in terms of revenue by multiplying the number of units by the selling price per item.

▶ *Example 03:*

A company makes a single product that has a variable cost of sales of Rs.12 and a selling price of Rs.20 per unit. Budgeted fixed costs are Rs.600,000.

What volume of sales is required to break even?

Method 1

$$\text{Break-even point in sales units} \quad \frac{\text{Total fixed costs}}{\text{Contribution per unit}}$$

Contribution per unit = Rs.20 – Rs.12 = Rs.8.

Therefore, break-even point:

In units: Rs.600,000 / Rs.8 per unit = 75,000 units of sales.

In sales revenue: 75,000 units × Rs.20 per unit = Rs.1,500,000 of sales.

Method 2: Breakeven point expressed in sales revenue

The second method calculates the break-even point in sales revenue.

- *Formula:*

Breakeven point expressed in sales revenue

$$\text{Break-even point in revenue} = \frac{\text{Fixed costs}}{\text{Contribution to sales ratio}}$$

Once the breakeven point is calculated as an amount of revenue it is easy to express it as a number of units by dividing the revenue by the selling price per item.

- *Example 04:*

A company makes a single product that has a variable cost of sales of Rs.12 and a selling price of Rs.20 per unit. Budgeted fixed costs are Rs.600,000.

What volume of sales is required to break even?

Method 2

$$\text{Break-even point in revenue} = \frac{\text{Total fixed costs}}{\text{C/S ratio}}$$

C/S ratio = Rs.8/Rs.20 = 40%

Therefore, break-even point:

In sales revenue = Rs.600,000/0.40 = Rs.1,500,000 in sales revenue.

In units = Rs.1,500,000 ÷ Rs.20 (sales price per unit) = 75,000 units.

- *Example 05:*

A soft drink company is planning to produce mineral water. It is contemplating the purchase of plant with a capacity of 100,000 bottles a month. For the first year of operation the company expects to sell between 60,000 to 80,000 bottles. The budgeted costs at each of the two levels are as follows:

	Rupees	
Particulars	**60,000 bottles**	**80,000 bottles**
Material	360,000	480,000
Labor	200,000	260,000
Factory overheads	120,000	150,000
Administration expenses	100,000	110,000

The production would be sold through retailers who will receive a commission of 8% of sale price.

In order to calculate, the break-even point in rupees and units, if the company decides to fix the sale price at Rs. 16 per bottle, please see below working

Calculation of variable and fixed cost

	Total costs		Variable cost			Fixed cost (A – E)
	60,000 bottles	80,000 bottles	20,000 bottles	Per bottle C/20,000	60,000 bottles D×60,000	
	A	B	C	D	E	F
Material	360,000	480,000	120,000	6.00	360,000	-
Labor	200,000	260,000	60,000	3.00	180,000	20,000
Factory overheads	120,000	150,000	30,000	1.50	90,000	30,000
Administration expenses	100,000	110,000	10,000	0.50	660,000	70,000
	780,000	1,000,000	220,000	11.00	660,000	120,000

Calculation of variable and fixed cost

	Rupees
Variable cost per bottle as above	11.00
Commission to retailers (8% of Rs. 16.00)	1.28
Variable cost per bottle	12.28
Contribution per bottle (16.00 – 12.28)	Rs. 3.72
PV ratio (contribution to sales ratio 3.72/16.00)	23.25%

$$\text{Break-even point (bottles)} = \frac{\text{Fixed cost}}{\text{Contribution per bottle}} = \frac{120{,}000}{3.72} = 32{,}258 \text{ bottles}$$

Break-even point in Rupees = 32,258 × 16.00 = Rs. 516,128

In addition, computation of the break-even point in units if the company offers a discount of 10% on purchase of 20 bottles or more, assuming that 20% of the sales will be to buyers who will avail the discount, would be as follows:

Average sales price (before discount)	Rs.16.00
Average discount per unit @ 10% on 20% of sales = 0.02 of Rs. 16.00	(0.32)
New average sales price	15.68
Variable cost per bottle as above	11.00
Commission to retailers (8% of Rs. 15.68)	1.25
Variable cost per bottle	12.25

Contribution per bottle (15.68 – 12.25) Rs. 3.43

$$\text{Break-even point (bottles)} = \frac{\text{Fixed cost}}{\text{Contribution per bottle}} = \frac{120{,}000}{3.43} = 34{,}985 \text{ bottles}$$

2.3 Margin of safety

The margin of safety is the difference between:

- the budgeted sales (in units or Rs.) and
- the break-even amount of sales (in units or Rs.).

It is usually expressed as a **percentage of the budgeted sales**. However, it may also be measured as:

- a quantity of units (= the difference between the budgeted sales volume in units and the breakeven sales volume), or
- an amount of sales revenue (= the difference between the budgeted sales revenue and the total sales revenue required to break even).

It is called the margin of safety because it is the maximum amount by which actual sales can be lower than budgeted sales without incurring a loss for the period. A high margin of safety therefore indicates a low risk of making a loss.

The margin of safety is often expressed as a percentage of budgeted sales.

▶ *Formula:*

$$\text{Margin of safety} = \frac{\text{Margin of safety (units)}}{\text{Budgeted sales (units)}} \times 100$$

$$\text{Margin of safety} = \frac{\text{Margin of safety (revenue)}}{\text{Budgeted revenue}} \times 100$$

▶ *Example 06:*

A company budgets to sell 25,000 units of its product. This has a selling price of Rs.16 and a variable cost of Rs.4. Fixed costs for the period are expected to be Rs.240,000.

The break-even point = Rs.240,000/(Rs.16 – 4) = 20,000 units.

The budgeted sales are 25,000 units.

Margin of safety = Budgeted sales – break-even sales
= 25,000 – 20,000 = 5,000 units

Margin of safety ratio 5,000 units/25,000 units =20% of budgeted sales

This means that sales volume could be up to 20% below budget, and the company should still expect to make a profit.

▶ *Example 07:*

Auto Industries Limited (AIL) manufactures auto spare parts. Currently, it is operating at 70% capacity. At this level, the following information is available:

Break-even sales	Rs. 125 million
Margin of safety	Rs. 25 million
Contribution margin to sales	20%

AIL is planning to increase capacity utilization through the following measures:

Selling price would be reduced by 5% which is expected to increase sales volume by 30%.

Increase in sales would require additional investment of Rs. 40 million in distribution vehicles and working capital. The additional funds would be arranged through a long-term loan at a cost of 15% per annum. Depreciation on distribution vehicles would be Rs. 5 million.

As a result of increased production, economies of scale would reduce variable cost per unit by 10%.

a) Preparing for profit statements under current and proposed scenarios would involve following calculations:

Auto Industries Limited	Current	Proposed
Profit statement	Rs. in million	
Sales (125+25), 150*1.3*0.95	150.00	185.25
Variable cost of sales (150*80%), 120*90%*1.3)	(120.00)	(140.40)
Contribution margin	30.00	44.85
Fixed cost (125×20%), 25+5+(40*15%)	(25.00)	(36.00)
Net profit	5.00	8.85

b) In addition, computing break-even sales and margin of safety after taking the above measures would have following results.

Break-even sales	(185.25÷44.85)×36	148.70
Margin of safety	(185.25-148.70)	36.55

2.4 Target profit

Management might want to know what the volume of sales must be in order to achieve a target profit. CVP analysis can be used to calculate the volume of sales required.

The volume of sales required must be sufficient to earn a total contribution that covers the fixed costs and makes the target amount of profit. In other words, the contribution needed to earn the target profit is the target profit plus the fixed costs.

The sales volume that is necessary to achieve this, is calculated by dividing the target profit plus fixed costs by the contribution per unit in the usual way.

- *Formula:*

Volume target expressed in units

$$\text{Volume target (units)} = \frac{\text{Total fixed costs + target profit}}{\text{Contribution per unit}}$$

Once the volume target is calculated as a number of units it is easy to express it in terms of revenue by multiplying the number of units by the selling price per item.

Similarly, the sales revenue that would achieve the target profit is calculated by dividing the target profit plus fixed costs by the C/S ratio.

- *Formula:*

target expressed in sales revenue

$$\text{target in revenue(Rs.)} = \frac{\text{Total fixed costs + target profit}}{\text{Contribution to sales ratio}}$$

Once the volume target is calculated as an amount of revenue it is easy to express it as a number of units by dividing the revenue by the selling price per item.

- *Example 08:*

A company makes and sells a product that has a variable cost of Rs.5 per unit and sells for Rs.9 per unit.

Budgeted fixed costs are Rs.600,000 for the year, and the company wishes to make a profit of at least Rs.100,000.

The sales volume required to achieve the target profit can be found as follows:

The total contribution must cover fixed costs and make the target profit.

	Rs.
Fixed costs	600,000
Target profit	100,000
Total contribution required	700,000

Contribution per unit = Rs.9 – Rs.5 = Rs.4.

Sales volume required to make a profit of Rs.100,000:

Rs.700,000 / Rs.4 per unit = 175,000 units.

Therefore, the sales revenue required to achieve target profit

175,000 units × Rs.9 = Rs.1,575,000

Alternatively:

C/S ratio = 4/9

Sales revenue required to make a profit of Rs.100,000

= Rs.700,000 ÷ (4/9) = Rs.1,575,000.

Therefore, the number of units required to achieve target profit

Rs.1,575,000 ÷ Rs. 9 = 175,000 units

- *Example 09:*

A company makes a single product that it sells at Rs.80 per unit. The total fixed costs are Rs.360,000 for the period and the contribution/sales ratio is 60%. Budgeted production and sales for the period is 8,000 units.

The margin of safety for the period, as a percentage of the budgeted sales would be calculated as follows

Contribution per unit = 60% × Rs.80 = Rs.48

Fixed costs = Rs.360,000

Break-even point = Rs.360,000/Rs.48 per unit = 7,500 units

Budgeted sales = 8,000 units

Margin of safety = (8,000 – 7,500) units = 500 units

As a percentage of budgeted sales, the margin of safety is (500/8,000) × 100% = 6.25%.

- *Example 10:*

A company makes and sells a single product. The following data relates to the current year's budget.

Sales and production (units):	8,000
Variable cost per unit:	Rs.20
Fixed cost per unit:	Rs.25
Contribution/sales ratio:	60%

The selling price next year will be 6% higher than the price in the current year budget and the variable cost per unit will be 5% higher than in the current year budget. Budgeted fixed costs next year will be 10% higher than budgeted fixed costs in the current year.

If required to calculate (i) the budgeted contribution per unit and (ii) the budgeted total profit for the current year following working is required

i. Contribution/sales ratio = 60%
Therefore, variable costs/sales ratio = 40%.
Variable cost per unit = Rs.20
Therefore, sales price per unit = Rs.20/0.40 = Rs.50.
Contribution per unit = Rs.50 – Rs.20 = Rs.30.

	Rs.
Budgeted contribution (8,000 × Rs.30)	240,000
Budgeted fixed costs (8,000 × Rs.25)	200,000
Budgeted profit, current year	40,000

However, for the next year, in order to calculate the number of units that will have to be sold in order to achieve a total profit that is equal to the budgeted profit in the current year please see below.

ii. Sales price next year = Rs.50 × 1.06 = Rs.53 per unit
Variable cost per unit next year = Rs.20 × 1.05 = Rs.21
Therefore, contribution per unit next year = Rs.53 – Rs.21 = Rs.32

	Rs.
Target profit next year	40,000
Fixed costs next year (200,000 × 1.10)	220,000
Target contribution for same profit as in the current year	260,000

Therefore target sales next year = Rs.260,000/Rs.32 per unit = 8,125 units.

▶ *Example 11:*

Entity D makes a single product which it sells for Rs.10 per unit. Fixed costs are Rs.48,000 each month and the product has a contribution/sales ratio of 40%.

If budgeted sales for the month are Rs.140,000, the margin of safety in units would be

Break-even point = Rs.48,000/0.40 = Rs.120,000 (sales revenue).

Margin of safety (in sales revenue) = Rs.140,000 – Rs.120,000 = Rs.20,000.

Selling price per unit = Rs.10.

Margin of safety (in units) = Rs.20,000/Rs.10 = 2,000 units.

▶ *Example 12:*

Entity E has monthly sales of Rs.128,000, but at this level of sales, its monthly profit is only Rs.2,000 and its margin of safety is 6.25%.

From the above information we can calculate (i) fixed costs as well as (ii) the level of monthly sales needed to increase the monthly profit to Rs.5000 as follows:

i. The margin of safety is 6.25%. Therefore the break-even volume of sales = 93.75% of budgeted sales = 0.9375 × Rs.128,000 = Rs.120,000

	Budget (Rs.)	**Break-even (Rs.)**
Sales	128,000	120,000
Profit	2,000	0
Total costs	126,000	120,000

This gives us the information to calculate fixed and variable costs, using high/low analysis.

	Rs. Revenue	Rs. Cost
High: Total cost at	128,000	126,000
Low: Total cost at	120,000	120,000
Difference: Variable cost of	8,000	6,000

Therefore variable costs = Rs.6,000/Rs.8,000 = 0.75 or 75% of sales revenue.

Substitute in high or low equation	Cost (Rs.)
Total cost at Rs.128,000 revenue	126,000
Variable cost at Rs.128,000 revenue (× 0.75)	96,000
Therefore fixed costs	30,000

Alternate approach

i. At sales of Rs.128,000, profit is Rs.2,000.

The contribution/sales ratio = 100% – 75% = 25% or 0.25.

To increase profit by Rs.3,000 to Rs.5,000 each month, the increase in sales must be:

(Increase in profit and contribution) ÷ C/S ratio

= Rs.3,000/0.25 = Rs.12,000.

Sales must increase from Rs.128,000 (by Rs.12,000) to Rs.140,000 each month.

Alternative approach to the answer

	Rs.
Target profit	5,000
Fixed costs	30,000
Target contribution	35,000
C/S ratio	0.25
Therefore sales required (Rs.35,000/0.25)	Rs.140,000

► *Example 13:*

Octa Electronics produces and markets a single product. Presently, the product is manufactured in a plant that relies heavily on direct labor force. Last year, the company sold 5,000 units with the following results:

	Rupees
Sales	22,500,000
Less: Variable expenses	13,500,000
Contribution margin	9,000,000
Less: Fixed expenses	6,300,000
Net income	2,700,000

a) Break-even point in rupees and the margin of safety would be

Break even point in Rupees

$$\text{Break even point in Rupees} = \frac{\text{Fixed Expense}}{\text{Contribution margin\%}}$$

$$= \frac{6{,}300{,}000}{40\%\ (\text{W-1})} = \text{Rs. } 15{,}750{,}000$$

W-1:	Rupees	
Selling price	22,500,000	
Less: variable expense	13,500,000	
Contribution margin	9,000,000	
Contribution margin %	40%	(9,000,000 / 22,500,000)

$$\text{Margin of safety} = \frac{\text{Current sales - Break even sales}}{\text{Current sales}}$$

$$= \frac{22{,}500{,}000 - 15{,}750{,}000}{22{,}500{,}000} = 30\%$$

b) For the contribution margin ratio and the break-even point in number of units if variable cost increases by Rs. 600 per unit can be calculated. The selling price per unit if the company wishes to maintain the contribution margin ratio achieved during the previous year involves following working.

New CM Ratio	Rupees	
Selling price	22,500,000	
Less: variable expense	16,500,000	(Rs.13,500,000 + 5,000 x Rs. 600)
Contribution margin	6,000,000	
Contribution margin %	26.67%	(Rs. 6,000,000 / Rs. 22,500,000)
Break-even point in units		
Break-even point in units =	Fixed Expense / Contribution margin per unit	
=	6,300,000 / Rs. 6,000,000 ÷ 5,000	= 5,250 units
New Selling Price		
Let S = new selling price per unit		
S =	Variable Costs per unit + S x 0.4	
S =	(Rs. 16,500,000 ÷ 5,000) + 0.4S	
0.6 S =	Rs. 3,300	
S =	Rs. 5,500	

c) The company is also considering the acquisition of a new automated plant. This would result in the reduction of variable costs by 50% of the amount computed in (b) above whereas the fixed expenses will increase by 100%. If the new plant is acquired, units that will have to be sold next year to earn net income of Rs. 3,150,000 would be

No. of units to be sold next year to earn a profit of Rs. 3,150,000

New contribution per unit		
Selling price	Rs. 4,500	
Less: variable expenses	Rs. 1,650	(Rs. 16,500,000 / 5,000 x 50%)
Contribution margin	Rs. 2,850	

AT A GLANCE
SPOTLIGHT
STIKCY NOTES

New breakeven point in units to achieve net income of Rs. 3,150,000t

$$\text{Break even point in units} = \frac{\text{Fixed Expense} + \text{Target Profit}}{\text{Contribution margin per unit}}$$

$$= \frac{(\text{Rs. } 6{,}300{,}000 \text{ x } 2) + \text{Rs. } 3{,}150{,}000}{\text{Rs. } 2{,}850} = 5{,}526 \text{ units}$$

- *Example 14:*

The following information pertains to Hope Limited for the latest financial year:

	Rupees
Sales price per unit	1,600
Direct labor per unit	240
Variable cost (other than direct labor) per unit	960
Fixed cost (no labor cost included)	850,000

Volume of sales and production was 6,000 units which represent 80% of normal capacity. The management of the company is planning to increase wages of direct labor by 15% with effect from next financial year.

i. In order to calculate the number of units to be sold to maintain the current profit if the sales price remains at Rs. 1,600 and the 15% wage increase goes into effect, please see below:

Units to be sold to maintain the current profit:		Rs.
Sales	(6,000 units × 1,600)	9,600,000
Variable cost	[6,000 × (960+240)]	(7,200,000)
Contribution margin	**A**	2,400,000
Revised contribution margin per unit [1,600–960–(240×1.15)]	**B**	364
Units to be sold	**A÷B**	**6,593 Units**

ii. The management believes that an additional investment of Rs. 760,000 in machinery (to be depreciated at 10% annually) will increase normal capacity by 25%. Determine the selling price in order to earn a profit of Rs. 2 million assuming that all units produced at increased capacity can be sold and that the wage increase goes into effect.

Selling price per unit to earn a profit of Rs. 2 million:		
Revised capacity	(6,000 ÷ 0.8 × 1.25) Units	9,375
Revised fixed cost	850,000 + (760,000 × 10%) Rs.	926,000
New selling price $= \frac{926{,}000+2{,}000{,}000}{9{,}375} + (240\times1.15) + 960$	Rs.	1,548

3. BREAK-EVEN CHARTS AND PROFIT-VOLUME CHARTS

3.1 Break-even chart

A break-even chart is a chart or graph showing, for all volumes of output and sales:

- total costs, analyzed between variable costs and fixed costs
- sales
- profit (= the difference between total sales and total costs)
- the break-even point (where total costs = total sales revenue, and profit = 0).

The concept of a break-even chart is similar to a cost behavior chart, but with sales revenue shown as well.

If the chart also indicates the budgeted volume of sales, the margin of safety can be shown as the difference between the budgeted volume and the break-even volume of sales.

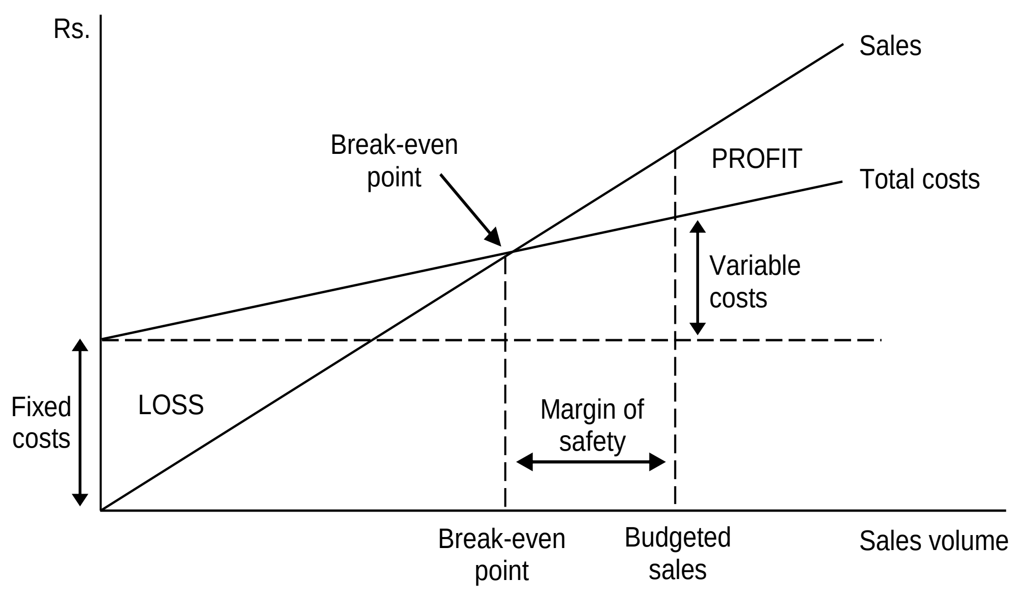
Two illustrations for of break-even are shown below. The only difference between them is the way in which variable costs and fixed costs are shown.

- In the first illustration, variable costs are shown on top of fixed costs. Fixed costs are represented by the horizontal line of dashes. Fixed costs are the same amount at all volumes of sales. Variable costs are shown on top of fixed costs, rising in a straight line from sales of Rs.0. Total costs are shown as the sum of fixed costs and variable costs.
- In the second (a more unusual presentation), fixed costs are shown on top of variable costs. An advantage of this method of presentation is that total contribution is shown. This is the difference between the total sales line and the total variable costs line.
- Total costs are exactly the same in both diagrams.

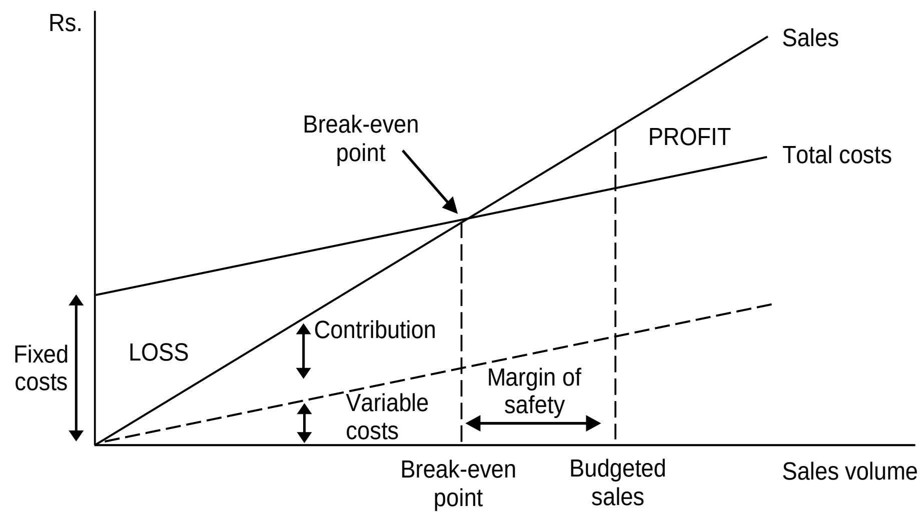
Because the sales price per unit is constant, the total sales revenue line rises in a straight line from the origin of the graph (i.e. from x = 0, y = 0).

First break-even chart: variable costs on top of fixed costs

▶ *Illustration 01:*



- *Illustration 02:*



Points to note

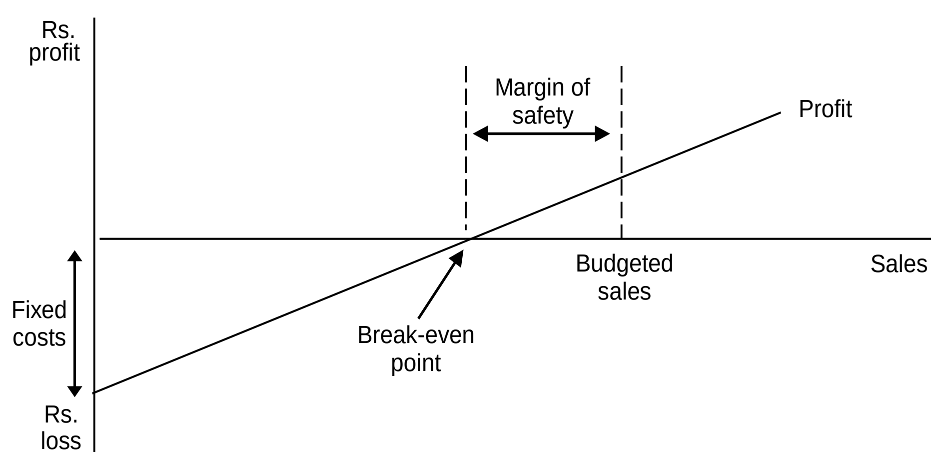
You should be able to identify the following points on these charts.

- The break-even point is shown on both charts as the volume of sales at which total revenue equals total costs.
- In the second chart, total contribution at the break-even point is shown as exactly equal to fixed costs.
- If budgeted sales are shown on the chart, the margin of safety can also be show, as the difference between budgeted sales and the break-even point.

3.2 Profit/volume chart (P/V chart)

A profit volume chart (or P/V chart) is an alternative to a break-even chart for presenting CVP information. It is a chart that shows the profit or loss at all levels of output and sales.

- *Illustration:*



At Rs.0 sales, there is a loss equal to the total amount of fixed costs. The loss becomes smaller as sales volume increases, due to the higher contribution as sales volume increases. Break-even point is then reached and profits are made at sales volumes above the break-even point.

We could draw a line on the graph to show fixed costs. This line should be drawn parallel to the x axis, starting at the loss (= total fixed costs) at Rs.0 sales. By drawing this line for fixed costs, total contribution would be shown as the difference between the line showing the profit (or loss) and the line for the fixed costs.

▶ *Example 15:*

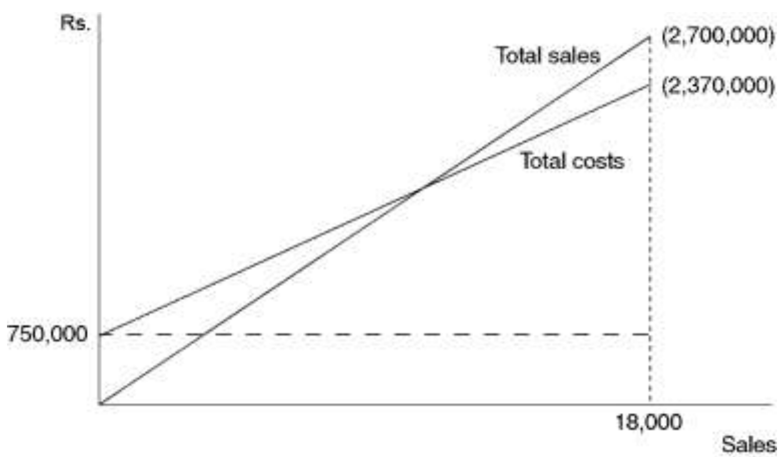
You are a management accountant for a business that develops specialist computers. You are consulted to investigate the viability of marketing a new type of hand-held computer.

With the help of the manager of research and development, the production manager, the buyer and the sales manager, you have made the following estimates of annual sales and profitability:

Sa1les	Profit/(loss)
units	Rs.
12,000	(30,000)
15,000	150,000
18,000	330,000

The selling price will be Rs.150.

A traditional break-even chart using the information given above will be prepared as follows:



Workings			
	Sales	Sales (at Rs.150)	Profit
	units	Rs.	Rs.
	18,000	2,700,000	330,000
	12,000	1,800,000	(30,000)
Difference	6,000	900,000	360,000

An increase in sales from 12,000 units to 18,000 units results in an increase of Rs.900,000 in revenue and Rs.360,000 in contribution and profit.

From this, we can calculate that the contribution is Rs.60 per unit (Rs.360,000/6,000) and the C/S ratio is 0.40 (Rs.360,000/Rs.900,000). Variable costs are therefore 0.6 or 60% of sales.

To draw a break-even chart, we need to know the fixed costs.

Substitute in high or low equation

When sales are 18,000 units:	Rs.
Sales (at Rs.150 each)	2,700,000
Variable cost (sales × 60%)	1,620,000
Contribution (sales × 40%)	1,080,000
Profit	330,000
Therefore fixed costs	750,000
When sales are 18,000 units:	**Rs.**
Fixed costs	750,000
Variable cost (see above)	1,620,000
Total costs	2,370,000

In addition, the margin of safety if annual sales are expected to be 15,000 units can be calculated as

Break-even point = Fixed costs ÷ C/S ratio

= Rs.750,000/0.40 = Rs.1,875,000

Break-even point in units = Rs.1,875,000/Rs.150 per unit = 12,500 units.

If budgeted sales are 15,000 units, the margin of safety is 2,500 units (15,000 – 12,500).

This is 1/6 or 16.7% of the budgeted sales volume.

4. MULTI PRODUCT CVP ANALYSIS

4.1 Breakeven analysis – Contribution per batch or per unit

The techniques for contribution margin can be extended to multi-product analysis. However, in order to do this we need to make a further assumption (which might seem very unrealistic).

This assumption is that products are sold in a set ratio which does not change with volume. This assumption allows us to calculate a weighted average contribution per unit or batch and/or CS ratio which can be used to solve breakeven, margin of safety and target profit problems.

Formula: Breakeven point for batches

$$\text{Break-even point in batches} = \frac{\text{Total fixed costs}}{\text{Contribution per batch}}$$

$$\text{Break-even point in revenue} = \frac{\text{Total fixed costs}}{\text{CS ratio for the batch}}$$

▶ *Example 16:*

The following budget information refers to the two products of a company.

	X	Y	
Sales price per unit	100	120	
Variable cost per unit	(75)	(111)	
Contribution per unit	25	9	
Sales volume	15,000	5,000	
Sales mix	3	1	
CS ratio	0.25	0.075	
Fixed costs			315,000

In calculating the number of units at which the company will breakeven using the average contribution per batch and the average contribution per unit and the revenue, please see below

Average contribution per batch

X and Y are sold in the ratio of 3:1 (15,000:5,000) therefore the average contribution per batch is: (3× 25) + (1×9) = Rs.84

Breakeven as a number of batches is given by:

Fixed costs/Contribution per batch = Rs.315,000/Rs.84 = 3,750 batches

		Units		
	Batches	X (3 per batch)	Y (1 per batch)	
Breakeven	3,750	11,250	3,750	
Revenue per unit		Rs.100	Rs.120	
Revenue		1,125,000	450,000	= 1,575,000

4.2 Breakeven analysis – C/S ratio

- *Example 16 (Contd):*

The following budget information refers to the two products of a company.

	X	Y	
Sales price per unit	100	120	
Variable cost per unit	(75)	(111)	
Contribution per unit	25	9	
Sales volume	15,000	5,000	
Sales mix	3	1	
CS ratio	0.25	0.075	
Fixed costs			315,000

For breakeven revenue using the average C/S ratio and the unit sales first average Average contribution and revenue per batch (as before) would be calculated that is

Average contribution per batch (as before): (3× 25) + (1×9) = Rs.84

Average revenue per batch: (3× 100) + (1×120) = 300 + 120 = Rs.420

Note that 300 out of every 420 will be revenue from selling X and 120 from selling Y.

Weighted average CS ratio: Rs.84/Rs.420 = 0.20

Breakeven in revenue is given by

Fixed costs/CS ratio = Rs.315,000/0.20 = Rs.1,575,000

		Units		
	Revenue	X ($^{300}/_{420}$)	Y ($^{120}/_{420}$)	
Breakeven	1,575,000	Rs.1,125,000	Rs.450,000	
Revenue per unit		÷ Rs.100	÷ Rs.120	
Units		11,250	3,750	= 15,000 units

4.3 Margin of safety – Multi product

The margin of safety is calculated in the same way as for single products by comparing the budgeted activity level to the breakeven. The breakeven point can be compared to the budgeted activity level using batches, units or revenue.

This will be illustrated using the previous example.

- *Example 16 (Contd):*

Margin of safety

	Batches	Units	Revenue
Budgeted activity	5,000	20,000	2,100,000[1]
Breakeven point	3,750	15,000	3,750
Margin of safety	1,250	5,000	450,000
Margin of safety as percentage of sales	25%	25%	25%

[1] Budgeted revenue = (Rs.100 × 15,000) + (Rs.120 × 5,000) = Rs.2,100,000

4.4 Target profit

The target profit is calculated in the same way as for single products. The necessary contribution to earn the target profit is the target profit plus the fixed costs. The activity level required to achieve the necessary contribution may be found using contribution per unit, contribution per batch or the CS ratio.

▶ *Example 16 (Contd):*

The company wishes to make a profit of Rs.189,000 on a fixed cost base of Rs.315,000

Average contribution per batch = Rs.84

Average contribution per unit = Rs.21

Weighted average CS ratio = 0.20

Target profit

	Batches	Units	Revenue
Target profit (Rs.189,000 + Rs.315,000)	Rs.504,000	Rs.504,000	Rs.504,000
Contribution per batch	Rs.84		
Contribution per unit		Rs.21	
C/S ratio			0.20
	6,000	24,000	Rs.2,520,000
Sales of X (×3 and × ¾)	18,000	18,000	
Sales of Y (×1 and × ¼)	1,000	6,000	

Proof of revenue

	X	Y	
Units to be sold	18,000	6,000	
Selling price per unit	100	120	
Revenue	1,800,000	720,000	Rs.2,520,000

5. COMPREHENSIVE EXAMPLES

- *Example 01:*

Sword Leather Limited (SLL) produces and sells shoes. The following information pertains to its latest financial year:

	Rs. in million
Sales (62,500 pairs)	187.5
Fixed production overheads	35.0
Fixed selling and distribution overheads	10.0
Variable production cost (in proportion of 40:35:25 for material, labor and overheads respectively)	60% of sale
Variable selling and distribution cost	15% of sale

To increase profitability, SLL has decided to introduce new design shoes and discontinue the existing deigns. In this regard it has carried out a study whose recommendations are as follows:

i. Replace the existing fully depreciated plant with a new plant at an estimated cost of Rs. 50 million. The new plant would:
   - reduce material wastage from 10% to 5%;
   - decrease direct wages by 5%; and
   - increase variable overheads by 6% and fixed overheads by Rs. 15 million
   - (including depreciation on the new plant).

ii. Improve efficiency of the staff by paying 1% commission to marketing staff and annual bonus amounting to Rs. 1.5 million to other staff.

iii. Introduction of new designs would require an increase in variable selling and distribution cost by 2%.

iv. Sell the newly designed shoes at 10% higher price.

v. Maintain finished goods inventory equal to one month's sale.

   if the budgeted sale has been determined with the objective of maintaining 25% margin of safety on sale, computation of budgeted production for the first year would be as follow:

Budgeted production of the new design shoes for the first year		Rs. per unit
Sales	187,500,000÷62,500×1.1 (A)	3,300.00
Variable costs:		
Direct material	(3,000×0.6×0.4)÷1.1×1.05	(687.27)
Direct wages	3,000×0.6×0.35×0.95	(598.50)
Production overheads	3,000×0.6×0.25×1.06	(477.00)
Selling and distribution	3,000×0.15×1.02	(459.00)
Sales commission to marketing staff	3,300×1%	(33.00)
	(B)	(2,254.77)
Contribution margin	(C)	1,045.23
Total fixed cost (Rs.)	(35+10+15+1.5) (D)	61,500,000

Budgeted production:		No. of pairs
Break-even sales	D÷C (E)	58,839
Margin of safety on sales at 25%	E÷0.75×0.25	19,613
Budgeted sales	(F)	78,452
Inventory - average one month's sales	F ÷12	6,538
Budgeted production		84,990

▶ *Example 02:*

The manager of a small printing business has received enquires about printing three different types of advertising leaflet, type A, type B and type C. Selling price and cost information for these leaflets is shown below:

Leaflet type:	Type A	Type B	Type C
	Rs.	Rs.	Rs.
Selling price, per 1,000 leaflets	300	660	1,350
Estimate printing costs:			
Variable costs, per 1,000 leaflets	120	210	390
Specific fixed costs per month	7,200	12,000	28,500

In addition to the specific fixed costs, Rs.12,000 per month will be incurred in general fixed costs.

Assuming that fixed orders have been received to print 50,000 of Leaflet A and 50,000 of Leaflet B each month, the quantity of Leaflet C that must be sold to produce an overall profit, for all three leaflets combined, of Rs.5,400 per month would be calculated as follows:

Tutorial note: The volume of sales required to achieve a target profit is an application of CVP analysis.

	Rs.		Rs.
Target profit			5,400
General fixed costs			12,000
Specific fixed costs:			
Leaflet Type A			7,200
Leaflet Type B			12,000
Leaflet Type C			28,500
Total contribution required			65,100
Contribution from:			
50,000 Leaflets Type A: (50 × (300 – 120))	9,000		
50,000 Leaflets Type B: (50 × (660 – 210))	22,500		
			31,500
Contribution required from Leaflets Type C			33,600

The contribution from Leaflets Type C is Rs.(1,350 – 390) = Rs.960 per 1,000 leaflets.

The sales quantity of Leaflets Type C required to achieve a target profit of Rs.5,400 each month is therefore Rs.33,600/Rs.960 per 1,000 = 35,000 leaflets.

In addition, the printing business now receives an enquiry from a customer about printing 30,000 of a different type of leaflet. The customer is willing to pay Rs.25,000. The variable labor and overhead costs of producing these leaflets would be Rs.80 per 1,000 leaflets.

The leaflets would be printed on a special type of paper. This costs Rs.500 per 1,000 leaflets. However, there are already sufficient quantities of the paper in inventory for 20,000 of the leaflets. This special paper was purchased three months ago for a customer who then cancelled his order. The material has a disposal value of Rs.1,500, but it could also be used to produce 20,000 units of leaflet C. The cost of normal paper for leaflet C is Rs.300 per 1,000 leaflets.

In calculating the relevant costs of making the leaflets for this special order, when it is required to indicate by how much profit would increase as a result of undertaking the order, please see below:

Relevant costs	Rs.
Materials	
To be purchased: 10,000 × Rs.500/1,000	5,000
Currently held in inventory	6,000
(Relevant cost = higher of [Rs.1,500 and (20,000 × Rs.300/1,000)]	
Variable costs of labor/overheads	2,400
(30,000 × Rs.80/1,000)	
Total relevant costs	(13,400)
Contract price	25,000
Incremental profit	11,600

▶ *Example 03:*

Himalayan Rivers (HR) is planning to install a new plant. Planned production from the plant for the next year is 150,000 units. Cost of production is estimated as under:

	Rs. In million
Direct material	6.00
Direct Labor	5.00
Production overheads	10.29

Production overheads include the following:

i. Factory premises would be acquired on rent at a cost of Rs. 1.8 million per annum.

ii. Indirect labor has been budgeted at 30% of direct labor cost, 50% of which would be fixed.

iii. Depreciation of the plant would be Rs. 0.5 million.

iv. Total power and fuel cost has been budgeted at Rs. 3 million. 80% of power and fuel cost would vary in accordance with the production.

v. All remaining production overheads are variable.

The sales and marketing budget includes the following:

i. Employment of two sales representatives at a monthly salary of Rs. 25,000 each and a sales commission of 2% on sales achieved.

ii. Hiring of a delivery van at Rs. 70,000 per month. (iii) Launching an advertisement campaign at a cost of Rs. 1.5 million

The breakeven sales revenue and quantity for the next year if HR expects to earn a contribution margin of 40% on sales, net of 2% sales commission, would be calculated as follows.

Break-even sales revenue and quantity		Rs. in million
Break even sales revenue	6.59**(W-2)**÷[(100–2)×40%]	16.81
Break even sales quantity	[16,810,000÷200**(W.1)**] **Units**	84,050

W-1: Sales price per unit		Rs. in million
Variable overheads (excluding 2% sales commission):		
Direct material		6.00
Direct labor		5.00
Variable overheads	10.29-3.65 **(W-2)**	6.64
		17.64
Variable overheads % to sales	[100-(100-2)×40%]–2%	58.80%
Sales price per unit	(17.64÷58.8%)÷150,000 **Rs.**	200.00

W-2: Fixed cost		Rs. in million
Production overheads:		
Rent - factory premises		1.80
Indirect labor	5×30%×50%	0.75
Depreciation of plant		0.50
Power and fuel	3×20%	0.60
		3.65
Sales and marketing expenses:		
Employees' salaries	25,000×2×12	0.60
Delivery van	70,000×12	0.84
Advertisement campaign		1.50
Total fixed overheads		6.59

▶ *Example 04:*

Following information has been extracted from the projected results of Saffron Limited (SL) for the year ending 31 March 2019:

Sales	Rs. 160 million
Contribution margin	30%
Margin of safety	25%

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Information for the next year ending 31 March 2020:

i. SL is planning to increase its sales by reducing sales prices by 5% and launching a sales campaign at a cost of Rs. 5 million.

ii. Cost efficiency measures planned for the next year are expected to reduce variable cost per unit by 10%.

iii. Inflation impact on all costs would be 8%, except depreciation. At present, depreciation is 40% of the total fixed cost.

iv. Margin of safety would be maintained at 25%.

a) A budgeted statement of profit or loss for the year ending 31 March 2020 based on the above projections, would be as follows:

Budgeted statement of profit or loss for the year ending 31 March 2020		
		Rs. in million
Sales	152**(W-2)**÷43.14×56.97	200.73
Variable cost	Balancing	(143.76)
Contribution margin (CM) (at a safety margin of 25% and fixed cost of Rs. 42.73 million) [42.73**(W-1)**÷0.75]		**56.97**
Fixed cost	**(W-1)**	(42.73)
Net profit		**14.24**
W-1: Fixed Cost		
- For 2019	(160×0.3×0.75)	36.00
- For 2020:		
Depreciation	(36×0.4)	14.40
Other fixed cost	(36-14.40)×1.08+5	28.33
		42.73
W-2: CM on revision of sales price and variable cost		**Rs. in million**
Sales	(160×0.95)	152.00
Variable cost	(160×0.7)×1.08×0.9	(108.86)
Contribution margin		**43.14**

b) The percentage increase in sales volume would be

Increase in sales volume %:		
Budgeted sales of 2019-20 at 2018-19 prices	(200.73÷0.95)	211.29
Increase in sales volume (%)	(211.29–160)÷160	**32.06%**

▶ *Example 05:*

Digital Industries Limited (DIL) incurred a loss for the year ended 30 June 2017 as it could achieve sales amounting to Rs. 89.6 million which was 80% of the break-even sales. Contribution margin on the sales was 25%. Variable costs comprised of 45% direct material, 35% direct labor and 20% overheads.

During a discussion on the situation, the Marketing Director was of the view that no increase in sales price was possible due to severe competition. However, sales volume can be increased by reducing prices. The Production Director was of the view that since the plant is quiet old, the production capacity cannot be increased beyond the current level of 70%.

Accordingly, the management has developed the following plan:

A new plant would be installed whose capacity would be 20% more than installed capacity of the existing plant. The cost and useful life of the plant is estimated at Rs. 30 million and 10 years respectively. The funds for the new plant would be arranged through a long-term bank loan at a cost of 10% per annum. Capacity utilization of 85% is planned for the first year of the operation.

The new plant would eliminate existing material wastage which is 5% of the input and reduce direct labor hours by 8%.

The existing plant was installed fifteen years ago at a cost of Rs. 27 million. It has a remaining useful life of three years and would be traded in for Rs. 2 million.

DIL depreciates its fixed assets on straight line basis over their estimated useful lives.

To sell the entire production, selling price would be reduced by 2%.

Material would be purchased in bulk quantity which would reduce direct material cost by 10%.

Direct wages would be increased by 8% which would increase production efficiency by 10%.

Impact of inflation on overheads would be 4%.

In order to calculate the projected sales for the next year and the margin of safety percentage after incorporating the effect of the above measures, please see below:

Digital Industries Limited

Projected sales and margin of safety % for the next year

		Rs. in million
Projected sales for the next year	(89.6÷0.7)×1.2×0.85×0.98 **(A)**	127.95
Margin of safety % to projected sales	(A-B)÷A×100	8.66%
Break-even sales	**[A÷ (A-C) × D] (B)**	**116.87**
Variable cost:		
Variable cost – 2017 level of 75%	[127.95**(A)**÷0.98]×0.75	97.92
Variable cost on incorporating impact of changes:		
Direct material	(97.92×0.45)×0.95×0.9	37.67
Direct labor	(97.92×0.35)×0.92×0.9×1.08	30.65
Overheads	(97.92×0.20)×1.04	20.37
Variable cost – projected	**(C)**	**88.69**
Fixed cost - projected:		
Fixed cost – 2017 (equal to CM for break-even sales)	(89.6÷0.8) ×0.25	28.00
Depreciation - old plant	27÷(15+3)	(1.50)
		26.50
Impact of 4% inflation	26.5×4%	1.06
Depreciation - new plant	30÷10	3.00
Long-term loan interest at 10%	(30-2) ×10%	2.80
Loss on Disposal (4.5-2)		2.50
	(D)	**35.86**

► *Example 06:*

Washington Limited (WL) is a listed company having paid-up capital of Rs. 140 million. WL deals in the manufacturing of washing machines. Following are the extracts from the budgeted statement of profit or loss for the year ending 31 December 2018:

	Rs. in '000
Sales revenue (Rs. 10,000 per unit)	168,000
Cost of goods sold (including fixed cost of Rs. 21.2 million)	(127,000)
Gross profit	41,000
Operating expenses (including fixed cost of Rs. 4.5 million)	(16,000)
Profit before taxation	25,000
Taxation @ 30%	(7,500)
Profit after taxation	17,500

Additional information:

i. An analysis of actual results for the first two months of the year 2018 shows that:

- Due to change in import duty structure, imported products have become available in the market at much cheaper prices. Consequently, it was decided to reduce the selling price to Rs. 9,500 per unit with effect from 1 January 2018.
- 1,500 washing machines were sold during the period.
- Due to increase in raw material prices with effect from 1 January 2018, variable cost of sales has increased by 5%.

ii. To boost the sales, WL has decided to launch a promotion campaign at an estimated cost of Rs. 5 million.

iii. The directors of WL wish to pay 5% dividend to its ordinary shareholders. However, according to the agreement with the bank, WL cannot pay dividend exceeding 80% of its profit after taxation.

The minimum number of units to be sold in remaining 10 months to enable WL to pay the desired dividend can be calculated as follows:

Washington Limited		Rupees
Dividend needs to pay	140,000,000×5%	7,000,000
Profit after tax (required)	(7,000,000÷0.8)	8,750,000
Required contribution margin in remaining 10 months		
Profit before tax (required)	8,750,000 /70%	12,500,000
Add: Fixed cost (Jan - Dec)	(21,200,000+4,500,000)	25,700,000
Add: Promotion campaign	***Given***	5,000,000
Contribution margin required		43,200,000
Contribution margin recovered in 1st two months	**(W-1)**	(3,304,464)
Required contribution in remaining 10 months		39,895,536

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		Rupees
Forecasted sales revenue to earn in next 10 months	39,895,536/23.19%**(W-1)**	172,037,670
Number of units to be sold	172,037,670/9,500	18,109
W-1: Actual results of first two months of 2018		
Sales	1,500×9,500	14,250,000.00
Variable manufacturing cost	(127,000,000–21,200,000)/ *16,800×1.05×1,500	9,918,750.00
Variable operating cost	(16,000,000–4,500,000)/16,800×1,500	1,026,785.71
Contribution margin		**3,304,464.29**
Contribution margin %		**23.19%**
***Budgeted number of units to be sold**	168,000,000/10,000	16,800

- *Example 07:*

Basketball (Private) Limited (BPL) is in the process of planning for the next year. BPL is currently operating at 70% of the production capacity. The management wants to achieve an increase of Rs. 36 million in profit after tax of the latest year.

The summarized statement of profit or loss for the latest year is as follows:

	Rs. in million
Sales	567
Cost of sales (60% variable)	(400)
Gross profit	167
Operating expenses (40% variable)	(47)
Profit before tax	120
Tax (25%)	(30)
Profit after tax	90

Following are the major assumptions/projections for the next year's budget:

i. Selling price of all products would be increased by 8%. However, to avoid any adverse impact of price increase, 10% discount would be offered to the large customers who purchase about 30% of the total sales. Additionally, distributor commission would be increased from 2% to 3% of net selling price.

ii. Average variable costs other than distributor commission are projected to increase by 4% while fixed costs other than depreciation are projected to increase by 5%.

iii. Depreciation for the latest year was Rs. 90 million and would remain constant.

The amount of sales required to achieve the target profit and well as the production capacity that would be utilized to achieve the calculated amount of sales would require following working:

Basketball Private Limited	***Rs. in million***
Budgeted sales to achieve target profit [361.11m **(W-1)**/53.7%**(W-2)**]	**672.46**

W-1: Contribution margin required in next year		
Total existing fixed cost including depreciation (400m×40%)+(47m×60%)		188.20
Add: Increase in fixed costs in next year	(188.2m–90m)×5%	4.91
Add: Target profit for the next year	(90m+36m)÷75%	168.00
Total contribution margin required in next year		**361.11**
W-2: Budgeted Contribution margin (next year)		
Budgeted sales	[567m×1.08]	612.36
Less: Discount @ 10% on 30% of sales	[612.36m×10%×30%]	(18.37)
Net average sales		593.99
Less: Distributor commission on net average sales	[593.99m×3%]	(17.82)
Less: Variable cost	[247.46m **(W-3)**×1.04]	(257.36)
Budgeted contribution margin		**318.81**
Budgeted contribution margin ratio	(318.81m/593.99m)	**53.7%**
W-3: Variable cost (existing)		
Distributor commission	(567m×2%)	11.34
Variable cost	[{(400m×60%)+(47m×40%)} –11.34m]	247.46
Average increase in selling price (1.08×30%×90%)+(1.08×70%) **OR** [1.08–(1.08×10%×30%)]	**A**	1.0476
Capacity to be utilized during next year [(672.46m (part a)÷**A**) ÷ (567m÷70%)]		79.25%

► *Example 08:*

Solvent Limited has two divisions each of which makes a different product. The budgeted data for the next year is as under:

	Product A	**Product B**
	Rupees	
Sales	200,000,000	150,000,000
Direct material	45,000,000	30,000,000
Direct labor	60,000,000	45,000,000
Factory overheads	35,000,000	15,000,000
Price per unit	20	25

Details of factory overheads are as follows:

i. Product A is stored in a rented warehouse whose rent is Rs. 0.25 million per month. Product B is required to be stored under special conditions. It is stored in a third party warehouse and the company has to pay rent on the basis of space utilized (varies in accordance with the production in units). The rent has been budgeted at Rs. 0.12 million per month.

ii. Indirect labor has been budgeted at 20% of direct labor. 70% of the indirect labor is fixed.

iii. Depreciation for assets pertaining to product A and B is Rs. 6.0 million and Rs. 2.0 million respectively.

iv. 80% of the cost of electricity and fuel varies in accordance with the production in units and the total cost has been budgeted at Rs. 4.0 million.

v. All other overheads are fixed.

The break-even sales assuming that the ratio of quantities sold would remain the same, as has been budgeted above would be calculated as follows:

Solvent Limited	**Product A**	**Product B**	**Total**
Sale – units	10,000,000	6,000,000	16,000,000
Sales price per unit	20	25	
Sales in Rupees	200,000,000	150,000,000	350,000,000

Less: Variable costs	**Product A**	**Product B**	**Total**
Direct material	45,000,000	30,000,000	-
Direct labor	60,000,000	45,000,000	-
Variable overheads (Note 1)	5,600,000	5,340,000	-
	110,600,000	80,340,000	190,940,000
Contribution margin Rs.	89,400,000	69,660,000	159,060,000
Contribution margin % to sales			45.446%
Break even sales revenue:			
Total 39,060,000/0.45446			85,948,699

Budgeted sales ratio	**Revenue (Rs.)**	**Ratio**	
Product A revenue	200,000,000	4	
Product B revenue	150,000,000	3	
Total revenue	350,000,000	7	
Revenue from A at breakeven 85,948,699 × 4/7	49,113,542		
Revenue from B at breakeven 85,948,699 × 3/7		36,835,157	
Sales price per unit	÷20	÷25	
Quantity of A: 49,113,542/20	2,455,677		
Quantity of A: 36,835,157/25		1,473,406	
Note 1: Variable & fixed overheads:			
Total overheads as given	35,000,000	15,000,000	50,000,000
Variable overheads:			
- Rent based on space utilized			
120,000 * 12	-	1,440,000	-
- Indirect labor			
60,000,000*20%*30%	3,600,000		

Budgeted sales ratio	Revenue (Rs.)	Ratio	
45,000,000*20%*30%		2,700,000	-
- Electricity & fuel			
(4,000,000*80%)/16,000,000*10,000,000	2,000,000	-	-
(4,000,000*80%)/16,000,000*6,000,000	-	1,200,000	-
Variable overheads	(5,600,000)	(5,340,000)	(10,940,000)
Fixed costs (Total overheads-Variable overheads)	29,400,000	9,660,000	39,060,000

- *Example 09:*

KPK Dairies Limited (KDL) is planning to introduce three energy flavored milk from 1 July 2015. In this respect, following projections have been made:

		C-Plus	I-Plus	V-Plus
Planned production	(No. of packets)	540,000	275,000	185,000
Sales	(No. of packets)	425,000	255,000	170,000
Production cost per packet:		---------- Rupees ----------		
Direct material		100	98	97
Direct labor		15	13	12
Variable overheads		23	19	16
Fixed overheads		25	22	20
Selling and distribution cost per packet:				
Variable overheads		12	8	10
Fixed overheads		5	5	5
Total cost per packet		**180**	**165**	**160**

KDL will sell its products through a distributor at a commission of 5% of sale price and expects to earn a contribution margin of 40% of net sales i.e. sales minus distributor's commission.

Computation for breakeven sales in packets and rupees, assuming that ratio of quantities sold would be as per projections would require:

KPK Dairies Limited						
Break-even sales:			**C-Plus**	**I-Plus**	**V-Plus**	**Total**
- In total	– No. of packets(H÷G)	**A**				287,660
- Product wise	– No. of packets (A×C)	**B**	143,830	86,298	57,532	287,660
- Product wise	– Rupees (B×D)		37,850,303	20,893,609	13,625,879	72,369,791
W.1: Sales quantity ratio			-------------------------Liters-------------------------			
Projected sales			425,000	255,000	170,000	850,000
Sales quantity ratio		**C**	0.5	0.3	0.2	1.0

W.2: Contribution margin per combination:		------------------------ Rupees ------------------------		
Gross sales price per unit (E÷0.57*) **D**	263.16	242.11	236.84	
Commission at 5% of sales	(13.16)	(12.11)	(11.84)	
Variable cost per unit **E**	(150.00) (100+15 +23+12)	(138.00) (98+13+ 19+8)	(135.00) (97+12+ 16+10)	
Contribution margin (CM) per unit **F**	100.00	92.00	90.00	
CM in sales quantity ratio(C×F) **G**	50.00	27.60	18.00	**95.60**
VC% to sales: (100-5%) × 60% = 57%*				

W-3: Fixed overheads				
Production fixed overheads	13,500,000 (540,000×25)	6,050,000 (275,000×22)	3,700,000 (185,000×20)	23,250,000
Selling and distribution fixed overheads	2,125,000 (425,000×5)	1,275,000 (255,000×5)	850,000 (170,000×5)	4,250,000
H				**27,500,000**

▶ *Example 10:*

Khan Limited (KL) imports and sells a product 'AA'. KL is faced with a situation where lead time is mostly predictable i.e. 1 month but lead time usage varies quite significantly. Data collected for past three years shows that probability for lead time usage is as follows:

No. of units demanded during lead time	Probability of demand during lead time (%)
1,000	30
660	50
450	20

Other relevant information is as follows:

i. Annual demand is 8,640 units.

ii. Contribution margin is Rs. 40 per unit.

iii. Purchase orders are raised on the basis of economic order quantity model. Annual

iv. holding cost is Rs. 100 per unit whereas average cost of placing an order is Rs. 6,750.

Following re-order levels are to be evaluated where KL's profit would be maximized:

- 1,000 units
- 450 units

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Also expected demand during lead time can be determined as follows

Reorder level (Units)	Demand level (Units)	Stock out per order (Units)	Stock out per year (Units)	Stock out cost (Rs.)	Average inventory (Units)	Holding cost (Rs.)	Probability	Expected total cost (Rs.)
a	b	c	d= c× 8(W-2)	e=d×40	g=[a-b+ EOQ (W-1)]/2	h=g×100	i	j=(h+e)×i
1,000	1,000	-	-	-	540	54,000	30%	16,200
	660	-	-	-	880	88,000	50%	44,000
	450	-	-	-	1,090	109,000	20%	21,800
								82,000
450	1,000	550	4,400	176,000	540	54,000	30%	69,000
	660	210	1,680	67,200	540	54,000	50%	60,600
	450	-	-	-	540	54,000	20%	10,800
								140,400
720 **(W-3)**	1,000	280	2,240	89,600	540	54,000	30%	43,080
	660	-	-	-	600	60,000	50%	30,000
	450	-	-	-	810	81,000	20%	16,200
								89,280

Conclusion: Profit would be maximized at re-order level of 1,000 units.

	Rupees
W-1: EOQ (Units) = SQRT[2×8,640×6,750)/100]	1,080.00
W-2: No. of orders (8,640/1,080)	8.00
W-3: Expected value (1,000×30%)+(660×50%)+(450×20%)	720.00

STICKY NOTES

Cost-volume-profit analysis is used to how changes in costs and profits with the change in volume activity.

Contribution is measured as sales revenue less variable costs. And profit is measured as contribution minus fixed costs.

Breakeven point is the point where total contribution is exactly equal to total fixed cost. It is calculated by dividing total fixed costs with contribution per unit.

Margin of safety is the difference between budgeted sales and the break-even amount of sales. It is usually expressed as a percentage of the budgeted sales.

If the target profit is known, then the volume of sales desired to achieve the target profit can be calculated using the formula as below:
Volume target (units) = (Total fixed costs + target profit)/contribution per unit

Breakeven chart is a visual representation showing all volumes of output and sales with their total costs, sales, profits and break-even points.

CHAPTER 15

DECISION MAKING TECHNIQUES

IN THIS CHAPTER

AT A GLANCE

Management are often required to make decisions where company is at stake. These decisions are required to make where factors or sources are limited, Concepts of relevant costing and cost-volume-profit analysis are used for such decisions.

One-off contract decisions, special pricing decisions, make or buy decisions and many other short term decisions including join product, discontinuation of operations, replacement of equipment or plant and further processing decisions, are some of the decision making areas that may need management's attention.

1. INTRODUCTION TO DECISION MAKING

1.1 Types of decision

Relevant costs can be applied to both short-term and long-term decisions.

- Short-term decisions are decisions where the financial consequences occur soon after the decision is taken. For example, a short-term decision may result in an immediate increase in profit (additional net cash inflows), or an increase in annual profits and cash flows.
- A long-term decision is one where a capital investment may be required and the benefits of the investment will be obtained over a period of several years.

The concept of relevant costs is the same for both short-term and long-term decisions, except that for long-term decisions the time value of money should also be taken into consideration.

Examples of management decisions where relevant costing is used are:

- Limiting factor decisions
- One-off contract decisions: management might want to decide whether or not to undertake a contract for a specified fixed price. If it is a one-off contract, rather than regular production work, it would be worthwhile undertaking the contract if the extra revenue from the contract is higher than the relevant costs of doing the work (including any opportunity costs).
- Make-or-buy decisions
- Shutdown decisions
- Joint product further processing decisions.

1.2 Marginal costing and decision-making

It is often assumed that marginal costs are relevant costs for the purpose of decision-making.

- The marginal cost of a product is the extra cost that would be incurred by making and selling one extra unit of the product.
- Similarly, the marginal cost of an extra hour of direct labor work is the additional cost that would be incurred if a direct labor employee worked one extra hour. When direct labor is a variable cost, paid by the hour, the marginal cost is the variable cost of the direct labor wages plus any variable overhead cost related to direct labor hours.

This chapter focuses on decision-making when there are limiting factors that restrict operational capabilities. Decision-making techniques for limiting factor situations are based on the following assumptions:

- The objective is to maximize profit and this is achieved by maximizing contribution;
- Marginal costs (variable costs) are the only relevant costs to consider in the model: and

Fixed costs will be the same whatever decision is taken; therefore, fixed costs are not relevant to the decision.

1.3 Incremental cost analysis

Incremental analysis helps companies decide whether or not to accept a special order. This special order is typically lower than its normal selling price. Incremental analysis also assists with allocating limited resources to several product lines to ensure a scarce asset is used to maximum benefit.

► *Example 01:*

A company sells an item for Rs. 500,000. The company pays Rs. 200,000 for labor, Rs. 100,000 for materials and Rs. 50,000 for variable overhead selling expenses. The company allocates Rs. 50,000 per item for fixed overhead costs.

The company is not operating at capacity and will not be required to invest in equipment or overtime to accept a special order it receives. Then, a special order requests the purchase of 20 items for Rs. 400,000 each.

The sum of all variable costs and fixed costs per item is Rs. 400,000. However, the Rs. 50,000 of allocated fixed overhead costs are a sunk cost as already spent. The company has excess capacity and should only consider the relevant costs. Therefore, the cost to produce the special order is Rs. 350,000 per item (Rs. 200,000 + Rs. 100,000 + Rs. 50,000) and the profit per item is Rs. 50,000 (Rs. 400,000 – Rs. 350,000).

While the company is still able to make a profit on this special order, the company must consider the consequences of operating at full capacity. If no excess capacity is present, additional expenses to consider include investment in new fixed assets, overtime labor costs, and the opportunity cost of lost sales.

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2. LIMITING FACTOR DECISIONS

2.1 Limiting factor: the issue

It is often assumed in budgeting that a company can produce as many units of its products (or services) as is necessary to meet the available sales demand. Sales demand is therefore normally the factor that sets a limit on the volume of production and sales in each period.

Sometimes, however, there could be a shortage of a key production resource, such as an item of direct materials, or skilled labor, or machine capacity. In these circumstances, the factor setting a limit to the volume of sales and profit in a particular period is the availability of the scarce resource, because sales are restricted by the amount that the company can produce.

If the company makes just one product and a production resource is in limited supply, profit is maximized by making as many units of the product as possible with the limited resources available.

However, when a company makes and sells more than one products with the same scarce resource, a budgeting problem is to decide how many of each different product to make and sell in order to maximize profits.

2.2 Identifying limiting factors

A question might tell you that there is a restricted supply of a resource without telling you which one it is.

In this case you must identify the limiting factor by calculating the budgeted availability of each resource and the amount of the resource that is needed to meet the available sales demand.

- *Example 02:*

A company manufactures and sells two products, Product X and Product Y which are both manufactured using two different machines.

The time taken to make each product together with the maximum machine time availability and contribution per unit and demands are as follows:

Product	X	Y	Hours available
Machine type 1	10 minutes per unit (6 per hour)	6 minutes per unit (10 per hour)	3,000 hours
Machine type 2	5 minutes per unit (12 per hour)	12 minutes per unit (5 per hour)	4,200 hours
Sales demand in units	12,000	15,000	

Which machine is the limiting factor is identified by calculating the time needed to meet the total demands for both goods and comparing that to the machine time available:

	Machine type 1 (hours)	Machine type 2 (hours)
12,000 ÷ 6 per hour	2,000	
12,000 ÷ 12 per hour		1,000
Making 15,000 units of Y would use:		
15,000 ÷ 10 per hour	1,500	
15,000 ÷ 5 per hour		3,000
Total hours needed to meet maximum demand	3,500	4,000
Total hours available	3,000	4,200
Therefore, machine 1 time is the limiting factor		

2.3 Maximizing profit when there is a single limiting factor

When there is just one limiting factor (other than sales demand), total profit will be maximized in a period by maximizing the total contribution earned with the available scarce resources.

The approach is to select products for manufacture and sale according to the contribution per unit of scarce resource in that product.

Step 1: Calculate the contribution per unit of each type of good produced.

Step 2: Identify the scarce resource.

Step 3: Calculate the amount of scarce resource used by each type of good produced.

Step 4: Divide the contribution earned by each good by the scarce resource used by that good to give the contribution per unit of scarce resource for that good.

Step 5: Rank the goods in order of the contribution per unit of scarce resource.

Step 6: Construct a production plan based on this ranking. The planned output and sales are decided by working down through the priority list until all the units of the limiting factor (scarce resource) have been used.

- *Example 03:*

A company manufactures and sells two products, Product X and Product Y which are both manufactured using two different machines.

The time taken to make each product together with the maximum machine time availability and contribution per unit and demands are as follows:

Product	X	Y	Hours available
Machine type 1	10 minutes per unit (6 per hour)	6 minutes per unit (10 per hour)	3,000 hours
Machine type 2	5 minutes per unit (12 per hour)	12 minutes per unit (5 per hour)	4,200 hours
Contribution per unit	Rs. 7	Rs. 5	
Sales demand in units	12,000	15,000	

Given that machine 1 is a limiting factor the optimal production plan (that which maximizes annual contribution and hence profit) can be found as follows:

Step 1: Calculate the contribution per unit of goods produced (given)

Step 2: Identify scarce resource (given as machine 1 in this case)

Step 3: Calculate the amount of scarce resource used to make each type of product (given in this case)

Step 4: Contribution per unit of scarce resource (machine time)

Product	X	Y
Contribution per unit	Rs. 7	Rs. 5
Machine type 1 time per unit	10 minutes	6 minutes
Contribution per hour (Machine type 1)	Rs. 42	Rs. 50
Step 5: Ranking	2nd	1st

The products should be made and sold in the order Y and then X, up to the total sales demand for each product and until the available machine 1 time is used completely.

Step 6: Construct a production plan to maximize contribution

Product	Sales units	Machine 1 hours used	Contribution per unit (Rs.)	Total contribution (Rs.)
Y (1st)	15,000 (maximum)	1,500	5	75,000
X (2nd)	9,000	1,500 (balance)	7	63,000
		3,000		138,000

Note: The plan is constructed as follows:

Y is ranked first so the company needs to make as many of these as possible. The most it can sell is 15,000 units which would take 1,500 hours (10 per hour) to make. The company has 3,000 hours available so all of these can be made.

The company now has 1,500 hours left. X is ranked second and the most of X that can be sold is 12,000 units. This would use 2,000 hours (6 per hour). This means that only 9,000 units of X can be made (found as 1,500 units at 6 per hour or 12,000 units × $^{1,500\text{ hours}}/_{2,000\text{ hours}}$).

- *Example 04:*

A company makes four products, A, B, C and D, using the same direct labor work force on all the products.

The company has no inventory of finished goods.

Direct labor is paid Rs. 12 per hour.

To meet the sales demand in full would require 12,000 hours of direct labor time.

Only 6,000 direct labor hours are available during the year.

Budgeted data for the company is as follows:

Product	A	B	C	D
Annual sales demand (units)	4,000	5,000	8,000	4,000
	Rs.	Rs.	Rs.	Rs.
Direct materials cost	3.0	6.0	5.0	6.0
Direct labor cost	6.0	12.0	3.0	9.0
Variable overhead	2.0	4.0	1.0	3.0
Fixed overhead	3.0	6.0	2.0	4.0
Full cost	14.0	28.0	11.0	22.0
Sales price	15.5	29.0	11.5	27.0
Profit per unit	1.5	1.0	0.5	5.0

The optimal production plan would be calculated as follows:

Step 1: Calculate the contribution per unit of goods produced

Product	A	B	C	D
Sales price	15.5	29.0	11.5	27.0
Direct materials cost	3.0	6.0	5.0	6.0
Direct labor cost	6.0	12.0	3.0	9.0
Variable overhead	2.0	4.0	1.0	3.0
Variable cost per unit	(11.0)	(22.0)	(9.0)	(18.0)
Contribution per unit	4.5	7.0	2.5	9.0

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Product	A	B	C	D
Step 2: Identify scarce resource (given as labor in this case)				
Step 3: Labor hours per unit				
($^{\text{total labor cost}}/_{\text{labor cost per hour}}$)	$^{6}/_{12}$	$^{12}/_{12}$	$^{3}/_{12}$	$^{9}/_{12}$
	0.5	1	0.25	0.75
Step 4: Contribution per hour				
($^{\text{contribution per unit}}/_{\text{labor hours per unit}}$	$^{4.5}/_{0.5}$	$^{7}/_{1}$	$^{2.5}/_{0.25}$	$^{9}/_{0.75}$
Contribution per hour (Rs.)	9	7	10	12
Step 5: Ranking	3rd	4th	2nd	1st
The products should be made and sold in the order D, C, A and then B, up to the total sales demand for each product and until all the available direct labor hours (limiting factor resources) are used up				
Step 6: Construct a production plan to maximize contribution				

Product	Sales units	Direct labor hours used	Contribution per unit	Total contribution
			Rs.	**Rs.**
D (1st)	4,000 (maximum)	3,000	9.0	36,000
C (2nd)	8,000 (maximum)	2,000	2.5	20,000
A (3rd)	2,000 (balance)	1,000	4.5	9,000
		6,000		65,000

Note: The plan is constructed as follows:

D is ranked first so the company needs to make as many of these as possible. The most it can sell is 4,000 units which would take 3,000 hours (0.75 hours per unit) to make. The company has 6,000 hours available so all of these can be made.

The company now has 3,000 hours left. C is ranked second and the most of C that can be sold is 8,000 units. This would use 2,000 hours (0.25 hours per unit).

The company now has 1,000 hours left. A is ranked third and the most of these that can be sold is 4,000 units. However, this would use 2,000 hours (0.5 hours per unit) so only half of these can be made.

- *Example 05:*

A company makes four products, W, X, Y and Z, using the same single item of direct material in the manufacture of all the products. Budgeted data for the company is as follows:

Product	W	X	Y	Z
Annual sales demand (units)	4,000	4,000	6,000	3,000
	Rs.	**Rs.**	**Rs.**	**Rs.**
Direct materials cost	5.0	4.0	8.00	6.00
Direct labor cost	4.0	6.0	3.00	5.00
Variable overhead	1.0	1.5	0.75	1.25
Fixed overhead	8.0	12.0	6.00	10.00
Full cost	18.0	23.5	17.75	22.25
Sales price	50.0	31.5	59.75	54.25
Profit per unit	32.0	8.0	42.00	32.00

Due to restricted supply, only Rs. 78,000 of direct materials will be available during the year. And it required to identify the quantities of production and sales of each product that would maximize annual profit, please see below

This question does not tell you the amount of material but it does give you its value. The analysis can proceed in the usual way using contribution per value of material rather than contribution per amount of material.

	W	X	Y	Z
	Rs.	Rs.	Rs.	Rs.
Sales price/unit	50.0	31.5	59.75	54.25
Variable cost/unit	10.0	11.5	11.75	12.25
Contribution per unit	40.0	20.0	48.00	42.00
Direct materials per unit (Rs.)	5	4	8	6
Rs. contribution per Rs.1 direct material	8.0	5.0	6.0	7.0
Priority for making and selling	1st	4th	3rd	2nd

Profit-maximising budget

Product	Sales units	Direct materials (Rs.)	Contribution per unit (Rs.)	Total contribution (Rs.)
W (1st)	4,000	20,000	40	160,000
Z (2nd)	3,000	18,000	42	126,000
Y (3rd) - balance	5,000	40,000	48	240,000
		78,000		526,000

► *Example 06:*

a) Company X manufactures four liquids: A, B, C and D. The selling price and unit cost details for these products are as follows:

	Liquid A	Liquid B	Liquid C	Liquid D
	Rs. per litre	Rs. per litre	Rs. per litre	Rs. per litre
Selling price	100	110	120	120
Costs:				
Direct materials	24	30	16	21
Direct labor (Rs.6/hour)	18	15	24	27
Direct expenses	0	0	3	0
Variable overhead	12	10	16	18
Fixed overhead (note 1)	24	20	32	36
Total cost per litre	78	75	91	102
Profit per litre	22	35	29	18

Note 1

Fixed overhead is absorbed on the basis of labor hours, based on a budget of 1,600 hours per quarter (three months).

During the next three months the number of direct labor hours is expected to be limited to 1,345 hours. The same labor is used for all products.

The marketing director has identified the maximum demand for each of the four products during the next three months as follows:

Liquid A	200 liters
Liquid B	150 liters
Liquid C	100 liters
Liquid D	120 liters

No inventories are held at the beginning of the period that could be used to satisfy demand in the period.

If the company requires to determine the number of liters of liquids A, B, C and D to be produced and sold in the next three months in order to maximize profits and calculate the profit that this would yield; working is given below:

	A	B	C	D
	Rs.	Rs.	Rs.	Rs.
Sales price	100	110	120	120
Variable cost per litre	54	55	59	66
Contribution per litre	46	55	61	54
Direct labor hours/unit	3	2.5	4	4.5
Contribution /direct labor hour (Rs.)	15.33	22.00	15.25	12.00
Priority for manufacture/sale	2nd	1st	3rd	4th

The fixed overhead absorption rate is Rs.8 per hour. This can be calculated from the overhead cost and direct labor hours for any of the four products.

The budgeted labor hours for calculating this absorption rate was 1,600 hours, therefore budgeted fixed costs are 1,600 hours × Rs.8 = Rs.12,800.

The output and sales that will maximize contribution and profit is as follows:

Product	Litres	Hours	Contribution /litre (Rs.)	Contribution /profit (Rs.)
B1	150.0	375	55	8,250.0
A	200.0	600	46	9,200.0
C (balance)	92.5	370	61	5,642.5
		1,345		23,092.5
Fixed costs (see above)				12,800.0
Profit				10,292.5

b) Suppose that a contract has been made before the beginning of the period by Company X and one of its customers, Company Y. Company X has agreed to supply Company Y with supply of 20 liters of each A, B, C and D during the three-month period.

This sales demand from Company Y is included in the demand levels shown above in part (a) of the question.

For the above scenario please see below working for following requirements

Given the contract with Company Y, determine the number of liters of liquids A, B, C and D to be produced and sold in the next three months in order to maximize profits, if the maximum number of labor hours remain 1,345 hours for the period.

The profit that this would yield, would be calculated as follows:

In this situation, there is a minimum sales demand from Company Y that must be met:

Product	Litres	Hours	Contribution /litre (Rs.)	Contribution (Rs.)
A: (3 hours/litre)	20	60	46	920
B: (2.5 hours/litre)	20	50	55	1,100
C: (4 hours/litre)	20	80	61	1,220
D: (4.5 hours/litre)	20	90	54	1,080
		280		4,320
Total hours available		1,345		
Hours remaining		1,065		

The remaining 1,065 hours should be used to maximize contribution, using the same priorities as before. However, maximum sales demand should be reduced by 20 liters for each product, to allow for the sales to Company Y.

The output and sales that will maximize contribution and profit, allowing for the sales to Company Y, are as follows:

Product	Litres	Hours	Contribution/ litre	Contribution/ profit
			Rs.	Rs.
B	130	325	55	7,150
A	180	540	46	8,280
C (balance)	50	200	61	3,050
		1,065		18,480
Contribution from sales to Y				4,320
Total contribution				22,800
Fixed costs				12,800
Profit				10,000

- *Example 07:*

A company produces three products using the same raw material. The raw material is in short supply and only 3,000 kilograms shall be available in April 2009, at a cost of Rs. 1,500 per kilogram.

The budgeted costs and other data related to April 2009 are as follows:

	X	Y	Z
Maximum demand (units)	1,000	800	1,200
Selling price per unit (Rs.)	3,750	3,500	4,500
Material used per unit (kg)	1.6	1.2	1.8
Labor hours per unit (Rs. 75 per hour)	12	16	15

The number of units that should be produced by the company to earn maximum profit would be determined as follows:

		X	Y	Z
Selling price	A	3,750	3,500	4,500
Material cost per unit at Rs. 1,500 per kilogram	B	2,400	1,800	2,700
Labor cost per unit at Rs. 75 per hour	C	900	1,200	1,125
Profit per unit (A – B – C)	D	450	500	675
Material usage in kilograms per unit	E	1.6	1.2	1.8
Profit per kg of material used (D ÷ E)	F	281.25	416.67	375.00
Preferred order of manufacture		3	1	2
Maximum demand in units		1,000	800	1,200
Total raw material available – kgs				3,000
Less: consumption for 800 units of Y (800 x 1.2 kgs)				960
Balance available				2,040
Consumption for 1,200 units of Z = (1,200 x 1.8 kgs)			2,160	
Limited to 1,133 units @ 1.8 kg per unit				2,040
Balance				-
Therefore, the production should be as follows:				
Y = 800 units				
Z = 1,133 units				

In addition, the number of units to be produced if finished products are also available from an external supplier at the following prices per unit:

	Rupees
X	3,450
Y	3,100
Z	3,985

It would require following calculations

Product			X	Y	Z
Selling price		A	3,750	3,500	4,500
Cost of purchase		B	3,450	3,100	3,985
Profit per unit from outside purchase	(A – B)	C	300	400	515
Profit from own manufacture *(as calculated in (a) above)*		D	450	500	675
Loss in profit on purchase as compared to own manufacture	(D – C)	E	150	100	160
Material usage in kilograms per unit		F	1.6	1.2	1.8
Loss in profit per kg as compared to own manufacture	(E ÷ F)	G	93.8	83.3	88.9
Preferred order of manufacture			1	3	2
Total raw material available - kgs					3,000
Less: consumption for 1,000 units of X					1,600
Balance available					1,400
Consumption for 1,200 units of Z =					2,160
Limited to 778 units @ 1.8 kg per unit					1,400
Balance					-

3. MAKE OR BUY DECISIONS

3.1 Make-or-buy decisions: outsourcing

A make-or-buy decision is a decision about:

- whether to make an item internally or to buy it from an external supplier, or
- whether to do some work with internal resources, or to contract it out to another organization such as a sub-contractor or an outsourcing organization.

The economic basis for the decision whether to make internally or whether to buy externally (outsource production) should be based on relevant costs. The preferred option **from a financial viewpoint** should be the one that has the lower relevant costs.

A financial assessment of a make-or-buy decision typically involves a comparison of:

- the costs that would be saved if the work is outsourced or sub-contracted, and
- the incremental costs that would be incurred by outsourcing the work.

► *Example 08:*

A company manufactures a component that is included in a final product that it also manufactures. Management have identified an external supplier who would be willing to supply the component.

The variable cost of manufacturing the component internally is Rs.10 and the external supplier would be prepared to supply the components for Rs.13 each. It has been estimated that cash savings on general overhead expenditure will be Rs.48,000 each year if internal production is ended. The company needs 10,000 units of the component each year.

The decision regarding whether the company make or buy the component would require following evaluations

The annual relevant costs and benefits of a decision to buy the components externally can be presented as follows:

	Rs.
Extra costs of purchasing externally (10,000 units × (Rs.13 - Rs.10))	(30,000)
Cash savings in overhead expenditures	48,000
Net benefit from external purchasing (outsourcing) per year	18,000

Conclusion: The company would increase its profit by purchasing externally instead of making the items in-house. The recommendation on financial considerations is therefore to buy (outsource production), not make internally.

► *Example 09:*

Galaxy Engineers (GE) manufactures and sells a wide range of products. One of the raw materials XPI is in short supply and only 80,000 kg are available in GE's stores. Following information pertains to the products in which XPI is used:

		Product A	Product B	Product C
Budgeted local sales/requirement	Units	4,500	1,000	2,500
Committed export sales as per agreement	Units	-	800	-

		---------------- Per unit-----------------		
Sales price	Rs.	20,000	14,100	For internal use
Material XPI (Rs. 500 per kg)	kg	14	12	2
Other material (Rs. 300 per kg)	kg	5	3	1
Direct labor hours (Rs. 100 per hour)	hours	20	15	5
Variable overheads based on labor cost	%	80%	80%	80%
Fixed overheads per direct labor hour	Rs.	95	75	60

Product C is used in other products made by GE. If it could not be produced internally, it has to be purchased from market at Rs. 3,000 per unit.

When required to determine the number of units of each product that should be manufactured, to earn maximum profit, following analysis may be of some assistance.

		Product A	Product B	Product C	Material XPI
		---------- Units----------			kg
Budgeted sales/requirements		**4,500**	**1,800**	**3,000**	
		---------- Rupees ----------			
Sales price per unit		20,000	14,100	**For internal use only**	
Opportunity cost per unit (Purchase price)		-	-	3,000	
Cost of production per unit:					
Material XPI usage at Rs. 500 per kg		(7,000)	(6,000)	(1,000)	
Other material usage at Rs. 300 per kg		(1,500)	(900)	(300)	
Direct labor at Rs. 100 per hour		(2,000)	(1,500)	(500)	
Variable overheads at 80% of labor cost		(1,600)	(1,200)	(400)	
		(12,100)	(9,600)	(2,200)	
CM/savings from own manufacturing	**(A)**	**7,900**	**4,500**	**800**	
Per unit usage of material XPI	**(B) kg**	14	12	2	
CM per one kg of material XPI	**(A)÷(B) Rs.**	564	375	400	
Ranking based on CM per XPI kg		**1st**	**3rd**	**2nd**	
Production from available material XPI:					
Production of committed export sales		-	800	-	9,600
Production in ranking order		4,500	200	2,500	70,400
Optimal production	**Units**	**4,500**	**1,000**	**2,500**	**80,000**

- *Example 10:*

Condaco produces two products with the following costs and revenue per unit:

	Product A	Product B
	Rs.	Rs.
Sales price	20	10
Variable cost	8	6
Fixed cost	4	3
	units	units
Sales demand	2,000	3,000

There are only 7,000 machine hours available, and Product A requires 4 machine hours per unit and Product B requires 1 machine hour per unit

Following calculations to be used when required calculate the profit-maximizing production and sales mix.

Total machine hours required to meet sales demand = (2,000 × 4) + (3,000 × 1) = 11,000. Since only 7,000 hours are available, machine hours are a limiting factor.

	Product A	Product B
	Rs.	Rs.
Sales price	20	10
Variable cost	8	6
Contribution	12	4
Machine hours per unit	4	1
Contribution per hour	Rs.3	Rs.4
Priority for manufacture	2nd	1st

Decision: produce and sell the following products:

Product	Units	Machine hours	Contribution per unit	Total contribution
			Rs.	Rs.
B	3,000	3,000	4	12,000
A (balance)	1,000	4,000	12	12,000
		7,000		24,000

Now assume that all the data is the same, except that we are able to sub-contract the products for an additional variable cost of Rs.1 per unit for A and Rs.0.50 per unit for B. The profit-maximizing decision would be evaluated as follows:

	Product A	Product B
	Rs.	Rs.
Extra cost of external purchase	1	0.50
Machine hours saved by external purchase	4	1
Extra cost per machine hour saved	Rs.0.25	Rs.0.50
Priority for manufacture	1st	2nd

Item	Number of units	Machine hours	Contribution per unit	Contribution
Make			**Rs.**	**Rs.**
A	1,750	7,000	12	21,000
Buy				
A (balance)	250	(12 – 1)	11	2,750
B	3,000	(4 – 0.5)	3.5	10,500
Total contribution				34,250

- *Example 11:*

NK Enterprises produces various components for telecom companies. The demand of these components is increasing. However, NK's production facility is restricted to 50,000 machine hours only. Therefore, NK is considering to buy certain components externally. In this respect, the following information has been gathered:

Description	Components			
	X-1	X-2	X-3	X-4
Estimated demand in units	6,500	2,000	7,100	4,500
Machine hours required per unit	8	4	5	2
In-house cost per unit:	------------ **Rupees** ------------			
Direct material	20.0	28.0	23.0	22.0
Direct labor	9.0	5.0	9.0	8.0
Factory overheads	16.0	8.0	8.5	5.0
Allocated administrative overheads	5.0	4.0	3.0	2.0
	50.0	45.0	43.5	37.0
External price of the component per unit	35.0	40	34.0	33.0

Factory overheads include fixed overheads estimated at Rs. 1.50 per machine hour.

The number of units to be produced in-house and bought externally, would be determined as follows:

		X-1	X-2	X-3	X-4
Demand in units	**(A)**	6,500	2,000	7,100	4,500
Machine hours per unit	**(B)**	8	4	5	2
		----------------- **Rupees** -----------------			
In-house cost		50.00	45.00	43.50	37.00

		X-1	X-2	X-3	X-4
Irrelevant cost for decision making					
- Fixed overheads	1.5×B	(12.00)	(6.00)	(7.50)	(3.00)
- Allocated administrative overheads		(5.00)	(4.00)	(3.00)	(2.00)
Relevant production cost	**(C)**	**33.00**	**35.00**	**33.00**	**32.00**
Per unit cost of buying externally	**(D)**	**35.00**	**40.00**	**34.00**	**33.00**

		X-1	X-2	X-3	X-4
Incremental cost in case of external buying:					
- Per unit	(C-D) **(E)**	2.00	5.00	1.00	1.00
- Per machine hour	(E÷B)	0.25	1.25	0.20	0.50
Ranking for **in-house production**		**3rd.**	**1st.**	**4th.**	**2nd.**
No. of units for in-house production:					
*[50,000–(2,000×4) – (4,500×2)]/8 **(F)**		***4,125**	**2,000**	**-**	**4,500**
No. of units to be bought externally	**A-F**	**2,375**	**-**	**7,100**	**-**

3.2 Make-or-buy decisions: non-financial considerations

When relevant costs are used to make a decision, it is assumed that the decision should be based on financial considerations and whether the decision will add to profit (cash flows).

In reality, however, managers are likely to think about non-financial issues as well as financial issues when making their decisions. The non-financial considerations in any decision will depend on the circumstances, and will vary from one decision to another. Non-financial considerations can influence a decision. In your examination, be prepared to identify relevant non-financial issues in a particular situation, and discuss their potential implications.

Non-financial considerations that will often be relevant to a make-or-buy decision include the following.

- When work is outsourced, the entity loses some control over the work. It will rely on the external supplier to produce and supply the outsourced items. There may be some risk that the external supplier will:
  - produce the outsourced items to a lower standard of quality, or
  - fail to meet delivery dates on schedule, so that production of the end-product may be held up by a lack of components.
- The entity will also lose some flexibility. If it needs to increase or reduce supply of the outsourced item at short notice, it may be unable to do so because of the terms of the agreement with the external supplier. For example, the terms of the agreement may provide for the supply of a fixed quantity of the outsourced item each month.
- A decision to outsource work may have implications for employment within the entity, and it may be necessary to make some employees redundant. This will have cost implications, and could also adversely affect relations between management and other employees.
- It might be appropriate to think about the longer-term consequences of a decision to outsource work. What might happen if the entity changes its mind at some time in the future and decides either (a) to bring the work back in-house or (b) to give the work to a different external supplier? The problem might be that taking the work from the initial external provider and placing it somewhere else might not be easy in practice, since the external supplier might not be co-operative in helping with the removal of its work.
- The company cannot hope to maintain any competitive advantage from the work of the external supplier, since the competitors can hire the same supplier.

The non-financial factors listed above are all reasons against outsourcing work. There might also be non-financial **benefits** from outsourcing work to an external supplier.

- If the work that is outsourced is not specialized, or is outside the entity's main area of expertise, outsourcing work will enable management to focus their efforts on those aspects of operations that the entity does best. For example, it could be argued that activities such as the management of an entity's fleet of delivery vehicles, or the monthly payroll work, should be outsourced because the entity itself has no special expertise on these areas.
- The external supplier, on the other hand, may have specialist expertise which enables it to provide the outsourced products or services more efficiently and effectively. For example a company might outsource all its IT support operations, because it cannot recruit and retain IT specialists. An external service provider, on the other hand, will employ IT specialists.

3.3 Make-or-buy decisions with scarce resources

A different situation arises when an entity is operating at full capacity, and has the opportunity to outsource some production in order to overcome the restrictions on its output and sales. For example, a company might have a restriction, at least in the short-term, on machine capacity or on the availability of skilled labor. It can seek to overcome this problem by outsourcing some work to an external supplier who makes similar products and which has some spare machine time or labor capacity.

In this type of situation, a relevant costing approach is to assume that the entity will:

- seek to maximize its profits, and therefore
- outsource some of the work, provided that profits will be increased as a consequence.

The decision is about which items to outsource, and which to retain in-house. The profit-maximizing decision is to outsource those items where the costs of outsourcing will be the least.

To identify the least-cost outsourcing arrangement, it is necessary to compare:

- the additional costs of outsourcing production of an item with
- the amount of the scarce resource that would be needed to make the item in-house.

Costs are minimized (and so profits are maximized) by outsourcing those items where the extra cost of outsourcing is the lowest per unit of scarce resource 'saved'.

The examples below illustrate the relevant costing technique required.

► *Example 12:*

Super clean Company is a contract cleaning company. It provides three services; daily office cleaning, intensive cleaning of office space and minor repairs. However it has insufficient resources to do all the work available, and wishes to use a sub-contractor to take on some of the work.

Information relating to the different type of work is as follows:

	Average labor hours per job	Variable cost per job(Rs.)	Budgeted number of jobs	Sub-contractor quote per job (Rs.)
Daily office cleaning	4	60	1,500	80
Intensive cleaning	6	108	400	150
Minor repairs	3	56	640	100

There are 8,000 labor hours available. The serviced that should be sub-contracted would be analyzed using following workings

The company can do all three types of job more cheaply with its own staff than by hiring the sub-contractor. However, provided that it earns more than Rs.80 for a daily office cleaning job, Rs.150 for an intensive cleaning job and Rs.100 for a minor repairs job, it is profitable to use the sub-contractor to make up the shortfall in in-house resources.

The problem is to decide which work to outsource/sub-contract. The ranking should be established as follows:

	Daily office cleaning	Intensive cleaning	Minor repairs
	Rs.	Rs.	Rs.
Cost of doing the work in-house	60	108	56
Cost of sub-contractor	80	150	100
Extra cost of outsourcing, per job	20	42	44

	Daily office cleaning	Intensive cleaning	Minor repairs
Hours saved by sub-contracting	4	6	3
Extra cost per hour saved	Rs.5	Rs.7	Rs.14.
Priority for outsourcing	1st	2nd	3rd
Priority for doing work with own resources	3rd	2nd	1st

It is cheaper to sub-contract office cleaning than intensive cleaning. It is most expensive to sub-contract minor repairs and this is the first choice of job to be carried out in-house. The cost-minimizing plan should be to carry out the following work:

	Budgeted jobs	Total labor hours	Total variable cost
			Rs.
Minor repairs	640	1,920	35,840
Intensive cleaning	400	2,400	43,200
Office cleaning (balance)	920	3,680	55,200
Maximum labor hours available		8,000	
Sub-contract: Office cleaning	580		46,400
			180,640

▶ *Example 13:*

Wombat Company makes four products, W, X, Y and Z. All four products are made on the same machines, and the machine capacity for the year at Wombat's factory is 3,500 hours. However, it is able to obtain any of these products in unlimited quantities from a sub-contractor.

Budgeted data is as follows.

Product	W	X	Y	Z
Annual sales demand (units)	4,000	6,000	3,000	5,000
	Rs.	Rs.	Rs.	Rs.
Sales price per unit	15	20	18	17
Variable cost per unit, in-house manufacture	5	7	6	7
Cost of external purchase (outsourcing)	8.0	11.8	10.5	11.0
Machine hours per unit, in-house production	0.25	0.50	0.30	0.40

Which items should be produced in-house and which should be outsourced? The question would require following calculations to reach the conclusion

The selling price for each product is higher than the variable cost of purchasing each product externally; therefore, profit will be maximized by making the products in-house or purchasing them externally, up to the full amount of the annual sales demand.

Product	W	X	Y	Z
	Rs.	Rs.	Rs.	Rs.
Variable cost per unit, in-house manufacture	5.00	7.00	6.00	7.00
Cost of external purchase (outsourcing)	8.00	11.8	10.50	11.00
Extra cost of outsourcing, per unit	3.00	4.80	4.50	4.00

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Product	W	X	Y	Z
	Rs.	Rs.	Rs.	Rs.
Machine hours per unit, in-house production	0.25	0.50	0.30	0.40
Extra cost of outsourcing, per machine hour saved	Rs.12	Rs.9.6	Rs.15	Rs.10
Priority for outsourcing	3rd	1st	4th	2nd
Priority for in-house production	2nd	4th	1st	3rd

The cost-minimizing and profit-maximizing budget is as follows.

Product	Units	Machine hours	Total variable cost
In-house production:			Rs.
Y	3,000	900	18,000
W	4,000	1,000	20,000
Z (balance)	4,000	1,600	28,000
		3,500	
Z	1,000		11,000
X	6,000		70,800
Total variable cost			147,800

► *Example 14:*

An engineering company has been experiencing problems with restricted availability of resources. The company manufactures a variety of casings. It makes four types of casing. Each casing requires the same bought-in component and some high-grade steel. The standard costs for the four types of casing are as follows:

Casing	A	B	C	D
	Rs.	Rs.	Rs.	Rs.
Steel	250	500	190	390
Bought-in component	50	50	50	50
Direct labor	60	60	50	100
Variable production costs	40	50	40	50
Fixed production costs	180	240	150	270
Selling and administration costs	145	225	120	215
Profit	35	55	30	55
Selling price	760	1,180	630	1,130

All the selling and administration costs are fixed and the same single component is used for each of the four products. Direct labor is paid Rs.8 per standard hour and each member of the workforce is capable of producing any of the casings.

The company's main customer has ordered 30 units of Casing A, 20 units of B, 30 units of C and 20 units of D for production and delivery in the next month. Senior management have agreed that this order should be treated as a priority order and that these casings must be manufactured and delivered to the customer next month. This is necessary to maintain the goodwill of the customer. It is estimated that this order represents 10% of the total demand next month for each type of casing.

The company operates a just in time system, and has no inventories of steel, components or finished goods.

If the aim is to maximize profit for the month, establish the production and selling plan for the company next month in each of the following situations:

a) **Situation 1**. Supplies of steel are limited to Rs.250,000.

b) **Situation 2.** Only 400 bought-in components are available from suppliers.

c) **Situation 3**. A labor dispute restricts available productive labor hours in the month to 2,125.

d) **Situation 4.** A labor dispute restricts available productive labor hours in the month to 2,125; but the manufacture of any quantities of the four casings could be sub-contracted to an outside supplier. The cost of buying the casings externally would Rs.475, Rs.705, Rs.380 and Rs.640 for Casing A, Casing B, Casing C and Casing D respectively. In addition, it should be assumed that the major customer insists that its order is completed by the company itself and the manufacture should not be sub-contracted.

Each of the restrictions on production should be treated independently, as four different situations.

Working: contribution per unit	A	B	C	D
	Rs./unit	Rs./unit	Rs./unit	Rs./unit
Profit	35	55	30	55
Fixed costs:				
Production	180	240	150	270
Selling	145	225	120	215
Contribution	360	520	300	540

Resources required for the priority order for the major customer

Casing	Units required	Steel		Direct labor	
		per unit	Total	per unit	Total
		Rs.	Rs.	hours	hours
A	30	250	7,500	7.5	225.0
B	20	500	10,000	7.5	150.0
C	30	190	5,700	6.25	187.5
D	20	390	7,800	12.5	250.0
Total			31,000		812.5

a) Steel in short supply and restricted to Rs. 250,000

Casing	A	B	C	D
	Rs.	Rs.	Rs.	Rs.
Contribution/unit	360	520	300	540
Steel costs/unit	250	500	190	390
Contribution/Rs.1 steel cost	1.44	1.04	1.58	1.38
Ranking for manufacture	2nd	4th	1st	3rd

It is assumed that the sales forecasts for the month are correct.

Profit-maximizing production schedule

	Steel used	A	B	C	D
	Rs.	units	units	units	units
Priority order	31,000	30	20	30	20
Sales of C	51,300			270	
Sales of A	67,500	270			
Sales of D	70,200				180
	220,000				
Balance: Sales of B	30,000		60		
Total steel available	250,000				
Total production/sales		300	80	300	200

b) Components are in short supply and restricted to 400 units

	A	B	C	D
Contribution/unit	Rs.360	Rs.520	Rs.300	Rs.540
Components/unit	1	1	1	1
Contribution/component	Rs.360	Rs.520	Rs.300	Rs.540
Ranking for manufacture	3rd	2nd	4th	1st

Profit-maximizing production schedule

Components used		A	B	C	D
	units	units	units	units	units
Priority order	100	30	20	30	20
Sales of D	180				180
	280				
Balance: Sales of B	120		120		
Total available	400				
Total production/sales		30	140	30	200

c) Labor is in short supply and restricted to 2,125 hours

Casing	A	B	C	D
Contribution/unit	Rs.360	Rs.520	Rs.300	Rs.540
Labor hours/unit	7.50	7.50	6.25	12.5
Contribution per hour	Rs.48.00	Rs.69.33	Rs.48.00	Rs.43.20
Ranking for manufacture	2nd	1st	2nd	4th

Profit-maximizing production schedule

Labor hours		A	B	C	D
		units	units	units	units
Special order	812.5	30	20	30	20
Remaining hours	1,312.5		175		
Total hours	2,125.0				
Total production/sales		30	195	30	20

d) Make or buy decision

	A	B	C	D
	Rs.	Rs.	Rs.	Rs.
Contribution if made	360	520	300	540
Contribution if bought in	285	475	250	490
Extra contribution if made	75	45	50	50
Labor hours	7.5	7.5	6.25	12.5
Extra contribution per hour	**Rs.10**	**Rs.6**	**Rs.8**	**Rs.4**
Ranking/priority for making	1st	3rd	2nd	4th

Profit-maximizing production schedule

Casing	Hours	A	B	C	D
Special order	812.5	30	20	30	20
Remaining hours	1,312.5	175			
Total hours	2,125.0				
Made internally		205	20	30	20
Purchased externally		95	180	270	180
Total sales		300	200	300	200

4. OTHER SHORT TERM DECISIONS

The principles of relevant costing can be applied to any type of management decision, not just make-or-buy decisions. Examples of other types of management decision where relevant costing may be used are:

- One-off contract decisions
- Shutdown decisions
- Joint product further processing decisions.

4.1 One-off contract decisions

Management might have an opportunity to carry out a contract or job for a customer, where the job is 'once only' and will not be repeated in the future. The decision is therefore to decide whether to agree to do the job at the price offered by the customer, or to decide a selling price at which an incremental profit would be made.

If it is a one-off contract, rather than regular production work, it would be worthwhile undertaking the contract if the extra revenue from the contract is higher than the relevant costs of doing the work (including any opportunity costs).

The incremental profit from the one-off contract is the revenue that would be obtained minus the relevant costs.

One-off contract decisions might occur when a company has spare capacity, and an opportunity arises to earn some extra profit. This type of analysis should not be applied to most contract decisions, however, because a company must earn sufficient profits in total to cover its fixed costs and make a profit. Relevant costs do not help management to decide what the size of the profit margin should be, in order to ensure that the company makes an overall profit from all its activities.

▶ *Example 15:*

Faisal Ltd. is deciding whether or not to proceed with a one-off special contract for which it would receive a once-off payment of Rs. 200,000

Details of relevant costs are:

a) The special contract requires 200 hours of labor at Rs.600 per hour. Employees possessing the necessary skills are already employed by Faisal Ltd. but are currently idle due to a recent downturn in business.

b) Materials X and Y will be used. 100 tonnes of material X will be needed and sufficient material is in inventory as the material is in common use by the company. Original cost of material in inventory was Rs.150 per tonne but it would cost Rs.180 per tonne to replace if used in this contract. Material Y is in inventory as a result of previous over-purchasing. The original cost of material Y was Rs.50,000 but it has no other use. Unfortunately material Y is toxic and if not used in this contract Faisal Ltd. must pay Rs.24,000 to have it disposed.

c) The contract will require the use of a storage unit for three months. Faisal is committed to rent the unit for one year at a rental of Rs.8,000 per month. The unit is not in use at present. However, a neighboring business has recently approached Faisal Ltd. offering to rent the unit from them for Rs.11,000 per month.

d) Overheads are absorbed at Rs.750 per labor hour which consists of Rs.500 for fixed overhead and Rs.250 for variable overhead. Total fixed overheads are not expected to increase as a result of the contract.

A trainee accountant has calculated that it will cost Rs. 359,000 to deliver the contract (calculation below) and concluded that the contract should therefore not be accepted for Rs.200,000.

Description	Relevant cost Rs.
Labor: 200 hours x Rs. 600	120,000
Material X: 100 tonnes x Rs. 150	15,000
Material Y: Original cost	50,000
Storage: 3 months x Rs. 8,000	24,000
Overheads: Rs. 750 x 200	150,000
Total	359,000

Advise whether the contract should be accepted or not on financial grounds would include:

a) The relevant cost of labor is zero as no extra cost will be incurred as a result of this contract.

b) The relevant cost of a material that is used regularly is its replacement cost. Additional inventory of the material must be purchased for use in this contract. The relevant cost of material X is therefore Rs.180 per tonne i.e. Rs.180 x 100 = Rs.18,000

c) There is a relevant saving from using material Y from not having to pay the disposal cost of Rs.24,000.

d) As Faisal is already committed to rent the storage unit for one year the monthly rental cost is not relevant to the contract. However, the opportunity cost is the foregone rental income that Faisal would have made from the neighboring business for the three months needed for this contract. i.e. 3 x Rs.11,000 = Rs.33,000

e) The fixed overhead is not relevant because there is no increment to fixed overheads expected as a result of this contract. Therefore the relevant overhead cost is just the variable part of Rs.250 per hour x 200 hours = Rs.50,000

So in total the relevant cost is Rs. 77,000 as follows:

Description	Relevant cost Rs.
Labor	0
Material X	18,000
Material Y	(24,000)
Storage	33,000
Overheads	50,000
Total	77,000

Conclusion: The contract should be accepted as it would make an incremental profit to Faisal of Rs. 123,000 (revenue of Rs. 200,000 less relevant costs of Rs. 77,000).

4.2 Shutdown decisions

A shutdown decision is a decision about whether or not to shut down a part of the operations of a company. From a financial viewpoint, an operation should be shut down if the benefits of shutdown exceed the relevant costs.

A shutdown decision may be a long-term decision when there are large initial expenditures involved (for example, costs of making the work force redundant). For the purpose of the examination, however, any shutdown decision will be a short-term decision.

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▶ *Example 16:*

Company V makes four products, P, Q, R and S. The budget for next year is as follows:

	P	Q	R	S	Total
	Rs.000	Rs.000	Rs.000	Rs.000	Rs.000
Direct materials	300	500	400	700	1,900
Direct labor	400	800	600	400	2,200
Variable overheads	100	200	100	100	500
	800	1,500	1,100	1,200	4,600
Sales	1,800	1,650	2,200	1,550	7,200
Contribution	1,000	150	1,100	350	2,600
Directly attributable fixed costs	(400)	(250)	(300)	(300)	(1,250)
Share of general fixed costs	(200)	(200)	(300)	(400)	(1,100)
Profit/(loss)	400	(300)	500	(350)	250

'Directly attributable fixed costs' are cash expenditures that are directly attributable to each individual product. These costs would be saved if operations to make and sell the product were shut down.

Decision would be required regarding whether any of the products should be withdrawn from the market. Following reasons and calculations may be observed:

From a financial viewpoint, a product should be withdrawn from the market if the savings from closure exceed the benefits of continuing to make and sell the product. If a product is withdrawn from the market, the company will lose the contribution, but will save the directly attributable fixed costs.

Product P and product R both make a profit even after charging a share of general fixed costs. On the other hand, product Q and product S both show a loss after charging general fixed costs, and we should therefore consider whether it might be appropriate to stop making and selling either or both of these products, in order to eliminate the losses.

Effect of shutdown	P	Q	R	S
	Rs.'000	Rs.'000	Rs.'000	Rs.'000
Contribution forgone	(1,000)	(150)	(1,100)	(350)
Directly attributable fixed costs saved	400	250	300	300
Increase/(reduction) in annual cash flows	(600)	100	(800)	(50)

Although product S makes a loss, shutdown would reduce annual cash flows because the contribution lost would be greater than the savings in directly attributable fixed costs.

However, withdrawal of product Q from the market would improve annual cash flows by Rs.100,000, and withdrawal is therefore recommended on the basis of this financial analysis.

Decision recommended: Stop making and selling product Q but carry on making and selling product S.

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4.3 Joint product further processing decisions

Joint products are products manufactured from a common process. In some instances, a company might have a choice between:

- selling the joint product as soon as it is output from the common process, or
- processing the joint product further before selling it (at a higher price).

This is a short-term decision, and the financial assessment should be made using relevant costs and revenues. The financial assessment should compare:

- the revenue that will be obtained (less any selling costs) from selling the joint product as soon as it is output from the common process, and
- the revenue that will be obtained if the joint product is processed further, less the incremental costs of further processing and then selling the product.

Applying relevant costing, the costs of the common process are irrelevant to the decision, because these costs will be incurred anyway, whatever the decision. The decision should be to further process the joint product if the extra revenue from further processing exceeds the extra (relevant) costs of the further processing.

▶ *Example 17:*

A company produces two joint products from a common process. For every 100 kilograms of input to the common process, output consists of 40 kilograms of joint product 1 (JP1) and 60 kilograms of joint product 2 (JP2). The costs of the common process are Rs.400 per 100 kilograms of input.

JP1 can be sold for Rs.10 per kilogram and JP2 can be sold for Rs.16 per kilogram.

Alternatively, JP1 can be processed to make a finished product, FP1. Costs of further processing consist of variable costs of Rs.6 per kilogram and fixed costs of Rs.120,000 per year. Of these fixed costs, Rs.96,000 would be directly attributable to the further processing operations, and the remaining Rs.24,000 would be an apportionment of general fixed overhead costs. The further processed product (FP1) would have a selling price of Rs.28 per kilogram.

It is estimated that 15,000 kilograms of JP1 will be produced each year. There are no losses in any process.

Should JP1 be sold as soon as it is produced from the common process, or should it be further processed into Product FP1? Following may be the solution

The common processing costs are irrelevant to the further processing decision. The annual relevant costs and benefits of further processing JP1 are as follows:

	Rs.
Revenue from selling FP1 (per kilogram)	28
Variable further processing cost	(6)
Additional variable revenue from further processing	22
Opportunity cost: sales of JP1 forgone	(10)
Benefit per kilogram from further processing	12
Number of kilograms produced each year	15,000
Total annual benefits before directly attributable fixed costs	180,000
Directly attributable fixed costs of further processing	(96,000)
Net annual benefits of further processing	84,000

Recommendation: The joint product should be processed to make FP1, because this will increase annual profit by Rs. 84,000.

4.4 Equipment/Plant Replacement and investment decisions

Equipment buying or replacement decisions are capital investment decisions which require discounted cash flow analysis. Moreover, book value of the replaced asset is irrelevant of sunk cost in this situation.

▶ *Example 18:*

Decimal World Limited manufactures and sells modems. It manufactures its own circuit boards (CB), an important part of the modem.

The present cost to manufacture a CB is as follows:

	Rupees
Direct material	440
Direct labor	210
Variable overheads	55
Fixed overheads	
Depreciation	60
General overheads	30
Total cost per unit	795

The company manufactures 400,000 units annually. The equipment being used for manufacturing CB has worn out completely and requires replacement. The company is presently considering the following options:

a) Purchase new equipment which would cost Rs. 240 million and have a useful life of six years with no salvage value. The company uses straight-line method of depreciation. The new equipment has the capacity to produce 600,000 units per year. It is expected that the use of new equipment would reduce the direct labor and variable overhead cost by 20%.

b) Purchase from an external supplier at Rs.730 per unit under a two year contract.

The total general overheads would remain the same in either case. The company has no other use for the space being used to manufacture the CBs.

In analyzing company's situation which course of action would you recommend to the company assuming that 400,000 units are needed each year?

	Differential Cost per Modem	
	Make	Buy
	Rs.	Rs.
Outside supplier's costs		730
Direct materials	440	
Direct labor (Rs. 210 x 80%)	168	
Variable overheads (Rs. 55x80%)	44	
Depreciation (Rs. 240,000,000 ÷ 6 years ÷ 400,000)	100	
	752	730

The company should accept the offer of external supplier because the price offered is lower than the variable costs of product.

Recommendation for the company when its annual requirements were 600,000 units would require following analysis

	Differential Cost per Modem	
	Make	**Buy**
	Rs.	**Rs.**
Outside supplier's costs		730
Direct materials	440.00	
Direct labor (Rs. 210 x 80%)	168.00	
Variable overheads (Rs. 55 x 80%)	44.00	
Depreciation (Rs. 240,000,000 ÷ 6 years ÷ 600,000)	66.67	
	718.67	730

The company should purchase the new equipment and make the modems if 600,000 modems per year are needed.

However, there may be other factors that the company should consider, before making a decision. These are

i. Will volume in future years be increasing? If yes then buying the new equipment becomes more desirable.
ii. Will quality control be maintained if the CB purchased from external suppliers?
iii. Will the external supplier be dependable in making delivery schedules?
iv. Can the company begin making the CB again if the supplier proves to be unacceptable?
v. If the external supplier's offer is accepted and the needs for CB increases in future years, will the supplier have the added capacity to provide more than 400,000 CB per year?
vi. If the order size increases, will the supplier given any additional bulk quality discount.
vii. Will the external supplies be able to supply the CB after 2 years?

4.5 Decisions for Discontinuing operations

Some operations are more profitable than the others. In this respect, organizations may often consider less profitable ventures to be discontinued for allocation of resources to those making more profits.

► *Example 19:*

Stamba makes two components, A and B, for which costs in the next year are expected to be as follows:

	A	B
Production (units)	30,000	20,000
Variable costs per unit:	Rs.	Rs.
Direct materials	6	5
Direct labor	3	9
Variable production overheads	1	3
Variable production cost	10	17

Direct labor is paid Rs.12 per hour. There will be only 19,500 hours of direct labor time available next year, and any additional components must be purchased from an external supplier.

Total fixed costs per annum are expected to be as follows:

	Rs.
Incurred as a direct consequence of making A	40,000
Incurred as a direct consequence of making B	50,000
Other fixed costs	30,000
	120,000

An external supplier has offered to supply units of A for Rs.12.50 and units of B for Rs.23.

a) Recommendation regarding whether Stamba should shut down internal production of Component A or Component B and switch to external purchasing is given below.

	Component A	Component B
	Rs.	Rs.
Cost of making internally	10.0	17.0
Cost of buying	12.5	23.0
Extra variable cost of buying	2.5	6.0
Quantities required next year	30,000	20,000
Total extra variable cost of buying	75,000	120,000
Fixed costs saved by closure	40,000	50,000
Net extra costs of buying	35,000	70,000

It appears that it would cost the company more each year to shut down internal production of either component and switch to external purchasing.

b) Recommendation regarding the quantities that Stamba should make of the components, and the quantities that it should buy externally, in order to obtain the required quantities of both components at the minimum cost would be as follows.

In addition, the total annual cost will be calculated below

Tutorial note. To answer part (b), you will need to consider that labor is a limiting factor.

Production hours required	hours
Component A (30,000 × 0.25 hours)	7,500
Component B (20,000 × 0.75 hours)	15,000
Total hours required	22,500
Total hours available	19,500
Shortfall	3,000

There are insufficient hours available to manufacture everything internally. Some components must be purchased externally.

	Component A	Component B
	Rs. per unit	Rs. per unit
Cost of making internally	10.0	17.0
Cost of buying	12.5	23.0
Cost saved by making	2.5	6.0
Hours required to make internally	0.25 hours	0.75 hours
(Rs.3/Rs.12 per hour: Rs.9/Rs.12 per hour)		
Costs saved per hour by making	Rs.10	Rs.8
(Rs.2.50/0.25 hours: Rs.6/0.75 hours)		

It is better to make Component A internally than Component B.

Component	Units	Hours	Cost/unit	Cost
			Rs.	Rs.
A	30,000	7,500	10	300,000
B (balance)	16,000	12,000	17	272,000
Variable cost of internal manufacture		19,500		572,000
Cost of external purchase – balance of units required	4,000		23	92,000
Fixed costs				120,000
Total costs				784,000

c) Non-financial considerations relevant to make-or-buy decision are discussed below:

Risks of outsourcing work:

i. Supplier may produce items to a lower standard of quality.

ii. The supplier may fail to meet delivery dates and the buyer may dependent on the supplier to commit onward delivery to its buyer. In case of buying of a component, production process of the end-product may be held up by a lack of component.

Benefits of outsourcing work:

i. Outsourcing work will enable the management to focus all of its efforts on those aspects of operation the entity does best.

ii. The external supplier may have specialist expertise which enables it to provide outsourced products more efficiently and at a cheaper price.

4.6 Pricing decisions for special orders

Sometimes decisions include one-time order related prizing decisions or prices related to deals and offers outside market. Such decisions although seems to be rejected as prices are lower than the actual costs incurred. However, in such cases relevant costs are much lowered and hence may seem profitable for the company.

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5. COMPREHENSIVE EXAMPLES

- *Example 01:*

Areesh Limited deals in various products. Relevant details of the products are as under:

	AW	AX	AY	AZ
Estimated annual demand (units)	5,000	10,000	7,000	8,000
Sales price per unit (Rs.)	150	180	140	175
Material consumption:				
Q (kg)	2	2.5	1.5	1.75
S (kg)	0.5	0.6	0.4	0.65
Labor hours	2	2.25	1.75	2.5
Variable overheads (based on labor cost)	75%	80%	100%	90%
Fixed overheads per unit (Rs.) (based on 80% capacity utilization)	10	20	14	16
Machine hours required:				
Processing machine hours	5	6	8	10
Packing machine hours	2	3	2	4

Company has a long term contract for purchase of material Q and S at a price of Rs. 15 and Rs. 20 per kg respectively. Wage rate for 8 hours shift is Rs. 200.

The estimated overheads given in the above table are exclusive of depreciation expenses. The company provides depreciation on number of hours used basis. The depreciation on each machine based on full capacity utilization is as follows:

	Hours	Rs.
Processing machine	150,000	150,000
Packing machine	100,000	50,000

The company has launched an advertising campaign to promote the sale of its products. Rs. 2 million have been spent on such campaign. This cost is allocated to the products on the basis of sale.

The number of units of each product that the company should produce in order to maximize the profit and the product wise and total contribution at optimal product mix can be calculated as follows:

	AW	AX	AY	AZ	Total
Sale price	150.00	180.00	140.00	175.00	
Less: Variable cost					
Material Q at Rs 15	30.00	37.50	22.50	26.25	
Material S at Rs 20	10.00	12.00	8.00	13.00	
Labor cost at Rs. 25 per hour	50.00	56.25	43.75	62.50	
Overheads	37.50	45.00	43.75	56.25	
	127.50	150.75	118.00	158.00	
Contribution margin per unit	**22.50**	**29.25**	**22.00**	**17.00**	
Annual demand (Units)	5,000	10,000	7,000	8,000	

	AW	AX	AY	AZ	Total
Possible production under each machine:					
Processing machine:					
Machine hours required per unit	5.00	6.00	8.00	10.00	
Average CM per hour	4.50	4.88	2.75	1.70	
Production priority	2	1	3	4	
No. of units that can be produced in available hours in order of CM priority (Restricted to annual demand)	5,000	10,000	7,000	900	
Hours required	**25,000**	**60,000**	**56,000**	**9,000**	**150,000**
Contribution margin (Rs.)	**112,500**	**292,500**	**154,000**	**15,300**	**574,300**

Production for product 'Z' has to be restricted to 900 units due to limited number of machine hours.

	AW	AX	AY	AZ	Total
Packing machine:					
Machine hours required per unit	2.00	3.00	2.00	4.00	
Average CM per hour	**11.25**	**9.75**	**11.00**	**4.25**	
Production priority	1	3	2	4	
No. of units that can be produced in available hours in order of CM priority (Restricted to annual demand)	5,000	10,000	7,000	8,000	
Hours required	**10,000**	**30,000**	**14,000**	**32,000**	**86,000**

Conclusion:

The packing machine can meet the full demand but capacity of processing machine is limited. Therefore, product mix of processing machine will be manufactured.

Assumption:

It has been assumed that the wage rate per eight hours is divisible.

▶ *Example 02:*

Jaseem Limited manufactures a stationery item in three different sizes. All the sizes are manufactured at a plant having annual capacity of 1,800,000 machine hours.

Relevant data for each product is given below:

	Small Size	Medium Size	Large Size
Sales price per unit (Rs.)	75	90	130
Direct material cost per unit (Rs.)	25	32	35
Labor hours per unit	3	4	5
Variable overheads per unit (Rs.)	5	7	8
Machine hours per unit	2	4	5
Demand (Units)	210,000	150,000	180,000
Minimum production required (Units)	100,000	100,000	100,000

Other relevant information is as under:

i. Cost of the monthly payroll is Rs. 1,500,000.

ii. Fixed overheads are Rs. 110,000 per month and are allocated on the basis of machine hours.

The number of units to be produced for each size may involve following calculations

	Small size	Medium size	Large size
Sales price	75.00	90.00	130.00
Direct material cost	(25.00)	(32.00)	(35.00)
Variable overheads	(5.00)	(7.00)	(8.00)
Contribution margin	**45.00**	**51.00**	**87.00**
Machine hours	2.00	4.00	5.00
Contribution margin per hour	22.50	12.75	17.40
Priority based on contribution per machine hour	**1**	**3**	**2**

Units to be produced:	Small size	Medium size	Large size	Machine hours
Minimum production - Units	100,000	100,000	100,000	
Hours consumed for minimum production	200,000	400,000	500,000	1,100,000
Units in excess of minimum production in CM priority:				
Small size - Units	110,000			220,000
Large size - Units			80,000	400,000
Medium size – Units		20,000		80,000
Total	**210,000**	**120,000**	**180,000**	**1,800,000**

- *Example 03:*

Bauxite Limited (BL) is engaged in the manufacture and sale of three products viz. Pentagon, Hexagon and Octagon. Following information is available from BL's records for the month of February 2012:

	Pentagon	Hexagon	Octagon
Sales price per unit (Rs.)	2,300	1,550	2,000
Material cost per Kg. (Rs.)	250	250	250
Labor time per unit (Minutes)	20	30	45
Machine time per unit (Hours)	4	2.5	3
Net weight per unit of finished product (Kg.)	6	4	5
Yield (%)	90	95	92
Estimated demand (Units)	10,000	20,000	9,000

Each worker is paid monthly wages of Rs. 15,000 and works a total of 200 hours per month. BL's total overheads are estimated at 20% of the material cost.

Fixed overheads are estimated at Rs. 5 million per month and are allocated to each product on the basis of machine hours. 100,000 machine hours are estimated to be available in February 2012.

Based on optimum product mix, computation of BL's net profit for the month of February 2012 would be as follows:

Computation of net profit on the basis of optimum product mix:

	Pentagon	Hexagon	Octagon
Selling price	2,300	1,550	2,000
Less: Variable Costs			
Direct Material			
(250 × 6 /0.9)	1,666.67		
(250 × 4 /0.95)		1,052.63	
(250 × 5 /0.92)			1,358.70
Direct Labor			
[15,000 /200 × (20/60)]	25.00		
[15,000 /200 × (30/60)]		37.50	
[15,000 /200 × (45/60)]			56.25
Variable Overheads			
[1666.66 × 20% - (Rs. 50 × 4 hrs)]	133.33		
[1052.63 × 20% - (Rs. 50 × 2.5 hrs)]		85.53	
[1358.70 × 20% - (Rs. 50 × 3 hrs)]			121.74
Total Variable Cost	1,825.00	1,175.66	1,536.69
Contribution per unit	475.00	374.34	463.31
Machine Hours required per unit	4.0	2.5	3.0
Contribution per Machine Hour	118.75	149.74	154.44
Ranking	3	2	1

Now, the scarce Hours will be allocated as per ranking.

Product	Volume	Hours required	Hours used	Balance unused
				100,000
Octagon	9,000	3.0	27,000	73,000
Hexagon	20,000	2.5	50,000	23,000
Pentagon (Bal.)	5,750	4.0	23,000	-

Profit arising from above production plan

Product	Units	Contribution per unit	Contribution margin
Octagon	9,000	463.31	4,169,790
Hexagon	20,000	374.34	7,486,800
Pentagon	5,750	475.00	2,731,250
Total Contribution			14,387,840
Less: Fixed costs			(5,000,000)
Net Profit			9,387,840

- *Example 04:*

Alpha Limited (AL) manufactures and sells products A, B and C. In view of limited production capacity, AL is meeting the demand for its products partly through imports.

The following information has been extracted from the budget for the next year:

	A	B	C
Machine hours used in production	240,000	225,000	270,000
	-------------- No. of units --------------		
Sale	42,000	35,000	26,500
Production	30,000	25,000	22,500
Imports	12,000	10,000	4,000
	------------- Rs. in million -------------		
Sales	252.00	175.00	185.50
Cost of production:			
- Direct material	48.00	31.25	40.50
- Direct labor	45.00	40.00	56.25
- Variable overheads	33.00	25.00	29.25
- Fixed overheads	28.80	27.00	32.40
Cost of import of finished products	68.40	47.00	26.88

Additional information:

a) AL is working at 100% capacity.

b) AL believes that it can obtain substantial quantity discounts from foreign suppliers if it increases the import volumes. Each product is supplied by a different supplier. After intense negotiations, the suppliers have offered discounts of 15%, 10% and 12% for products A, B and C respectively.

In preparing a product-wise plan of production/imports to maximize the company's profitability, please see below analysis

		Product-A	Product-B	Product-C
Capacity utilization	Machine hours **(A)**	240,000	225,000	270,000
Sales of units to be produced	**(B)**	30,000	25,000	22,500
Sales of units to be imported	**(C)**	12,000	10,000	4,000
Total sale units		**42,000**	**35,000**	**26,500**

		Rupees in million		
Variable Cost of production:				
Direct material		48.00	31.25	40.50
Direct labor		45.00	40.00	56.25
Overheads		33.00	25.00	29.25
Total cost	**(D)**	126.00	96.25	126.00
Cost per produced unit	**E (D÷B)**	**4,200.00**	**3,850.00**	**5,600.00**

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		Rupees in million		
Cost of imports:				
Existing cost of imported finished goods:		68.40	47.00	26.88
Bulk discount offered		15%	10%	12%
Discounted price of imported goods	**(F)**	58.14	42.30	23.65
		Rupees		
Cost per imported unit	**G (F÷C) Rs.**	**4,845.00**	**4,230.00**	**5,912.00**
Loss per unit on imports	**(G-F)**	**(645.00)**	**(380.00)**	**(312.50)**
Production Plan:				
Machine hours per unit	**H (A÷B)**	8.00	9.00	12.00
Loss per machine hour on imports	**Rs.**	(80.63)	(42.22)	(26.04)
Production priority to save loss on imports		**1st.**	**2nd.**	**3rd.**
Production from available hours of 735,000 in sequence of the above priority:				
Product-A	Units demand	42,000		
	Hrs. utilized (42,000×8)	336,000		
Product-B	Units demand		35,000	
	Hrs. utilized (35,000×9)		315,000	
Product-C	Units from remaining hrs.			7,000
	Remaining hrs, [735-336-315]			84,000
Import plan:				
Product-C: Demand exceeding production	(26,500-7,000)	-	-	19,500
Total units		**42,000**	**35,000**	**26,500**

► *Example 05:*

Artery Limited (AL) produces and markets three products viz. Alpha, Beta and Gamma. Following information is available from AL's records for the manufacture of each unit of these products:

		Alpha	Beta	Gamma
Selling price	(Rs.)	66	88	106
Material-A (Rs.4 per kg)	(Rs.)	8	0	12
Material-B (Rs.6 per kg)	(Rs.)	12	18	24
Direct labor (Rs. 10 per hour)	(Rs.)	25	30	25

		Alpha	Beta	Gamma
Variable overhead based on:				
– Labor hours	(Rs.)	1.5	1.8	1.5
– Machine hours	(Rs.)	1.6	1.4	1.2
Total	(Rs.)	3.1	3.2	2.7
Other data:				
Machine hours		8	7	6
Maximum demand per month (units)		900	3,000	5,000

Additional information:

i. AL is also engaged in the trading of a fourth product Zeta, which is very popular in the market and generates a positive contribution. AL currently purchases 600 units per month of Zeta from a supplier at a cost of Rs. 40 per unit. In-house manufacture of Zeta would require: 2.5 kg of material-B, 1 hour of direct labor and 2 machine hours.

ii. Materials A and B are purchased from a single supplier who has restricted the supply of these materials to 22,000 kg and 34,000 kg per month respectively. This restriction is likely to continue for the next 8 months.

iii. AL has recently accepted a Government order for the supply of 200 units of Alpha, 300 units of Beta and 400 units of Gamma each month for the next 8 months. These quantities are in addition to the maximum demand stated above.

iv. There is no beginning or ending inventory.

In determining whether AL should manufacture Zeta internally or continue to buy it from the supplier during the next 8 months, following are the required calculations

The internal manufacturing cost of Zeta would be as follows:

	Rs. per unit
Direct material-**B** (2.5 kg @ Rs. 6/kg)	15.0
Direct labor (1 hours @ Rs. 10/hour)	10.0
Variable overhead **W-1**	
Direct labor (1 hour @ Rs. 0.60/hour)	0.6
Machine hours (2 hours @ Rs. 0.20/hour)	0.4
Total	**26.0**

The buying price of the component is Rs. 40 per unit so if resources are readily available the company should manufacture the component. However, due to the scarcity of resources during the next 8 months the contribution earned from the component needs to be compared with the contribution that can be earned from the other products.

W-1:

Using Alpha (though any product could be used) the variable overhead rate per hour can be calculated:

Labor related variable overheads per unit = Rs 1.5

Direct labor hours per unit = Rs 25 / Rs 10 = 2.5 hours

Labor related variable overhead per hours = Rs. 1.5 / 2.5 hour = Rs 0.60 per hour

Machine related variable overhead per hour = Rs. 1.6 / 8 hour = Rs 0.2 per hour

Both material-**A** and material-**B** are limited in supply during the next 8 months, but calculations are required to determine whether this scarcity affects the production plans of AL. The resources required for the maximum demand must be compared with the resources available to determine whether either of the materials is a binding constraint.

Total quantity of each product to be manufactured:

	Government order	Market demand	Total
	Units		
Alpha	200	900	1,100
Beta	300	3,000	3,300
Gamma	400	5,000	5,400
Zeta	0	600	600

All figures in kg:

Resource	Available	Requirement	Alpha	Beta	Gamma	Zeta
Direct material-**A**	22,000	18,400	2,200	0	16,200	0
Direct material-**B**	34,000	35,200	2,200	9,900	21,600	1,500

It can be seen from the above that the scarcity of material-B is a binding constraint and therefore the contributions of each product and the component per kg of material-B must be compared.

	Alpha	Beta	Gamma	Zeta
	Rupees			
Contribution	17.9	36.8	42.3	14.0
Contribution /kg of material-**B**	8.95	12.27	10.58	5.60
Rank	**3**	**1**	**2**	**4**

AL should manufacture 120 units of Zeta and continue to purchase 480 units from the market.

- *Example 06:*

Snooker (Private) Limited (SNPL) manufactures a component 'Beta' which is used as input for many products. The current requirement of Beta is 18,000 units per annum. Current production cost of Beta is as follows:

	Rs. per unit
Direct material	3,670
Direct labor	1,040
Variable manufacturing overheads	770
Fixed manufacturing overheads	870
Total cost	6,350

A supplier has recently offered SNPL to supply Beta at Rs. 7,000 per unit. The management has nominated a team to evaluate the offer which has gathered the following information:

1. There is a shortage of labor. However, some of the labor would become available due to outsourcing of Beta, which would be utilized for production of a product 'Zee'. The estimated selling price of Zee is Rs. 5,800 per unit whereas production cost would be as follows:
   a. Direct material would cost Rs. 2,600 per unit.
   b. Each unit of Zee would require 20% more labor as compared to each unit of Beta.
   c. Estimated variable manufacturing overheads would be Rs. 480 per unit.
2. Outsourcing of Beta and production of Zee would result in net reduction in fixed manufacturing overheads by Rs. 1,900,000 per annum.

The decision regarding outsourcing by SNPL would require following evaluation:

Snooker Private Limited		Rupees
Additional cost of outsourcing of component Beta	**W-1**	(27,360,000)
Additional contribution from utilizing spare capacity by producing Zee	**W-2**	22,080,000
Net savings of fixed factory overheads		1,900,000
Loss due to outsourcing		**(3,380,000)**

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Opinion: SNPL should not outsource the production of component X.

W-1: Difference between cost of production and cost of outsourcing of component Beta		Rupees
Purchase cost	(18,000×7,000)	126,000,000
Variable production costs saved	[18,000×(3,670+1,040+770)]	98,640,000
Allocation of shared cost (irrelevant)	Ignore	-
Additional cost of outsourcing component Beta		**27,360,000**

W-2: Profit from spare capacity - Production of Zee		Rupees
Sales revenue of Zee	[5,800×15,000 **(W-3)**]	87,000,000
Material	[(2,600×15,000 **(W-3)]**	(39,000,000)
Labor	(1,040×15,000 **(W-3)**×1.2)	(18,720,000)
Variable manufacturing overheads	(480×15,000)	(7,200,000)
Profit from Zee		**22,080,000**
W-3: Production of Zee	**(18,000÷1.2)**	**15,000**

► *Example 07:*

DEL Limited manufactures radiators for car manufacturers. In normal operations, about 200,000 units are sold per annum at an average selling price of Rs. 15,000 per unit. Manufacturing process is carried out by 500 highly skilled labors who work an average of 180 hours per month at Rs. 250 per hour. Raw material cost is Rs. 3,000 per unit. Annual factory overheads are estimated at Rs. 540 million. Variable overheads are 150% of labor cost.

DEL had received an offer from TRU Limited to manufacture 4,000 units of radiators of trucks, at Rs. 50,000 per unit. DEL had expected to earn significantly high margin on this order and had planned to stop normal production for this purpose. It had already procured the raw material for Rs. 60 million but before the start of manufacturing it came to know that TRU has gone into liquidation.

To deal with the situation, DEL's marketing department has negotiated with another truck manufacturer, NTR Limited. NTR's specifications are slightly different and the price offered by NTR is Rs. 40,000 per unit.

The costs to be incurred on the new order and other relevant details are as follows:

1. Additional raw material of Rs. 12 million would have to be purchased for NTR's order.
2. DEL expects that first unit would take 10 hours. The labor time would be subject to a 95% learning rate upto 1,000 units. Thereafter, the learning rate would stop. The index of 95% learning curve is -0.074.
3. Variable overheads would be 240% of the cost of labor.
4. Fixed overheads are to be applied at Rs. 400 per labor hour.
5. Total cost of preparing the plant for NTR's order and resetting it to the normal production would be Rs. 4 million.

If the order from NTR is not accepted, raw materials of Rs. 60 million already procured would have to be sold at 70% of their cost. However, raw material worth Rs. 10 million can be utilized in the car's radiators after slight alteration at a cost of Rs. 1 million. The altered raw material can produce 30% components of 10,000 car radiators.

Whether DEL may accept the order from NTR would require following calculations:

DEL Limited		
Acceptance of order from NTR Limited for truck radiators		**Rs. in million**
Revenue from NTR Limited	40,000×4,000	160.00
Additional raw material		(12.00)
Raw material already procured – sales value	(60-10)×70%	(35.00)
– use value for truck radiators	(10,000×3,000×30%)-1	(8.00)
Labor cost	[22,647.91 **(W-1)**×250]	(5.66)
Variable overheads	(5.66×240%)	(13.58)
Preparation and resetting cost of the plant		(4.00)
Fixed overheads applied	**To be ignored**	-
		81.76
Loss of CM for not producing car radiators	4,194 **(W-2)** ×8,625 **(W-3)**	(36.17)
Profit on acceptance of the order from NTR		**45.59**
Conclusion: DEL should accept the order from NTR Limited		
W-1: Direct labor hours for production of truck radiators		**Hours**
Direct labor hours for 1,000 units	$[1{,}000 \times 10 \times (1{,}000)^{-0.074}]$	5,997.91
Direct labor hours for 999 units	$[999 \times 10 \times (999)^{-0.074}]$	(5,992.36)
Hours per unit for 1,001 and onward		**5.55**
Direct labor hours for first 1,000 units		5,997.91
Direct labor hours for next 3,000 units	(5.55×3,000)	16,650.00
		22,647.91
W-2: No. of Car radiators to be produced if NTR's order is not accepted		
Labor hours per unit of car radiator	(500×180×12)÷200,000 **Hrs.**	5.40
No. of car radiators to be produced	22,647.91 **(W-1)** ÷ 5.40 **Nos.**	**4,194**
W-3: Contribution margin per unit/hour for car radiators		**Rupees**
Selling price		15,000
Raw material cost		(3,000)
Labor cost	(500×180×250×12)÷200,000	(1,350)
Variable overheads	150%×1,350	(2,025)
Contribution margin per unit		**8,625**

▶ *Example 08:*

In May 2015, the board of directors of Sahil Limited (SL) had decided to close one of SL's operating segments at the end of the next year. The sales and production for the next year were budgeted at 50,000 units and on the basis thereof, the budget of the segment for the next year was approved as follows:

	Rs. in '000
Sales	5,000
Direct material (50,000 kg)	(950)
Direct labor	(1,000)
Variable production overheads	(500)
Fixed production overheads	(1,750)
Administrative and selling overheads	(500)
Budgeted net profit	300

However, rumors of the closure prompted majority of the segment's skilled labor to leave the company. Consequently, the management is considering the following alternatives to cope with the issue:

- Close the segment immediately and rent the factory space for one year at a rent of Rs. 40,000 per month; or
- Employ contract labor which would be able to produce a maximum of 40,000 units in the year. The quality of the product is however expected to suffer due to this change.

The following further information is available:

1. The sales manager estimates that a sales volume of 30,000 units could be achieved at the current selling price whereas sales volume of 40,000 units would only be achieved if the price was reduced to Rs. 90 per unit.
2. 25,000 kg of raw material is in stock. Any quantity of the material may be sold in the market at a price of Rs. 19 per kg after incurring a cost of Rs. 2 per kg. Up to 15,000 kg can be used in another segment of the company in place of a material which currently costs Rs. 18 per kg.
3. Wages of contract labor would be Rs. 24 per unit. SL would also be required to spend Rs. 40,000 on the training of the contract labor.
4. Due to utilization of contract labor, variable production overheads per unit are expected to increase by 20%.
5. Fixed production overheads include:
   - Depreciation of three machines used in the segment amounting to Rs. 170,000. These machines originally costed Rs. 1.7 million and could currently be sold for Rs. 830,000. If the machines are used for production in the next year, their sales value would reduce by Rs. 5 per unit of production.
   - All other costs included in 'fixed production overheads' represent apportionments of general overheads.
6. 40% of administrative and selling overheads are variable whereas the remaining amounts represent apportionment of general overheads.

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In advising the best course of action for Sahil Limited, please see below:

	Available options		
	Immediate closure and renting of factory bldg.	Operation using contract labor	
		To produce 30,000 units	To produce 40,000 units
	------------- Rupees -------------		
Incremental savings			
Sales (30,000×100), 40,000×90)		3,000,000	3,600,000
Rental income (40,000×12)	480,000		
Proceeds from sale of machine (830,000-30,000×5), (830,000-40,000×5)	830,000	680,000	630,000
Direct material - Use for other segment (15,000×18)	270,000	-	-
Direct material - sale externally [10,000×(19-2)]	170,000	-	-
Fixed production overheads; apportionment of general overheads (1,750-170= 1580)	-	-	-
Fixed admin and selling overheads; apportionment of general overheads (500×60%=300)	-	-	-
Incremental costs			
Purchase of direct material (5,000×19), (15,000×19)	-	(95,000)	(285,000)
Training of contract labor	-	(40,000)	(40,000)
Contract labor cost (30,000×24), (40,000×24)	-	(720,000)	(960,000)
Variable production overhead (500÷50×1.2×30,000),(500÷50×1.2×40,000)	-	(360,000)	(480,000)
Variable admin. & selling overheads: [(500×40%)÷50×30], [(500×40%)÷50×40]	-	(120,000)	(160,000)
Net savings	**1,750,000**	**2,345,000**	**2,305,000**

Conclusion: Since the highest savings occur with a production level of 30,000 units, SL should operate the segment at this level of activity.

► *Example 09:*

Zee Chemicals Limited (ZCL) produces two joint products, Alpha and Beta from a single production process. Both products are processed upto split-off point and sold without any further processing.

Presently, ZCL is considering the following proposals:

- Expansion of the existing facility by installing a new plant
- Installation of a refining plant to sell either Alpha or Beta after refining

To assess the above proposals, following data has been gathered:

i. Actual cost incurred in the month of December 2014:

	Rs. in '000
Direct material	15,000
Variable conversion costs (Rs. 230 per hour)	4,890
Fixed overheads	2,600

ii. Actual production and selling price for the month of December 2014:

	Liters	Selling price per liter (Rs.)
Alpha	11,300	1,000
Beta	14,700	1,125

iii. There is no process loss and joint costs are apportioned between Alpha and Beta according to the weight of their output.

iv. Details of the proposed plans are as follows:

	Expansion of existing facility	Installation of refining plant
Capacity in machine hours per month	5,000	5,000
	------------ Rs. in '000 ------------	
Cost of plant and its installation	20,000	25,000
Estimated residual value at the end of life	1,400	2,800
Estimated additional fixed overheads per month	250	500
Estimated useful life of the plant	20 Years	20 Years

v. Estimated variable cost of refining and sales price of refined products:

	Alpha	Beta
	Rupees per liter	
Direct material	90	125
Conversion cost (Rs. 150 per hour)	68	80
Selling price	1,380	1,525

vi. There would be no loss during the refining process. There is adequate demand for Alpha and Beta at split-off point and after refining.

It is important to evaluate each of the above proposals and give recommendations. Following calculations may be of some help:

	Expansion (Sale at split-off point)		Refining plant (Sale after refining)	
	Alpha	Beta	Alpha	Beta
Sales/incremental sales value per liter	1,000	1,125	380	400
			(1,380–1,000)	(1,525 – 1,125)
Variable cost at split-off point/cost of refining per liter	(765)	(765)	(158)	(205)
	(15,000+4,890) ÷ (11,300+14,700)		(90+68)	(125+80)
Contribution margin per liter **A**	**235**	**360**	**222**	**195**

	Expansion (Sale at split-off point)		Refining plant (Sale after refining)	
	Alpha	**Beta**	**Alpha**	**Beta**
CM from 5,000 hours:				
Total hours worked in December 2014	21,261 Hrs. (4,890,000÷230)			
Hours per liter for refining			0.453 Hrs. (68÷150)	0.533 Hrs. (80÷150)
Production from 5,000 hours **B**	2,657 Ltrs. (5,000/21,261×11,300)	3,457 Ltrs. (5,000/21,261×14,700)	11,038 Ltrs. (5,000÷0.453)	9,381 Ltrs. (5,000÷0.533)
Contribution margin **(A×B)**		**1,868,915** (2,657×235)+(3,457×360)	**2,450,436** (11,038×222)	**1,829,295** (9,381×195)
Fixed overheads:				
Depreciation per month (20,000-1,400)÷20÷12		(77,500)		
(25,000-2,800)÷20÷12			(92,500)	(92,500)
Additional fixed overheads per month		(250,000)	(500,000)	(500,000)
Net profit per month		**1,541,415**	**1,857,936**	**1,236,795**

Recommendations: As refining of Alpha produces the highest profit, ZCL should install refining plant to refine and sell 11,038 liters of Alpha.

- *Example 10:*

Sarwar Limited (SL) manufactures two industrial products i.e. K2 and K9. It also manufactures other products in accordance with the specification of customers. SL's products require specialized skilled labor. Maximum labor hours available with the company are 300,000 per month.

Following information has been extracted from SL's budget:

	K2	K9
	---- Rs. per unit ----	
Selling price	16,500	26,000
Direct material	6,000	8,000
Direct labor (Rs. 300 per hour)	4,500	7,500
Variable production overheads (based on labor hours)	1,875	3,125
Applied fixed production overheads (based on labor hours)	1,500	2,500
Monthly demand (Units)	5,000	8,000

An overseas customer has offered to purchase 3,000 units of a customized industrial product 'A-1' at a price of Rs. 35,000 each. The duration of contract would be one month.

The cost department has ascertained the following facts in respect of the contract:

i. Each unit of A-1 would require 3 units of raw material B-1 and 2 units of raw material C-3. B-1 is available in the local market at Rs. 2,500 per unit. However, the required quantity of C-3 is not available in the local market and would be imported from Srilanka at a landed cost of Rs. 2.4 million.

ii. Each unit of A-1 would require 35 labor hours.

iii. A specialized machinery would be hired for five days. However, due to certain production scheduling issues, it is difficult for SL to exactly predict when the machine would be required.

As a result of negotiations, SL has received the following offers:

Falah Modarba has quoted a rent of Rs. 0.9 million for the entire month. If accepted, SL would be able to sublet the machine at Rs. 20,000 per day.

Tech Rentals has quoted a rent of Rs. 57,000 per day and guaranteed availability of machinery when required.

The management believes that it can increase/decrease the production of K2 and K9, if required.

The maximum profit that can be earned by SL, in the above situation can be determined as below:

		K2	K9	A-1
		------------------- Rs. per unit -------------------		
Selling price	Given	16,500.00	26,000.00	35,000.00
Variable cost		12,375.00 (6,000+4,500+1,875)	18,625.00 (8,000+7,500+3,125)	23,270.00 (W-1)
Contribution per unit	A	4,125.00	7,375.00	11,730.00
Labor hours required per unit	B	15 (4,500/300)	25 (7,500/300)	35 Given
CM per labor hour (Rs.)	A/B	275.00	295.00	335.14
Ranking		3	2	1
Allocation of 300,000 hours	C		195,000 (300,000–105,000)	105,000 (35×3,000)
Units to be produced	C/B		7,800.00	3,000.00

Contribution margin for the month after accepting special contract		Rs. in million
A-1	(3,000×11,730) 35.19 K-9 (7,800×7,375)	57.53
Contribution margin		92.72
Fixed cost	(1,500/15)×300,000	30.00
Maximum profit		**62.72**

W-1: Relevant cost for A-1	Rs. per unit
Material cost - B1 (3×2,500)	7,500.00
Material cost - C3 (2,400,000/3,000)	800.00
Labor cost (35×300)	10,500.00
Variable overheads [{1875÷(4,500÷300)}×35]	4,375.00
Machine hire cost [Lower of (57,000×5) and {900,000–(20,000×25)}]/3,000	95.00
Variable cost per unit of A-1	**23,270.00**

► *Example 11:*

Ideal Chemicals (IC) blends and markets various cleaning chemicals. Presently, IC's plant is working at 70% capacity. To utilize its idle capacity, IC is planning to acquire rights to produce and market a new brand of chemical namely Z-13 on payment of fee of Rs. 160,000 per month.

In this respect, the relevant information is summarized as under:

i. Z-13 would be produced using the existing plant whose cost is Rs. 81 million. Processing would be carried out in batches of 2,000 liters of raw-materials.

Production costs per batch are estimated as under:

Raw material: Imported	1,200 liters	@ Rs. 1,500 per liter
Local	800 liters	@ Rs. 900 per liter
Direct labor	4,000 hours	@ Rs. 165 per hour
Variable production overheads		@ Rs. 120 per direct labor hour

1,700 liters of Z-13 is produced from each batch. 100 liters are lost by way of evaporation whereas 200 liters of input is converted into solid waste. The approximate weight of the solid waste is 225 kg per batch.

ii. Net volume of each bottle of Z-13 would be 1.25 liters.

iii. The solid waste would be refined to produce a by-product, polishing wax. Refining would cause an estimated loss of 2% of by-product output.

iv. Cost of refining and sales price of wax would be Rs. 250 and Rs. 400 per kg respectively. Net sales revenue (sales less refining cost) from sale of wax is to be deducted from the cost of the main product.

v. Variable selling overheads are estimated at Rs. 175 per unit.

vi. The plant is depreciated at 10% per annum. It is estimated that production of Z-13 would utilize 20% capacity of the plant.

vii. To introduce Z-13, IC plans to launch a sales campaign at an estimated cost of Rs. 3.5 million.

viii. IC wishes to sell Z-13 at a contribution margin of 40% on sales.

In determining Z-13's sale price per unit and annual units to be sold, if IC intends to earn an incremental profit before tax of Rs. 10 million from its sale; please see below:

Ideal Chemicals		**Units**
Finished units per batch	1,700÷1.25 **(A)**	**1,360**
By-product units per batch	225÷1.02	**221**

Variable production cost per unit:		**Rupees**
Material: Imports	1,200×1,500	1,800,000
Local	800×900	720,000
Direct labor	4,000×165	660,000
Variable production overheads	4,000×120	480,000
Net sales revenue from sale of by-product	221×(400–250)	(33,150)
	(B)	**3,626,850**
Variable production cost per unit	**(B÷A)**	2,666.80
Variable selling overheads per unit		175.00
Variable cost per unit	**(C)**	**2,841.80**
Sales price per unit to earn 40% contribution on sale	**D=(C÷0.6)**	**4,736.33**

No. of sale units to earn annual profit before tax of Rs. 10,000,000		
Incremental fixed overheads and profit:		
- Fee for blending and marketing of Z-13	160,000×12	1,920,000
- Sales promotion expenses		3,500,000
- Required incremental profit before tax		10,000,000
	(E)	**15,420,000**
Required annual sales units	**No. of units E÷ (D-C)**	**8,139**

- *Example 12:*

Lily (Private) Limited (LPL) has two factories. LPL manufactures a product Delta in its Quetta factory. One unit of Delta is assembled from three components P, Q and R which are produced in the Hub factory. Monthly demand of Delta is estimated at 5,000 units.

Following information is available in respect of each component:

	P	Q	R
Quantity required for one unit of Delta	2	2	3
Machine hours required for producing each component	4	3	5
Cost of production:	----------Rupees---------		
Direct material	900	800	300
Direct Labor	270	250	240
Factory overheads	500	700	280
Allocated administrative overheads	40	30	50

Fixed factory overheads are charged at Rs. 20 per machine hour.

Production capacity at Hub factory is restricted to 100,000 machine hours per month. In order to meet the demand, LPL is considering to purchase P, Q and R from a vendor at Rs. 1,700, Rs. 1,800 and Rs. 870 per unit respectively.

In determining how LPL can optimize its profit in the above situation, please see below working

		P	Q	R
Quantity required to produce one unit of Delta	**A**	2	2	3
Machine hours to produce the components	**B**	4	3	5
Components required to produce 5,000 units of Delta (5,000×A)	**C**	10,000	10,000	15,000
Relevant production cost per component:		---------- Rupees ---------		
Direct material		900	800	300
Direct labor		270	250	240
Variable overheads 500–(B×20); 700–(B×20); 280–(B×20)		420	640	180
Fixed overheads	**(Not relevant)**	-	-	-
Allocated administrative overheads	**(Not relevant)**	-	-	-
Total relevant cost	**D**	**1,590**	**1,690**	**720**

		---------- Rupees ---------		
External purchase price per component	**E**	1,700	1,800	870
Savings per component in case of in-house production	E–D = **F**	110	110	150
Savings per machine hour for in-house production	F÷B	27.50	36.67	30.00
Priority for in-house production		**3rd.**	**1st.**	**2nd.**
In-house production in sequence of priority	Units **G**	**-**	**10,000**	**14,000**
Use of available hours	G×B	-	30,000	70,000
External purchase	Units **C–G**	**10,000**	**-**	**1,000**

- *Example 13:*

Jasmine Limited (JL) manufactures various products according to customers' specifications. In March 2019, JL is required to submit a tender for supply of 5,000 plastic bodies of a washing machine. In this respect, following information has been gathered:

i. The production would be carried out on JL's plant at its Sialkot factory. Cost of the plant is Rs. 3,600,000. Its estimated useful life is 96,000 hours. Each plastic body (unit) would require 2 machine hours.

ii. Production would be carried out in ten batches of 500 units each. Cost per unit for the first batch has been estimated as under:

		Rupees
Direct material	2 kg	150
Direct Labor	3 labor hours	300
*Overheads (based on direct labor hours):		
Variable overheads		240
Fixed overheads		360
****Overheads do not include depreciation of the plant***		

iii. Direct material consumption would reduce by 5% in each subsequent batch up to the third batch and would become constant thereafter.

iv. Applicable learning curve effect is 95% but it will remain effective for the first six batches only. The index of 95% learning curve is –0.074.

The bid amount that JL should quote to earn 30% contribution margin, would be calculated as follows:

		Rs. in '000
Direct material cost:		
For first 3 batches	$75{,}000 + (75{,}000 \times 0.95) + [75{,}000 \times (0.95)^2]$	214
For last 7 batches	$75{,}000 \times (0.95)^2 \times 7$	474
	A	**688**
Direct labor cost:		
For first 6 batches	**(W-1)** 7,882×100	788
For last 4 batches	**(W-1)** 1,224×4×100	490
	B	**1,278**

		Rs. in '000
Overheads		
Variable overheads based on direct labor hours	240÷3×1278	1,022
Variable overheads based on machine hours (molding plant depreciation)	3,600÷96,000×(5,000×2)	375
		1,397
Fixed overheads		-
	C	**1,397**
Bid amount to earn 30% contribution margin	(A+B+C)÷0.7	**4,804**

W-1: Direct labor hours at 95% learning curve		**Hours**
For the first 6 batches	6×(500 units × 3 hours)×(6)$^{-0.074}$	7,882
For the first 5 batches	5×(500 units × 3 hours)×(5)$^{-0.074}$	(6,658)
For the 7th. batch and onwards		**1,224**

▶ *Example 14:*

Binary Ltd. (BL) manufactures three products, A, B and C. It is the policy of the company to apportion the joint costs on the basis of estimated sales value at split off point. BL incurred the following joint costs during the month of August 20X3:

	Rs. in '000
Direct material	16,000
Direct labor	3,200
Overheads (including depreciation)	2,200
Total joint costs	21,400

During the month of August 20X3 the production and sales of Product A, B and C were 12,000, 16,000 and 20,000 units respectively. Their average selling prices were Rs. 1,200, Rs. 1,400 and Rs.1,850 per unit respectively.

In August 20X3, processing costs incurred on Product A after the split off point amounted to Rs. 1,900,000.

Product B and C are sold after being packed on a specialized machine. The packing material costs Rs. 40 per square foot and each unit requires the following:

Product	Square feet
B	4.00
C	7.50

The monthly operating costs associated with the packing machine are as follows:

	Rupees
Depreciation	480,000
Labor	720,000
Other costs	660,000

All the above costs are fixed and are apportioned on the basis of packing material consumption in square feet.

a) The joint costs to be apportioned to each product, would be calculated as follows:

Total joints costs as given in the question	Rs. 21,400,000

	Joint Costs (Rs.)
Product A:	
Rs.12,500,000 **(W-1)** / Rs. 61,480,000 **(W-1)** x Rs. 21,400,000	4,351,008
Product B:	
Rs.19,283,738 **(W-1)** / Rs. 61,480,000 **(W-1)** x Rs. 21,400,000	6,712,297
Product C:	
Rs.29,696,262 **(W-1)** / Rs. 61,480,000 **(W-1)** x Rs. 21,400,000	10,336,695
	21,400,000

W-1 : Computation of sales value at split off point	**Product A**	**Product B**	**Product C**	**Total**
	Rs.	**Rs.**	**Rs.**	
Sales value				
Rs. 1,200 x 12,000	14,400,000			
Rs. 1,400 x 16,000		22,400,000		
Rs. 1,850 x 20,000			37,000,000	
Less:				
Further processing costs – A	(1,900,000)			
Packing costs - Fixed **B:** Rs. 1,860,000 (W2)×64,000 ÷ 214,000 (W3) **C:** Rs. 1,860,000 (W2)×150,000 ÷ 214,000 (W3)		(556,262)	(1,303,738)	
Packing costs – Variable **B:** 64,000 x Rs. 40 **C:** 150,000 x Rs. 40		(2,560,000)	(6,000,000)	
Estimated sales value at split off point	**12,500,000**	**19,283,738**	**29,696,262**	**61,480,000**

W-2: Fixed costs relating to packing machine = 480,000 + 720,000 + 660,000 = Rs. 1,860,000

W-3: Total Volume in Square Feet

Product	Square Feet per Unit	Units produced	Total Volume
B	4.00	16,000	64,000
C	7.50	20,000	150,000
			214,000

a) BL has received an offer from another company to purchase the total output of Product B without packaging, at Rs. 1,200 per unit. Determine the viability of this offer.

To sell Product B without packaging for Rs. 1,200 per unit, following calculations would be required:

	Packaged (Rs.)	Unpackaged (Rs.)
Selling price per unit	1400	1,200
Less: Variable cost of packing (Rs.40 x 4)	160	-
Contribution margin	1,240	1,200

Conclusion: Since the alternative option has a lower contribution margin, the decision should be to continue to sell Product B with packaging at Rs. 1,400 per unit

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In profitability decisions, limiting factors refer to the circumstances in which in availability of production resources are scarce. Identifying the limiting factor will help meet the sale or profit demand with the available resources.

Often companies have to go through make or buy decisions that is decisions whether to make internally or to buy externally. These decisions involve relevant costs that is lower from a financial point of view.

Various non-financial considerations are involved in make or buy decisions which may involve control, employee redundancy as well as maintaining a competitive advantage of the company.

CHAPTER 16

INTRODUCTION TO FINANCIAL INSTRUMENTS

IN THIS CHAPTER

AT A GLANCE

The objective of understanding the concepts of financial instruments is to understand the different aspects of financial management. An important aspect of financial management is the choice of among different options of financing for company's assets. The aim is to achieve an efficient capital structure by maintaining an adequate working capital maintaining balance between equity and debt capital in the long term capital structure and creating a suitable balance between short –term and long term funding.

The two main sources of finance used in long term capital structure of company is are equity and dept. the choice between these sources are affected by various factors. For eg. Costs, flexibility, repayments and so on.

Divisibility, liquidity and holding period are amongst the basis which are used to differentiate between indirect and indirect investment decisions

Other options available to investors before invest is the buying and selling of different financial instruments to hedge them against future expected losses.

1. CORE SOURCES OF FINANCE

A suitable balance between short-term and long-term funding

Adequate working capital

A suitable balance between equity and debt capital in the long-term capital structure

1.1 Factors considered before selecting source of finance

Before selecting the source of finance the company should consider different factors that are:

- **Amount required** – for example access to long-term bank lending may be restricted due to the amount of risk that banks are willing to take. The company may be required to raise new long-term capital through the sale of equity shares (see below).
- **Cost** – the company should consider both the on-going servicing cost and the initial arrangement cost for its financing. For example, the cost of both raising and servicing equity may be high as shareholders accept high risk in return for the promise of higher rewards (dividends).
- **Duration** – broadly speaking short-term financing is used to fund short-term assets and long-term financing used to fund long-term assets.
- **Flexibility** – the Directors should consider balancing risk, cost and flexibility. For example in a year with low profits (or even a loss) the company could decide not to pay a dividend to the shareholders. However, most debt financing requires the payment of interest irrespective of company performance.
- **Repayment** – the company needs to carefully forecast future cash flows in order to ensure it is able to repay debt as it falls due. For example, a company should ensure it generates enough cash to repay a 10-year bank-loan in 10-years' time on the due date.
- **Impact on financial statements** – stakeholders such as equity investors and the providers of debt finance will often analyses a company's financial statements to help them assess the risk involved in financing the company. Therefore, the company should consider the impact that its financial management decisions might have on its financial statements and the message that sends to providers of finance. The details of sources of finance are explained in next section.

There are two main sources of finance:

a) Equity

b) Debt

2. EQUITY

Providers of equity are the ultimate owners of the company and exercise control through the voting rights attached to shares.

Equity shareholders gain a return on their investment in two ways:

- **Capital gains** – the value of their share in the company increases as the value of the company increases
- **Dividends** – companies return cash to shareholders through the payment of dividends. Dividends are typically paid once or twice per year.

The cost of equity is higher than other forms of finance as the equity holders carry a high level of risk, and therefore command the highest of returns as compensation.

New issues to new investors will dilute control of existing owners. Finance is raised through the sale of shares to existing or new investors (existing investors often have a right to invest first which is called pre-emption rights). Issue costs can be high.

The company issues two types of shares to raise equity finance:

- **The ordinary shares** holders are the real owners of the company and are entitled for residual profit of the company. Their investments are not normally redeemable.
- **The Preference share** holders are entitled normally for fix dividend before distribution of profit to ordinary shareholders. Their investments are normally redeemable.

Comparison of Ordinary shares and preference shares

The company can issue ordinary shares as well as preference shares to raise equity finance but the characteristics of both types of shares are different as:

Feature	Ordinary shares	Preference shares
Dividend rate	Variable – higher in a good year, lower in a bad year	Fixed e.g. 4% per annum
Dividend distribution	Paid only if there are spare funds after the payment of a preference dividend	Receives the dividend before ordinary shareholders (therefore lower risk)
Liquidation	The last to be repaid in a liquidation	Repaid before (in preference to) the ordinary shareholders
Voting rights	Normally receive the right to vote on major decisions. Each ordinary share would attract one vote.	Typically receive no right to vote on company decisions.

2.1. Methods of Floatation

There are five principal methods for a company to raise equity finance:

- Initial public offer
- Private placing
- Introduction
- Right Issue
- Bonus Issue

2.1.1. Initial public offer (IPO)

A public offer refers to the process in which a company offers its shares for sale to private and/or institutional investors. The first time the company offers its shares for sale is called an initial public offer.

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Shares are normally offered at a fixed price which is decided by the company and its broker. The issue price needs to be attractive to prospective shareholders in order to incentivize them to invest.

An initial public offer normally involves the acquisition (or underwriting) by an issuing house of a large block of shares of a company. They will then offer them for sale to the general public and/or other investors. The issuing house is normally a merchant bank or a syndicate of banks.

IPOs are normally the most expensive route to market and are therefore commonly seen with larger companies looking to raise substantial amounts of capital.

2.1.2. Private placing

With a private placing an issue of equity shares is 'placed' by the company with one or more institutional investors through a broker. Unlike with an IPO it is not open to the general public.

Placing is a lower risk and lower cost method of issuing shares. Placing is suitable when issuing a lower volume of shares than in an IPO. For such issues the costs of an IPO such as advertisement, marketing and underwriting costs are unjustified by the size of issue.

A private placing normally results in a narrower shareholder base and potentially lower liquidity in the shares once the company has been admitted to a market.

There may be some limits on the maximum amount of an issue that can be placed. This will depend on local law.

Placing is popular with listing on the AIM (Alternative Investment Market). AIM is an alternative to the main stock exchange and is more suited to companies with lower capitalization levels than the very largest of companies.

2.1.3. Introduction

Under a stock exchange introduction, no new shares are made available to the market. An 'introduction' describes when shares in a large company are already widely held by the public (typically at least 25% of a company's ordinary share capital - so that a market for the shares already exists) and the company wants its shares to be publicly tradable on a recognized stock market.

A company might execute an 'introduction' in order to enhance the marketability of its shares and gain better access to capital in the future through increased exposure to a wider investor base.

Comparison of Introduction with other methods of raising equity

If the company uses placing a method of raising equity finance as compare to introduction, then it can avail different benefits that are:

- Placings are cheaper and therefore well suited to smaller issues.
- Placings are quicker to perform.
- Placings are likely to involve less disclosure of information.

At the same time if the company uses placing a method of raising equity finance as compare to introduction then it faces different drawbacks that are:

Most of the shares are usually placed with a small number of institutional investors. This means that most of the shares are unlikely to be available for public trading and therefore institutional investors will have control of the company.

2.1.4. Other methods

Right Issue

This is when a company issues new shares to its existing ordinary shareholders. Each shareholder has the right to buy new shares in proportion to their existing shareholding – e.g. "1 for 1" which means a shareholder can buy one new share for each one they already own.

Bonus Issue

With a bonus issue no new capital is raised. The company capitalizes part of its reserves by making a bonus issue to the existing shareholders. This has the effect of increasing the number of shares in circulation (and thus increase liquidity) although as no new capital was raised the average value of the greater number of shares will fall proportionally. This is normally done when company does not want to pay cash dividends.

Difference between Right issue and bonus issue

In case of right issue the company issues shares to its existing shares holders in exchange of consideration that increases the assets of company normally in cash.

In case of bonus issue the company issue shares by capitalizing its existing reserves that increase the shares of company without increasing the assets of company.

For example, if company 'A' limited issued 5,000 right shares to existing shares holders of Rs. 100 per share then at the same time it increases the share capital as well as cash of the company by Rs. 5,000,00.

On the other hand, if company 'A' issues 5,000 bonus shares to its existing shares holders then it only increasing its share capital by Rs. 500,000.

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3. DEBT

Debt finance describes finance obtained when a company borrows money in exchange for the payment of interest.

Debt can be categorized between short-term and long-term depending on the length of time between issuance and maturity. However, this classification is not a perfect science.

Generally speaking, short term finance is used to fund short-term working capital requirements. Long term finance is used for major long-term investments and is usually more expensive and less flexible than short term finance (because the lender is risking their money for longer).

Types of long and short-term debt finance include:

Short-term	Long-term
Overdraft	Bonds, loan stock, debentures, loan notes, commercial paper
Short-term bank loan	Euro bonds
Certificate of deposit	Convertible bonds and warrants
Treasury-bill	Long-term bank loan
Trade credit	

Debt is also classified between redeemable and irredeemable:

- Redeemable debt will be repaid and cancelled.
- Irredeemable debt is (in theory) never repaid. The debt buyer benefits solely from the interest payments they receive.

Irredeemable debt is less common compared to redeemable debt although some national, state and local governments and some companies do issue irredeemable debt, typically as bonds or debentures. The other common type of irredeemable debt is when companies issue irredeemable preference shares. These are similar to normal preference shares except that the capital is not repaid.

3.1. Factors influencing the choice of debt finance

Availability

For example, only listed companies will be able to make a public issue of loan notes on a stock exchange. Smaller companies may only be able to obtain significant amount of debt finance from the banks or other financial institutions.

Duration

If finance is sought to buy a particular asset to generate revenue for the business, the period of repayment of the finance should match the length of time that the asset will be generating revenues.

Fixed or floating rates

Expectations of interest rate movements will determine whether a company chooses to borrow at a fixed or floating rate. Fixed rate finance may be more expensive, but the business runs the risk of adverse upward rate movements if it chooses floating rate finance on the other hand it will have to forego the upside potential of rate reduction.

Security and covenants

The choice of finance may be determined by the assets that the business is willing or able to offer as security, also on the restrictions in the covenants that the lenders wish to impose and the business is able to bear.

3.2. Advantages and disadvantages of debt finance

Advantages of debt finance to investors

- Investors are entitled to a fixed return each year thus reducing the risk of variable income (e.g. dividends).
- In the case of non-payment of interest, debt holders can appoint a liquidator.
- Debt is attractive to investors because it will be secured against the assets of the company.
- In the case of liquidation debt holders rank higher than other payables for recovery of dues.

Advantages of debt finance to the company

- Debt is a cheaper form of finance than equity because, unlike dividends, debt interest is tax deductible in most tax regimes.
- Debt holders do not have any voting rights and therefore will not participate in the decision making process therefore the current owners do not have to yield decision making powers.
- In the case of high profits companies only have to pay a fixed interest.
- There is no immediate dilution in earnings and dividends per share.
- Low issuance cost as compared to equity.
- Provides the company with a facility to raise cash.

Disadvantages of debt finance to investors

- Debt holders do not have any voting rights.
- In case of high profit, their interest will be limited (fixed interest).
- If the bonds or debentures are unsecured, the investment will be high risk compared to secure loans.

Disadvantages of debt finance to the company

- Companies have to provide security against the debt provided which may limit their use of the mortgaged asset.
- In the case of very low profits or losses fixed interest still has to be paid.
- In the case of non-payment of interest debt holders can appoint liquidators which will affect the reputation of the company.
- In the case of company liquidation, the company must repay the debt holders first.
- The future borrowing capacity of the firm will be reduced as there will be fewer assets to provide security for future loans.
- The real cost is likely to be high as compared with other sources of finance.
- The more highly geared the company, the higher will be its risk profile.

3.3. Selection of Source of finance

Decision of selecting the source of finance by the company is very critical for its long term survival.

For evaluating the source of finance the company should consider its gearing level as:

Equity is used to provide long-term finance. 'Gearing' describes the balance of long-term financing between non-interest-bearing Equity and interest-bearing Debt – the higher the proportion of interest-bearing debt the higher the gearing. Equity finance may be used in preference to debt finance if the company is already highly geared.

Note that per company law private companies are typically not allowed to offer shares for sale to the public at large. In such cases the private limited company would need to convert to a public limited company to enable it to offer shares for sale to the public.

3.4. Bonds, loan notes, debentures, commercial paper and loan stock

The basic principle of bonds, loan notes, debentures, commercial paper and loan stock is the same. An investor loans money to a company in exchange for receiving interest and the subsequent repayment of the loan.

All these instruments have a '**par value**' that signifies the debt owed by a company to the instrument holder.

These instruments can be bought and sold on the capital markets. These markets are known as secondary markets, since they trade debt that has already been issued. The market value may be different from the par value. This is because the market value depends upon market forces and interest rate expectations.

Interest is usually paid every year or every six months and is calculated on the par value. Usually the interest rate is fixed: however, it may also be floating (variable) related to the current market interest rate.

In today's markets the terms bonds, loan note, debentures and commercial paper are often used interchangeably although the legal definition can vary between jurisdictions.

The most commonly accepted differences between the instruments are:

- **Commercial paper** – very short term with a maturity of less than 9 months
- **Loan note** – short term with maturity of less than 12 months in the case of government notes, or less than 5 years for corporate loan notes
- **Debenture** – unsecured long-term loan
- **Bond** – secured long-term loan (typically between 5 and 20 years)

For the rest of this section we will use the generic term 'loan stock' to include bonds, loan notes, debentures and commercial paper.

Market value of loan stock

Unlike shares, debt is often issued at **par** which is Rs100 (also called **nominal** value). Where the **coupon** (interest) rate is fixed at the time of issue, it will be set according to prevailing issuing debt.

Subsequent changes in market and company conditions will cause the market value of the bond to fluctuate, although the coupon will stay at the fixed percentage of nominal value.

The basic principle for valuing loan stock based on future expected returns is:

Value of debt =	(Interest earnings x annuity factor)	+	(Redemption value x Discounted cash flow factor)
OR			
M.V. of debt= P.V of interest payments+ P.V of redemption value			

The market will also take account of other market factors such as reputation, interest rate expectations and risk when valuing debt. Detailed valuation is outside the scope of this paper.

► *Example 01:*

If 'A' limited has the following data

Interest per annum	Rs. 490
Required rate of return	10%
Loan agreement	5 years
Interest rate	7% p.a
Redemption value	7% premium
Loan amount	7000

In the above context the market value of debt is =(490 x 3.79) + (7490 x .621)

= 1857 + 4651

= Rs. 6508

Charge (mortgage) on loan stock

Loan stock may be secured through a fixed or floating charge on assets. A fixed charge may be on specific assets such as land and buildings. The specified assets cannot be sold while the loan is outstanding. A floating charge is a charge on a class of assets, such as inventory, receivables or machinery. Sale of some assets of the class is permitted. When a fault arises, such as a default in payment of interest, a floating charge converts into a fixed charge on the specific class of assets.

Interest rate on loan stock

Interest rate can be fixed (agreed at the outset) or floating (vary over the life depending on prevailing market interest rates).

3.4.1. Deep discounted bonds

A deep discount bond is a bond offered at a large discount on the par value of the debt so that a significant proportion of the return to the investor comes by way of a capital gain on redemption rather than through interest payment.

3.4.2. Zero coupon bonds

A zero coupon bond is the extreme case of a deeply discounted bond with an interest rate of zero. All investor returns are gained through capital appreciation.

Advantages of zero coupon bonds to borrowers

- Zero coupon bonds can be used to raise cash immediately without the need to repay cash until redemption.
- The cost of redemption is known at the time of issue and so the borrower can plan to have funds available to redeem the bonds at maturity.

Advantages of zero coupon bonds to lenders

- The advantage for lenders is restricted, unless the rate of discount on the bonds offers a high yield.
- They are ideal for investors who are willing to sacrifice periodic return for a higher return at maturity.
- The only way of obtaining cash from the bonds before maturity is to sell them, and their market value will depend on the remaining term to maturity and current market interest rates.

3.4.3. Euro bonds

A Eurobond is a bond denominated in a currency that is not native to the country where it is issued.

Eurobonds are named after the currency they are denominated in. For example:

- A Eurodollar bond could be issued anywhere outside the USA
- A European bond could be issued anywhere outside Japan
- A Euro sterling bond could be issued anywhere outside the UK

Eurobonds are normally issued by an international syndicate and are an attractive financing tool as they normally have small par values and high liquidity. Eurobonds give the issuer flexibility to choose the country in which to offer their bond according to the country's regulatory constraints.

3.4.4. Convertible bonds and warrants (hybrids)

A **hybrid** is a financial instrument that combines features of equity and debt. Convertible bonds and warrants are examples of hybrids.

Convertible bonds are fixed interest debt securities which give the holder the right to convert the bond into ordinary shares of the company. The conversion takes place at a pre-determined rate and on a pre-determined date. If the conversion does not take place the bond will run its full life and be redeemed on maturity. Conversion rates often vary overtime.

Once converted, convertible securities cannot be converted back into original fixed return security.

A **warrant** is similar to a convertible bond in that the warrant allows the holder to buy stock at a set price (rather than convert the underlying bond into stock). As such the 'stock' part of a warrant can be separated from the bond and traded on its own whereas a convertible bond cannot be separated.

3.4.5. Features of convertible securities

How they work

Interest is paid at an agreed rate for a specified period. At the end of the period the holder can choose to be repaid in cash or to change the debt into equity shares. Whether or not conversion occurs depends on the share price at the conversion date.

The issuing company will need to raise cash in order to pay back the amount if conversion is not chosen.

Conversion rate

The conversion rate is expressed as a conversion price. i.e. the price of one ordinary share that will be appropriated from the nominal value of the convertible bond. Conversion terms may vary over time.

Conversion value

The current market value of ordinary shares into which a loan note may be converted is known as the conversion value. The conversion value will be below the value of the note at the date of issue, but will be expected to increase as the date for the conversion approaches on the assumption that a company's shares ought to increase in market value over time.

Conversion premium

A conversion premium is the difference between the market price of the convertible bond and its conversion value. In other words, it is the difference between the market price of the convertible bond and the market price of shares into which the bond is expected to be converted.

Conversion value	= Conversion ratio x Market price/share (Ordinary shares)
Conversion premium	= Current market Price/Value - Conversion value

As the conversion date approaches the market price of a convertible bond and its conversion value tend to be equal. In other words, the conversion premium will be negligible. Initially the conversion value is lower than the market value of the bond. The conversion premium is proportional to the time remaining before conversion. It is highest in the beginning and decreases so that, just before conversion, it is negligible.

- Interest rate on convertible debt

  Convertible securities attract lower interest rates than straightforward debt due to the presence of a conversion right. The lender is, in effect, lending money and buying a call option on the company's shares.

- Market price of convertibles

  The actual market price of convertible notes depends upon:

  - The price of straight debt.
  - The current conversion value.
  - The length of time before conversion may take place.
  - The markets expectation as to future equity returns and the risks associated with these returns.

Advantages of convertible bonds to a company

- Convertible bonds serve a company as delayed equity. Thus a company can delay the issue of ordinary shares (equity) and the resultant reduction in earnings per share (EPS).
- Similarly, if the directors feel that the prices of shares of the company are depressed at present and therefore do not represent a favorable time to issue new ordinary shares immediately it may issue convertible bonds.
- The interest payable on the bond is tax deductible.

- Since interest payments are fixed financial planning becomes easier.
- The convertible bonds are expected to be self-liquidating in the sense that cash is not needed to redeem them.

Advantages of convertible bonds to investors

- A convertible bond offers the unique combination of fixed interest plus lower risk in the beginning and the possibility of higher gains in the long run.
- Investors get an opportunity to participate in the growth of the company.
- It is possible for investors to evaluate the performance of a company and then decide whether to opt for conversion.

Disadvantages of convertible bonds to the company

- On conversion there will be a reduction in EPS.
- On conversion there may be a reduction in the control of existing shareholders.
- Before conversion gearing will be higher, thereby affecting the risk profile of the company.

Disadvantages of convertible bonds to investors

- Future dividend payments are not taken into account in the calculations. Therefore, after conversion there may be less profit available for distribution as dividends. In this case investors will incur an opportunity cost related to their investment.

► *Example 02:*

Aamir Foods Limited (AFL) has issued 8,000 convertible bonds of Rs. 100 each at par value. The bonds carry mark-up at the rate of 8% which is payable annually. Each bond may be converted into 10 ordinary shares of AFL in three years. Any bonds not converted will be redeemed at Rs. 115 per bond.

In the above contexts if the bondholders require a return of 10% and the expected value of AFL's ordinary shares on the conversion day is:

a) Rs. 12 per share

b) Rs. 10 per share

Then the current market price of the bonds is:

Current market value for 8,000 convertible bonds

Year	Description		Cash flows/value for 8,000 bonds	Discount factor at 10%	Current market value for 8,000 bonds, when price per share is	
					(a) Rs. 12	(b) Rs. 10
			Rupees		--------- Rupees -------	
1	Annual interest	(8,000×100×8%)	64,000	0.909	58,176	58,176
2S	Annual interest	(8,000×100×8%)	64,000	0.826	52,864	52,864
3	Annual interest	(8,000×100×8%)	64,000	0.751	48,064	48,064
					159,104	**159,104**

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Year	Description			Cash flows/value for 8,000 bonds	Discount factor at 10%	Current market value for 8,000 bonds, when price per share is	
						(a) Rs. 12	(b) Rs. 10
	Bonds' value at higher of shares' expected value and bonds' redemption value:						
		Expected value of 10 shares	Redemption value of one bond				
3	(a)	**120.00**	115.00	960,000*1	0.751	720,960	
3	(b)	100.00	**115.00**	920,000*2	0.751		690,920
Current market value for 8,000 convertible bonds						**880,064**	**850,024**
*1	*(8,000 × 120)*						
*2	*(8,000 × 115)*						

3.5. Bank loans and overdrafts

3.5.1. Bank loans

Banks provide term loans as medium or long-term financing for customers. The customer borrows a fixed amount and pays it back with interest. The capital is typically repaid at the end of the term although it may be repayable in tranches.

With a loan both the customer and the bank know exactly what the repayment of the loan will be and how much interest is payable and when. This makes planning (budgeting) simpler compared with the uncertainty of the overdraft (see below).

Other features of bank loans include:

- Interest and fees are tax deductible.
- Once the loan is taken interest is paid for the duration of the loan.
- A loan might become immediately repayable if loan covenants are breached but failing that the cash is available for the term of the loan.
- Can be taken out in a foreign currency as a hedge of a foreign investment.
- A company can offer security in order to secure a loan.

Short-term loans are suitable for funding smaller investments and long-term loans are suitable for funding major long-term investments.

Difference between Bank Loan and Loan Stock:

if company wants to know which type of loan is beneficial for it either bank loan or loan stock then it considers the following points:

Feature	Bank loans	Loan stock
Flexibility	It may be possible to alter the terms of the bank loan as the finance requirements of the company changes	Terms are fixed
Confidentiality	Only the bank will require limited information as part of the loan application	Customer will have to fulfil the publicity requirements that an issue of loan stock on the financial markets would need
Speed	Quick to arrange	Slower to arrange due to the need to fulfil the requirements of a public issue

Feature	Bank loans	Loan stock
Costs	Low cost	High issuance costs
Restrictions	Restrictions such as collateral and possible restrictive covenants are normally required	Much less restrictive
Financial information	Detailed financial information such as budgets and management accounts may have to be submitted periodically to the bank	No such submissions required

3.5.2. Overdrafts

With an overdraft facility the borrower can borrow through their current account on a short-term basis up to an agreed overdraft limit. However, overdrafts are repayable on demand whereas term loans are repayable only on the date(s) agreed when the loan was arranged.

Other features include:

- Interest and fees are tax deductible.
- Interest is only paid when the account is overdrawn.
- Penalties for breaching overdraft limits can be severe.

Overdrafts are normally used to finance day-to-day operations and as such form an important component of working capital management policies.

3.6. Leases

An agreement whereby the lessor conveys to the lessee in return for a payment or series of payments the right to use an asset for an agreed period of time (IFRS 16).

As per IFRS 16 lessee shall capitalize all leases except short term and low value lease and IFRS 16 identifies two types of lease for Lessor one is finance lease and other is operating lease:

3.6.1. Finance lease

A finance lease is a lease that transfers substantially all the risks and rewards incidental to ownership of an asset. Title may or may not eventually be transferred.

3.6.2. Operating Lease

An operating lease is a lease other than a finance lease.

The tax deductibility of rental payments depends on the tax regime but typically they are tax deductible in one way or another.

Finance leases are capitalized and affect key ratios (ROCE, gearing)

In both cases:

- legal ownership of the asset remains with the lessor; but
- the lessee has the right of use of the asset in return for a series of rental payments

The leases differ in the following respects for lessor:

	Finance lease	Operating lease
Lease term	Long (compared to the life of the asset). Usually for major part of the asset's life.	Short (compared to the life of the asset)
Risks and rewards of ownership	Pass to the lessee	Remain with the lessor
Insurance of the asset	Lessee's responsibility	Lessor's responsibility

	Finance lease	Operating lease
Maintenance of the asset	Lessee's responsibility	Lessor's responsibility
Ownership	The contract may allow the lessee to buy the asset at the end of the lease (often at a low price – giving the lessee a bargain purchase option)	The contract never allows the lessee to buy the asset at the end of the lease

3.7. Other short-term debt instruments

Other short-term debt instruments which an investor can trade before the debt matures include:

- Certificates of deposit (CDs)
- Treasury bills (T-bills)

Trade credit is a further mechanism for funding short-term financing requirements.

3.7.1. Certificates of deposit (CDs)

A CD is a security that is issued by a bank, acknowledging that a certain amount of money has been deposited with it for a certain period of time (usually, a short term). The CD is issued to the depositor, and attracts a stated amount of interest. The depositor will be another bank or a large commercial organization.

CDs are negotiable and traded on the CD market (a money market), so if a CD holder wishes to obtain immediate cash, he can sell the CD on the market at any time. This secondary market in CDs makes them attractive, flexible investments for organizations with excess cash.

3.7.2. Treasury bills (T-bills)

Treasury bills are issued by a government to finance short-term cash deficiencies in the government's expenditure program. They are essentially bonds issued by the government, giving a promise to pay a certain amount to their holder on maturity.

Treasury bills typically have a term of less than a year to maturity after which the holder is paid the full value of the bill.

3.7.3. Trade Credit

Credit available from supplies is one of the easiest and cheapest sources of short term finance. If credit is obtained, it reduces the need for finance from other sources e.g. banks.

Advantages of trade credit:

- The advantage of trade credit is that no interest is usually charged unless the firm defaults on payment.
- Current assets such as raw materials can be purchased on credit with payment terms normally varying between 30 to 90 days.
- In a period of high inflation, purchasing through trade credit will be very helpful in keeping costs down.

Disadvantages of trade credit:

- Delays in payment will worsen a company's credit rating.
- Additional credit is difficult to obtain if you are currently delaying the payments.
- Cost of trade credit beyond the agreed terms is very high in terms of the penalty interest charged as well as in terms of retaining relations with suppliers.

4. OTHER COMMON SOURCES OF FINANCE

4.1. Venture capital (VC)

The term 'venture capital' is normally used for capital provided to a private company by specialist investment institutions, sometimes with support from banks in the form of loans.

The company must demonstrate to the venture capitalist organization that it has a clear strategy and a convincing business plan.

A venture capital organization will only invest if there is a clear 'exit route' (e.g. a listing on an exchange).

Investment is typically for 3-7 years after which the VC will realize their profits and exit the investment.

Factors to consider the appropriateness of Venture Capital:

- VC is an important source of finance for management buy-outs.
- VC can provide finance to take young private companies to the next level.
- VC may provide cash for start-ups but this is less likely.

4.2 Business angels

Business angels are wealthy individuals who invest directly in small businesses, usually by purchasing new equity shares. Angels do not get involved in the management of the company.

Business angels are not that common. There is too little business angel finance available to meet the potential demand for equity capital from small companies. Business angels are a way for small companies to raise equity finance, normally at the very start of their life.

4.3 Private equity funds

Private equity describes equity in operating companies that are not publicly traded on a stock exchange.

Private equity as a source of finance includes venture capital and private equity funds.

A private equity fund looks to take a reasonably large stake in mature businesses.

In a typical leveraged buyout transaction, the private equity firm buys majority control of an existing or mature company and tries to enhance value by eliminating inefficiencies or driving growth.

Their view is to realize the investment, possibly by breaking the business into smaller parts.

Private equity's approaches to eliminate inefficiencies usually by downsizing have attracted criticism.

Factors to consider the appropriateness of private equity fund. For example, if the company wants to judge when private equity fund is appropriate it should consider the following points:

- If used as a source of funding a private equity fund will take a large stake (30% is typical) and appoint directors.
- Private equity is a method for a private company to raise equity finance where it is not allowed to do so from the market.

4.4 Asset securitization and sale

Securitization is the process of converting existing assets or future cash flows into marketable securities.

Typically, the following occur simultaneously:

- Company A sets up Company B (described as a special purpose vehicle or SPV) and transfers an asset to it (or rights to future cash flows).
- Company B issues securities to investors for cash. These investors are then entitled to the benefits that will accrue from the asset.
- The cash raised by Company B is then paid to Company A.

In substance this is like Company A raising cash and using the asset as security. Accounting rules might require Company A to consolidate Company B even though it might have no ownership interest in it.

Conversion of existing assets into marketable securities is known as asset-backed securitization and the conversion of future cash flows into marketable securities is known as future-flows securitization.

Factors to consider the appropriateness of asset securitization and sale

- Asset securitization is used extensively in the financial services industry.
- Securitization allows the conversion of assets which are not marketable into marketable ones.
- Securitization allows the company to borrow at rates that are commensurate with the rating of the asset. A company with a credit rating of BB might hold an asset rated at AA. If it securitizes the asset it gains access to AA borrowing rates.

5. DIRECT AND INDIRECT INVESTMENT

Direct investment describes when an investor owns all or part of an asset. With indirect investment, the investor gains exposure to the risks and rewards of an underlying asset without actually owning it through vehicles such as securities, funds, derivatives and private equity. For instance, A direct investor might own a building then make a profit from the capital appreciation when they sell the building. Whereas, an indirect investor might invest in an investment fund whose return is then based on the average movement in property values. They will therefore make a profit as property values grow without actually owning the building.

Similarly, a direct investor would buy shares in a company and an, an indirect investor might invest in a pension fund that speculates on the movement in market price of shares through buying futures.

Foreign Direct Investment (FDI)

FDI describes when a company invests in overseas operations either by buying (and directly owning) a foreign company, or by expanding existing operations overseas.

Difference between Direct & Indirect investment

Direct and indirect investment can normally be differentiated by levels of divisibility, liquidity and holding period.

Note though that these are general observations rather than specific rules. The main differences are:

	Direct investment	Indirect investment
Divisibility	Often required to fund the whole project – e.g. building and owning an overseas distribution network. Thus greater levels of capital are required.	More opportunity to spread the risk and share the indirect investment with other investors. This enables the investor to invest in more opportunities each one with a more modest amount. For example being part of a syndicate of 20 investors who invest in 20 different start-up opportunities through an overseas holding company exposes the investor to 20 opportunities rather than just one.
Liquidity	Normally illiquid due to the size (larger) and uniqueness of the investment.	More liquid than direct investments as investment funds are often open-ended with investors entering and leaving the investment vehicle frequently in an open market.
Holding period	Potentially longer-term, may be permanent. For example owning a factory in a foreign territory.	Medium term. For example investing in a real estate investment fund until a price target has been met.

Investment vs. speculation

Investment and speculation are similar in that they both involve an investor risking capital in the expectation of making a profit. However, a number of differences exist as detailed in the table below.

Feature	Investment	Speculation
Timeframe	Normally long-term	Often short to medium- term
Attitude to risk	Risk neutral	Risk seeker
Liquidity	Investment usually involves putting money into an asset that isn't typically marketable in the short term. The objective is to yield a series of returns over the life of the investment.	Speculators often invest in more marketable assets as they do not plan to own them for too long.
Volatility	Investors build their strategy based on the expectation that a certain price movement or income stream will occur.	Speculators will normally expect some kind of change without necessarily knowing what.

Feature	Investment	Speculation
Investment risk	Low-moderate risk	Moderate-high risk
Expected returns	Moderate returns for taking moderate risk	High returns in exchange for high risks.
Where do returns come from?	Yield (interest, dividends, coupons) and capital (price) appreciation	Capital (price) appreciation
Basis for investment choice	Careful research	Intuition, rumor, charts, some research

- *Example 03:*

An investor might opt to buy shares in large established companies with a strong record of paying a steady (modest) dividend and increasing the share price steadily yet consistently over a long period.

The speculator on the other hand might look to buy shares in a company they think is about to be taken over. They hope that the take-over will occur soon which would attract a sharp increase in share price in the short-term after which the speculator would immediately sell their shares.

Similarly, with property, an investor may buy a rental property in an area where rentals are consistently strong with the intention of owning the property for say 20 years. The speculator might buy a property in the hope that the site will be bought at a significant premium in the short term say for retail or social development.

6. OTHER FINANCIAL INSTRUMENTS

6.1. Options

An option gives the holder the right, but not the obligation to trade 'something'. The 'something' might be shares, a foreign currency or a commodity.

The holder of an option pays a **premium** in exchange for the option. This is similar to paying a car insurance premium i.e. the fee paid in advance to cover a subsequent event that may or may not occur.

If the holder of the option takes up the option, this is called '**exercising'** the option.

Let's say an investor pays a premium of Rs. 300 for the option to buy a share in Company A for Rs. 20,000 in 3 months' time. Rs. 20,000 is called the '**strike price'**.

If the price of shares in Company A is Rs. 25,000 in 3 months' time then the holder of the option will exercise their right to buy a share at Rs. 20,000. They could immediately see that share for Rs. 25,000 in the open market making a profit of Rs. 5,000 (less the original option premium of Rs. 300).

However, if in 3 months' time the market price of shares in company A is only Rs. 18,000. In this case the holder of the option will not exercise their option to buy for Rs. 20,000 as they can buy shares in Company A at that time in the open market for Rs. 18,000. In this case the option '**lapses'** (i.e. is not exercised).

The option to buy something in the future is called a **CALL option**. The option to sell something in the future is called a **PUT option**.

When the market price of the underlying product (e.g. a share) is such that to exercise the option would enable the option holder to make a profit this is called '**in the money**'. If the underlying price is such that to exercise the option would lose money, the option is said to be '**out of the money**'.

So in the previous example the call option with a strike of Rs. 20,000 is 'in the money' when the market price of the shares is above Rs. 20,000, but 'out the money' when the market price of the shares is trading below Rs. 20,000.

Options have both an intrinsic value and a time value.

6.1.1 Intrinsic value

Intrinsic value is the difference of an 'in-the-money' option between the underlying's price and the strike price. An 'out-the-money' option has no intrinsic value.

- Intrinsic value (call option) = underlying price – strike price
- Intrinsic value (put option) = strike price – underlying price

6.1.2 Time value

Time value describes the excess premium paid above the intrinsic value for the 'potential' that the underlying price will move sufficiently before exercise date in order to secure an overall profit. It follows then that time value decreases over time and decays to zero at expiration. This is called 'time decay'.

Time value = premium – intrinsic value

6.1.3 Options can be further classified as follows:

- **Exchange traded options** – these are standardized products traded in an open market.
- **Over the counter (OTC) options** – these are bespoke products where terms are agreed specifically between the two counterparties.

▶ *Example 04:*

Company A purchases a call option giving it the right to buy shares in Company B in 6 months' time for Rs. 500. The current share price of Company B is Rs. 450.

In 6 months' time, if the market price of shares in Company B is above Rs. 500 then Company A will exercise its right to buy shares at the pre-determined price of Rs. 500.

However, if the market price of Company B shares is below Rs. 500 in 6 months' time then Company A would let the option lapse (i.e. why would it buy shares at Rs. 500 when it could just go to the open market and buy them for a lower market price).

- *Example 05:*

If an investor paid a premium of Rs. 300 for the option to buy 500 shares in ABC limited for Rs. 20,000 at any time the next three months. The investor exercised his right to buy the shares when the price in the market was Rs. 50 per share.

In the context of the above example strike price is 40 per share. Because in the example the investor has an option to buy shares so it is a call option. There would be a loss of Rs. 5940-35) per share, if the investor exercises the option to buy shares at a strike price of Rs. 40 per share as against the prevailing market price of Rs. 35 per share. Therefore, the option was termed as out the money.

- *Example 06:*

If an investor paid a premium of Rs. 60 to buy a put option at a strike price of Rs. 300. The current market price of the share is Rs. 260.

In the above context if the investor wants to know the profit/loss if the market price of the share on the expiry date of the option i.e. 30 days from now is:

1) Rs. 180 : Strike price-underlying price

=300 – 180 -60

= 60 (profit)

2) Rs. 260 : Strike price – underlying price

=300 – 260

=Rs. 20 Loss

3) Rs. 380 : Strike price – underlying price

= (Rs.60) (loss)

(option should not be exercised and should be allowed to lapse.)

- *Example 07:*

On 1 January 2019, Marigold Enterprises (ME) purchased an option for Rs. 10,000 allowing ME to buy 5,000 shares of Aroma Limited (AL) at a price of Rs. 140 per share, during the next two months. On 12 February 2019, ME purchased the shares at the agreed price when the market value of AL's shares was Rs. 180 per share.

Briefly explain each of the following terms and relate each term to the above scenario, wherever possible:

(i) 'Call option' and 'Put option'

(ii) 'In the money' and 'Out the money'

i. 'Call option' and 'Put option'

An option to buy something in the future is called a 'call option'.

An option to sell something in the future is called a 'put option'.

In the given situation, option is for purchase of shares, therefore, it is a 'call option'.

ii. 'In the money' and 'Out the money'

When the market price of the share is such that by exercising the option, the option holder makes a profit, the option is said to be 'in the money'.

When the market price of the share is such that by exercising the option, the option holder suffers a loss, the option is said to be 'out the money'.

By exercising the option, ME made a profit of Rs. 38 (180–140–2) per share, therefore, the option is said to be 'in the money'.

6.1.4 Currency options

Currency options offer an advantage over both currency forwards and futures (see below) since they not only protect against downside risk but also allow the buyer of the option to take advantage of favorable currency movements. This is possible by allowing the option to lapse by paying-off the option premium.

When is a currency option used?

- Where there is uncertainty about foreign currency receipt and payments
- To support an overseas contract priced in a foreign currency
- To allow the publication of price list for its goods in a foreign currency
- To protect the import or export of price sensitive goods. If there is a favorable movement in exchange rates, options allow the importers or exporters to profit from the favorable change but in case of unfavorable movements the strike price would set the floor or the ceiling for the exchange rate.

6.2. Caps, collars and floors

A cap is a ceiling agreed to an interest rate

A floor is a lower limit set for an interest rate

A collar combines both caps and floors thus maintaining the interest rate within a particular range.

▶ *Example 08:*

A company's current prevailing variable borrowing rate is 8%.

The company treasurer has identified that a rise in interest rates above 10% could cause serious financial difficulties for the company.

The company could buy an interest rate cap at 10% from the bank. As part of the deal the company agrees to a floor of 7%.

Thus:

If interest rates rise above 10%, the bank will reimburse the company for the excess in interest payments

If interest rates fall below 7% the company will reimburse the bank the difference.

Note that the company would suffer a fee (premium) levied by the bank for entering into such an arrangement.

6.3. Interest rate swaps

An interest rate swap is an agreement between two parties to exchange interest rate payments. The objective might be to:

- switch from paying one type of interest to another
- Raise less expensive loans
- Securing better deposit rates

In essence, party A agrees to pay the interest on party B's loan, whilst party B agrees to pay the interest on party A's loan.

The counterparties to interest rate swaps are typically the large financial institutions, national and local governments and other international institutions.

The most common motivation for entering a swap agreement is to switch from paying floating (variable) rate interest to fixed rate, and vice versa. This will typically be for either speculative reasons or used for hedging.

► *Example 09:*

Company A currently pays interest on a Rs. 10m loan at a fixed rate of 10%.

Company B currently pays floating rate interest on a Rs. 10m loan at LIBOR + 1% (assume LIBOR is currently 9%).

Company A and Company B enter into an interest rate swap agreement whereby:

- Company A agrees to pay Company B a floating rate of LIBOR + 1% on a notional loan of Rs.10m
- Company B agrees to pay Company A a fixed rate of 10% on a notional loan of Rs. 10m

Note that Company A and Company B retain their original loan obligation. However, when combined with the effect of the interest rate swap, the effect is that Company A ends up paying LIBOR + 1% and Company B pays a fixed 10%.

► *Example 10:*

Unity Limited (UL) has obtained a loan of Rs. 250 million from Eastern Investment Limited (EIL) for 5 years. The loan carries a floating (variable) rate of interest which is paid annually. The existing rate is 10%.

To avoid losses on account of any extra-ordinary increase in interest rate, UL bought an interest rate cap at 12% from Sawera Bank Limited (SBL). In addition, they also agreed to a floor at 8%.

The interest which UL would pay to EIL and the amounts which UL and SBL would pay to settle their obligations towards each other, if the interest rate on the due date is:

a) 13% per annum

b) 6% per annum

Unity Limited			
Amounts payable by UL to EIL:			**Rs. in million**
Interest rate is 13%		250×13%	32.50
Interest rate is 6%		250×6%	15.00
Settlement between UL and SBL:			
Interest rate is 13%	Payable by SBL to UL	(13%-12%)×250	2.50
Interest rate is 6%	Payable by UL to SBL	(8%-6%)×250	5.00

6.4. Currency swaps

A currency swap is an agreement to make a loan in one currency and to receive a loan in another currency.

With currency swaps 3 sets of cash flows are involved:

- Principals are exchanged when the swap starts.
- Interest payments are made over the life of the swaps.
- The underlying principal amounts are re-exchanged.

Banks are involved in swap arrangements as swap dealers.

Advantages of currency swaps

- They enable a company to obtain funds at a cheaper rate than borrowing in domestic markets, thereby resulting in cost reduction.
- They enable a company to restructure its debt profile without physical redemption or issuance of new debt.
- They facilitate access to the international capital markets by avoiding exchange control restrictions.
- They enable a company to hedge its currency exposure for longer time periods than is possible with forwards contracts.

Disadvantages of currency swaps

- If the government imposes exchange control restrictions the swaps may turn out to be risky.
- In the case of adverse movements in exchange rates the swaps may not achieve its purpose of cost reduction.
- There is the possibility that the counterparty may default giving rise to a credit risk. Swaps arranged with a bank as the counterparty tend to be less risky.
- Finding companies whose needs mutually offset one another is difficult and only partially reduces currency exposure risk.
- If a company cannot find a match a **credit swap** may be used. Credit swaps involve a deposit in one currency and a loan in another. The deposit is returned after the loan is repaid.

6.5. Forwards

A forward contract is a binding agreement to exchange a set amount of goods at a set future date at a price agreed today.

Forward contracts are used by business to set the price of a commodity well in advance of the payment being made. This brings stability to the company who can budget with certainty the payment they will need to raise or the revenue that a given set of output would bring.

Forwards are particularly suitable in commodity markets such as gold, agriculture and oil where prices can be highly volatile.

▶ *Example 11:*

A coffee wholesaler needs to purchase coffee beans for future production and wants to acquire them for a fixed price. This can be achieved by agreeing with the producer to purchase a quantity of coffee beans for delivery at a specific date in the future at a price agreed now.

In June when the price of a consignment is Rs. 1m the wholesaler might agree a price with the supplier of Rs. 1.1m for delivery at the end of September which remains set through to delivery.

Forward contracts are tailor-made between the two parties and therefore difficult to cancel (as both sides need to agree). A slightly more flexible approach would be to use futures (see below).

6.6 Futures

Futures share similar characteristics to Forward contracts i.e.:

- Prices are set in advance.
- Futures hedges provide a fixed price.
- Futures are available on commodities, shares, currencies and interest rates.

However, futures are standardized contracts that are traded on an open futures market (unlike forward contracts which are unique to the two counterparties).

Advantages of futures

- Futures are standardized in terms of currencies, the amount and maturity dates.
- Futures are "marked to market" – this means that companies can reflect current market prices at year-end even though the future is yet to mature.

- In futures hedging, there is flexibility of closing a position at any time before the delivery date.
- Futures contracts can be cancelled (or hedged) by an opposite transaction.
- Futures can be arranged quickly and effectively.
- Multiple contracts can be bought or sold.

Disadvantages of futures

- Margins (i.e. a deposit e.g. 6% of the underlying transaction value) are tied up in making the contracts until position is reversed.
- Considerable administration costs are involved in managing them.
- Continuous monitoring and decision making is required to ensure that intended rates work effectively.

▶ *Example 12:*

A coffee wholesaler needs to purchase coffee beans for future production in September but wants certainty over the price.

In June when the price of a consignment is Rs. 1m the wholesaler might buy a coffee futures contract at Rs. 1.1m that expires 30 September. This means the coffee wholesaler is committing to buying a consignment at Rs. 1.1m in September.

6.6.1 Currency futures

A foreign exchange futures contract is an agreement between two parties to buy or sell a particular currency at a particular rate on a particular future date.

When entering into a currency futures contract no one is actually buying or selling anything. The participants are agreeing to buy or sell currencies on pre-agreed terms at a specified future date if the contract is allowed to reach maturity which it rarely does.

The range of available rates contracts is however limited and usually only cover major currencies.

STICKY NOTES

Sources of Finance may include Equity and Debt. There are certain factors which may be considered before selecting sources of finance

Equity financing may include ordinary as well preference shares as well as in addition, methods of flotation include Initial public offer, private placing, right or bonus issues

Debt Financing would include bonds, loan notes, debentures, commercial paper and loan stock. Lease is another form of debt financing. Each of the source has its own advantage and disadvantage.

Other Common Sources Of Finance may include Venture Capital, Business Angles, Private equity funds and asset securitisation and sale

Direct and Indirect Investment & Speculation would be required to note for Divisibility, Liquidity and Holding period.

Other Financial Instruments may include options, Caps, Collars and Floors Interest rate swaps, Currency swaps, Forwards and forwards

CHAPTER 17

TIME VALUE OF MONEY

IN THIS CHAPTER

AT A GLANCE

The objective of learning time value of money concept involves the evaluation and appraisal of investment projects involving capital expenditures. Capital expenditure refers the spending on non-current assets such as building, machinery, equipment or investing in new business.

The purpose of investment appraisal is to make decision about whether the capital expenditures project is worthwhile and whether investment project should be undertaken.

The core principles and techniques for evaluating capital expenditure project are predicted in four following steps

1. The estimation of expected future cash flows from projects (cash receipt & cash payments) using relevant costing principles.
2. The determination of expected future period where estimated expected future cash flows (cash inflows & cash outflows) will be occurred.
3. Apply the time value of money concept and discount future cash flows to present values using discount factor or cost of capital.
4. To make decision for acceptance or rejection of proposed investment project using discounted cash flows techniques(DCF). There are two techniques involving DCF concepts for evaluation of investment projects that are Net Present Value Method(NPV) and Internal rate of return(IRR)

1. CORE PRINCIPLE & FOUR STEPS MODEL

The core principles of evaluating investment projects involving capital expenditures using time value of money concept is based on discounted cash flows methods (DCF). Using DCF techniques like Net present value method (NPV) and internal rate of return, an entity can decide whether investment project should be undertaken or not.

The core principle is defined in following four steps model framework:

Step 1: The estimation of expected future cash flows from projects (cash receipt & cash payments) using relevant costing principles.

Step 2: The determination of expected future period where estimated expected future cash flows (cash inflows & cash outflows) will be occurred.

Step 3: Apply the time value of money concept and discount future cash flows to present values using discount factor or cost of capital.

Step 4: To make decision for acceptance or rejection of proposed investment project using discount cash flows techniques(DCF). There are two techniques involving DCF concepts for evaluation of investment projects that are:

a) Net Present Value Method(NPV)

b) Internal rate of return(IRR)

1.1 Step 1: Estimation of expected future cash flows

The expected future cash flows related to investment project are measured using relevant costing principles.

Expected cash flows are:

a) The amount that will be spent for purchase of non-current asset. It involves large sum of money normally occurred at the start of project.

b) Future cost and revenues (cash inflows and cash outflows) arise from the use of non-current assets.

c) Disposal value of asset at the end of its useful life.

d) The investment in working capital related to investment projects.

1.1.1 Relevant costing principles:

As investment appraisal of capital expenditures based on decision making techniques so relevant costs and revenues should be used in decision of acceptance or rejection of investment projects.

1.1.2 Definition of relevant cost and benefits

Relevant costs are cash flows. Any items of cost that are not cash flows must be ignored for the purpose of decision. For example, depreciation expenses are not cash flows and must always be ignored.

Relevant costs are future cash flows. Costs that have already been incurred are not relevant to a decision that is being made now. The cost has already been incurred, whatever decision is made, and it should therefore not influence the decision. For example, a company might incur initial investigation costs of Rs. 20,000 when looking into the possibility of making a capital investment. When deciding later whether to undertake the project, the investigation costs are irrelevant, because they have already been spent and are not recoverable if the investment is not undertaken.

Relevant costs are also costs that will arise as a direct consequence of the decision, even if they are future cash flows. If the costs will be incurred whatever decision is taken, they are not relevant to the decision.

Relevant costs can also be measured as an opportunity cost. An opportunity cost is a benefit that will be lost by taking one course of action instead of the next-most profitable course of action.

- *Example 01:*

A company is considering an investment in a major new information system. The investment will require the use of six of the company's IT specialists for the first one year of the project.

These IT specialists are each paid Rs. 100,000 each per year. IT specialists are difficult to recruit. If the six specialists are not used on this project, they will be employed on other projects that would earn a total contribution of Rs. 500,000. The relevant cost of the IT specialist in Year 1 of the project would be:

	Rs.
Basic salaries	600,000
Contribution forgone	500,000
Total relevant cost	1,100,000

- *Example 02:*

A company has been asked by a customer to carry out a special job. The work would require 20 hours of skilled labor time. There is a limited availability of skilled labor, and if the special job is carried out for the customer, skilled employees would have to be moved from doing other work that earns a contribution of Rs.60 per labor hour.

A relevant cost of doing the job for the customer is the contribution that would be lost by switching employees from other work. This contribution forgone (20 hours × Rs.60 = Rs.1,200) would be an opportunity cost. This cost should be taken into consideration as a cost that would be incurred as a direct consequence of a decision to do the special job for the customer. In other words, the opportunity cost is a relevant cost in deciding how to respond to the customer's request.

Conclusion:

a) Variable cost is normally relevant for decision making like incremental, differential, avoidable, opportunity, cost are example of relevant cost.

b) Fixed cost are normally irrelevant (other than incremental fixed cost) like Sunk or past cost, unavoidable, committed cost are examples of irrelevant cost.

1.1.3 Relevant cost of materials

As explained earlier in the text, relevant costs of materials are the additional cash flows that will be incurred (or benefits that will be lost) by using the materials for the purpose that is under consideration.

If **none of the required materials are currently held as inventory**, the relevant cost of the materials is simply their purchase cost and if the required materials are currently held as inventory, the relevant costs are identified by applying the certain rules.

Note that the historical cost of materials held in inventory cannot be the relevant cost of the materials, because their historical cost is a sunk cost.

The relevant costs of materials can be described as their 'deprival value'. The deprival value of materials is the benefit or value that would be lost if the company were deprived of the materials currently held in inventory.

1.1.4 Relevant cost of labor

The relevant cost of labor for any decision is the additional cash expenditure (or saving) that will arise as a direct consequence of the decision. If the cost of labor is a variable cost, and labor is not in restricted supply, the relevant cost of the labor is its variable cost. If labor is a fixed cost and there is spare labor time available, the relevant cost of using labor is 0. The spare time would otherwise be paid for idle time, and there is no additional cash cost of using the labor to do extra work. If labor is in limited supply, the relevant cost of labor should include the opportunity cost of using the labor time for the purpose under consideration instead of using it in its next-most profitable way.

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1.1.5 Relevant cost of overheads

Relevant costs of expenditures that might be classed as overhead costs should be identified by applying the normal rules of relevant costing. Relevant costs are future cash flows that will arise as a direct consequence of making a particular decision.

1.1.6 Relevant cost of existing equipment

When new capital equipment will have to be purchased for a project, the purchase cost of the equipment will be a part of the initial capital expenditure, and so a relevant cost.

However, if an investment project will also make use of equipment that the business already owns, the relevant cost of the equipment will be the higher of:

- The current disposal value of the equipment, and
- The present value of the cash flows that could be earned by having an alternative use for the equipment.

▶ *Example 03:*

A company bought a machine six years ago for Rs. 125,000. Its written down value is now Rs. 25,000. The machine is no longer used for normal production work, and it could be sold now for Rs. 17,500. A project is being considered that would make use of this machine for six months. After this time the machine would be sold for Rs. 10,000.

Relevant cost = Difference between sale value now and sale value if it is used. This is the relevant cost of using the machine for the project.

Relevant cost = Rs. 17,500 - Rs. 10,000 = Rs. 7,500.

1.1.7 Relevant cost of investment in working capital

It is important that you should understand the relevance of investment in working capital for cash flows. This point has been explained previously.

Strictly speaking, an investment in working capital is not a cash flow. However, it should be treated as a cash flow, because:

- When capital investment projects are evaluated, it is usual to estimate the cash profits for each year of the project.
- However, actual cash flows will differ from cash profits by the amount of the increase or decrease in working capital.
- You should be familiar with this concept from cash flow statements.
- If there is an increase in working capital, cash flows from operations will be lower than the amount of cash profits. The increase in working capital can therefore be treated as a cash outflow, to adjust the cash profits to the expected cash flow for the year.
- If there is a reduction in working capital, cash flows from operations will be higher than the amount of cash profits. The reduction in working capital can therefore be treated as a cash inflow, to adjust the cash profits to the expected cash flow for the year.
- The investment in working capital is assumed to be recovered at the end of project. Unless it is stated that it may be recovered straight line basis.

▶ *Example 04:*

A company is considering whether to invest in the production of a new product. The project would have a six-year life. Investment in working capital would be Rs. 30,000 at the beginning of Year 1 and a further Rs. 20,000 at the beginning of Year 2.

It is usually assumed that a cash flow, early during a year, should be treated as a cash flow as at the end of the previous year.

The relevant cash flows for the working capital investment would therefore be as follows:

Year	Rs.
1 (cash outflow)	(30,000)
2 (cash outflow)	(20,000)
6 (cash inflow)	50,000

1.2 Step 2: Timing of Cash flows

The identification of timing of future estimated cash flows is very important. It must be clear at what time the cash flows whether cash outflows or cash inflows related to project will be occurred.

As the investment decision is based on discounting future cash flows to their present values using the time value of money concept, for discounting future cash flows discount factor will be used so determination of exact timing of future cash flows is very critical for choosing and applying exact discount factors.

The following assumptions are made about the timing of cash flows during each year:

- All cash flows for the investment are assumed to occur at a discrete point in time (usually the end of the year).
- If a cash flow will occur early during a particular year, it is assumed for the sake of simplicity that it will occur at the end of the previous year. Therefore, cash expenditure early in Year 1, for example, is assumed to occur at time 0.

Time 0 cash flows

Often cash flows are described as occurring in a particular year (e.g. year 1, year 2 etc.). The project commences at time 0. Sometimes time 0 is described as year 0 but this is misleading. There is no year 0, it can be assumed to be the present time. The first year (year 1) starts at time 0 and ends one year after this.

Cash flows at the beginning of the investment (at time 0) are already stated at their present value.

► *Example 05:*

A company is considering a new large project. It owns a piece of land that it bought for Rs. 6,000 over forty years ago. This land is currently not being used but could be sold now for Rs. 1.2 million. If it is used it could be sold in three years' time for Rs. 1.3 million.

The company will spend Rs. 500,000 building a work processing plant for the project. The company finances the plant with a three-year bank loan at 5%. The resale value of the plant is Rs. 50,000 at the end of year 3.

The raw material requirements for the project output of 100 tons of Product X together with information about amounts already held are as follows:

Raw material	A	B
Current amounts in inventory (tons)	100	100
Cost (per ton)	Rs.95	Rs.80
Scrap value (per ton)	Rs.30	Toxic
Replacement cost (per ton)	Rs.100	Rs.90
Used elsewhere?	Yes	No
Contribution per ton used on other products**		
(**contribution = after deduction of current replacement cost)	Rs.40	Rs.400
Annual requirement (tons)	200	100

Notes

Raw material B is toxic. No further supplies are available until the end of the first year. Material B is also being used in another product, for which 50 tons are required annually. This other product is being discontinued from the end of year 1.

There are no other uses for Material B. To dispose of material B would cost the company Rs.125 per ton.

The standard cost card prepared by the management accountant shows a cost for Product X of Rs.450 per ton produced. This includes a direct labor cost of Rs.100 per unit of Product X.

There is spare capacity in the labor force – no extra personnel or overtime will be needed to produce the new product.

Receipts from sales will be:

Year 1	Rs.500,000
Year 2	Rs.500,000
Year 3	Rs.300,000

The project will last three years. Assume that all cash flows occur at the end of the relevant year.

The expected future cash outflows and inflows for calculation of Net Cash Flows are:

1. **Land**

   By undertaking the project, the company will forgo the immediate sale of the land, for which it could obtain Rs.1,200,000. This revenue forgone is an opportunity cost. However, if the project is undertaken, the land can be sold at the end of Year 3 for Rs.1,300,000

2. **Plant**

   The relevant cash flows are its current cost (the Rs.500,000 is assumed to be a cash cost) and its eventual disposal value. The 5% financing of the plant is irrelevant and must be ignored: interest costs are implied in the cost of capital, which is 10%, not 5%.

3. **Labor costs**

   Labor costs are irrelevant because they are not incremental cash flows. The wages or salaries will be paid whether or not the project goes ahead.

4. **Material A costs**

   Material A is in regular use; therefore, its relevant cost is its replacement cost. Annual cost = 200 tons × Rs.100 = Rs.20,000.

5. **Material B costs**

   100 tons are currently in inventory and no additional units can be obtained until Year 2. The choices are to use all 100 tons to make Product X, or to use 50 tons to make the other product and dispose of the remaining 50 tons.

The other product earns a contribution of Rs.400 per ton of Material B used, and the contribution is after deducting the replacement cost of the material. The opportunity cost of using the 50 tons to make Product X instead of this other product in Year 1 is therefore Rs.490 per ton. The total opportunity cost of lost cash flow is therefore 50 tons at Rs.490 each = Rs.24,500, but in Year 1 only.

However, by making Product X, the company will also avoid the need to dispose of 50 tons of Material B at a cost of Rs.25 per ton. It is assumed that these costs would be incurred early in Year 1 (T0). Making and selling Product X will therefore save the company disposal costs of 50 tons × Rs.25 = Rs.6,250 at t0.

Based on above analysis the calculation of Net cash flow is as under:

Year	0	1	2	3
	Rs.	Rs.	Rs.	Rs.
Land	(1,200,000)			1,300,000
Plant	(500,000)			50,000
Sales		500,000	500,000	300000
Material A		(20,000)	(20,000)	(20,000)
Material B: disposal costs saved	6,250			
Material B: cash profits forgone		(24,500)		
Material B: purchase costs			(9,000)	(9,000)
Net cash flow	(1,693,750)	455,500	471,000	1,621,000

1.3 Step 3: Discounting Cash flows using time value of money concept

One of the basic principles of finance is that a sum of money today is worth more than the same sum in the future. If offered a choice between receiving Rs 10,000 today or in 1 years' time a person would choose today.

A sum today can be invested to earn a return. This alone makes it worth more than the same sum in the future. This is referred to as the time value of money.

The impact of time value can be estimated using one of two methods:

Compounding which estimates future cash flows that will arise as a result of investing an amount today at a given rate of interest for a given period. An amount invested today is multiplied by a compound factor to give the amount of cash expected at a specified time in the future assuming a given interest rate.

Discounting which estimates the present day equivalent (present value which is usually abbreviated to PV) of a future cash flow at a specified time in the future at a given rate of interest. An amount expected at a specified time in the future is multiplied by a discount factor to give the present value of that amount at a given rate of interest. The discount factor is the inverse of a compound factor for the same period and interest rate. Therefore, multiplying by a discount factor is the same as dividing by a compounding factor. Discounting is the reverse of compounding.

Money has a time value, because an investor expects a return that allows for the length of time that the money is invested. Larger cash returns should be required for investing for a longer term.

These methods are further explained as under:

1.3.1. The time value of money compounding & Annuities

Compound interest

Compound interest is where the annual interest is based on the amount borrowed plus interest accrued to date. The interest accrued to date increases the amount in the account and interest is then charged on that new amount.

Compounding is used to calculate the future value of an investment, where the investment earns a compound rate of interest. If an investment is made 'now' and is expected to earn interest at r% in each time period, for example each year, the future value of the investment can be calculated as follows.

- *Formula:*

$$Sn = So \times (1 + r)^n$$

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Where:

Sn = final cash flow at the end of the loan (the amount paid by a borrower or received by an investor or lender).

So = initial investment

r = period interest rate

n = number of periods

Note that the $(1 + r)^n$ term is known as a compounding factor

► *Example 06:*

A person borrows Rs 10,000 at 10% to be repaid after 3 years.

The calculation for final cash flow would require

$Sn = So \times (1 + r)^n$

$Sn = 10,000 \times (1.1)^3 = 13,310$

► *Example 07:*

A company is investing Rs.200,000 to earn an annual return of 6% over three years. If there are no cash returns before the end of Year 3, the return from the investment after three years is:

$\text{Future value} = \text{Amount today} \times (1+r)^n$

$\text{Future value} = 200,000 \times (1.06)^3 = 238,203$

Annuities

An annuity is a series of regular periodic payments of equal amount.

Examples of annuities are:

- Rs.30,000 each year for years 1 – 5
- Rs.500 each month for months 1 – 24.

There are two types of annuity:

- Ordinary annuity – payments (receipts) are in arrears i.e. at the end of each payment period
- Annuity due – payments (receipts) are in advance i.e. at the beginning of each payment period.

► *Illustration:*

Assume that it is now 1 January 2013

A loan is serviced with 5 equal annual payments.

Ordinary annuity	The payments to service the loan would start on 31 December 2013 with the last payment on 31 December 2017.
Annuity due	The payments to service the loan would start on 1 January 2013 with the last payment on January 2017.

All payments (receipts) under the annuity due are one year earlier than under the ordinary annuity.

Calculating the final value of an annuity

The following formula can be used to calculate the future value of an annuity.

- *Formula:*

> Future value of an annuity
>
> Ordinary annuity $\quad Sn = \frac{X(1+r)^{n}-1}{r}$
>
> Annuity due $Sn = \frac{X(1+r)^{n}-1}{r} \times (1+r)$
>
> Where:
>
> Sn = final cash flow at the end of the loan (the amount paid by a borrower or received by an investor or lender).
>
> X = Annual investment
>
> r = period interest rate
>
> n = number of periods

- *Example 08:*

A savings scheme involves investing Rs.100,000 per annum for 4 years (on the last day of the year).

If the interest rate is 10% the sum to be received at the end of the 4 years is:

$Sn = \frac{X(1+i)^{n}-1}{i} \qquad Sn = \frac{100{,}000(1.1)^{4}-1}{0.1}$

$Sn = \frac{100{,}000(1.4641-1)}{0.1}$

$Sn = \frac{46{,}410}{0.1} = \text{Rs.}\,464{,}100$

- *Example 09:*

A savings scheme involves investing Rs.100,000 per annum for 4 years (on the first day of the year).

If the interest rate is 10% the sum to be received at the end of the 4 years is:

$Sn = \frac{X(1+r)^{n}-1}{r} \times (1+r) \qquad Sn = \frac{100{,}000(1.1)^{4}-1}{0.1} \times 1.1$

$Sn = \frac{100{,}000(1.4641-1)}{0.1} \times 1.1$

$Sn = \frac{46{,}410}{0.1} \times 1.1 = \text{Rs.}\,510{,}510$

Sinking funds

A business may wish to set aside a fixed sum of money at regular intervals to achieve a specific sum at some future point in time. This is known as a sinking fund.

The question will ask you to calculate the fixed annual amount necessary to build to a required amount at a given interest rate and over a given period of years.

The calculations use the same approach as above but this time solving for ***X*** as ***Sn*** is known.

- *Example 10:*

A company will have to pay Rs.5,000,000 to replace a machine in 5 years.

The company wishes to save up to fund the new machine by making a series of equal payments into an account which pays interest of 8%.

The payments are to be made at the end of the year and then at each year end thereafter.

What fixed annual amount must be set aside so that the company saves Rs.5,000,000?

$$Sn = \frac{X(1+i)^n - 1}{i} 5{,}000{,}000 = \frac{X(1.08)^5 - 1}{0.08}$$

$$5{,}000{,}000 = \frac{X(1.469 - 1)}{0.08}$$

$$5{,}000{,}000 = \frac{X(0.469)}{0.08}$$

$$X = \frac{5{,}000{,}000 \times 0.08}{0.469} = \text{Rs.}\,852{,}878$$

1.3.2 The time value of Money-Discounting & Annuities

Discounting

Discounting is the reverse of compounding. Future cash flows from an investment can be converted to an equivalent present value amount.

Present value of future return is the future cash flow multiplied by the discount factor.

- *Formula:*

> $$\textbf{Discount factor} = \frac{1}{(1+r)^n}$$
>
> Where:
>
> r = the period interest rate (cost of capital)
>
> n = number of periods

- *Example 11:*

A person expects to receive Rs 13,310 in 3 years.

If the person faces an interest rate of 10% what is the present value of this amount?

$$\text{Present value} = \text{Future cash flow} \times \frac{1}{(1+r)^n}$$

$$\text{Present value} = 13{,}310 \times \frac{1}{(1.1)^3}$$

$$\text{Present value} = 10{,}000$$

<u>Discount tables</u>

Discount factors can be calculated as shown earlier but can also be obtained from discount tables. These are tables of discount rates which list discount factors by interest rates and duration.

- *Illustration:*

Discount rates (r)						
(n)	5%	6%	7%	8%	9%	10%
1	0.952	0.943	0.935	0.926	0.917	0.909
2	0.907	0.890	0.873	0.857	0.842	0.826
3	0.864	0.840	0.816	0.794	0.772	0.751
4	0.823	0.792	0.763	0.735	0.708	0.683

(Full tables are given as an appendix to this text).

Where:

n = number of periods

- *Example 12:*

The present value of Rs 60,000 received in 4 years assuming a cost of capital of 7%.

From formula $\text{PV} = 60{,}000 \times \frac{1}{(1.07)^4} = 45{,}773$

From table (above) $\text{PV} = 60{,}000 \times 0.763 = 45{,}780$

The difference is due to rounding. The discount factor in the above table has been rounded to 3 decimal places whereas the discount factor from the formula has not been rounded.

Interpreting present value

It is important to realize that the present value of a cash flow is the equivalent of its future value after taking time value into account. Using the above example to illustrate this, Rs 10,000 today is exactly the same as Rs 13,310 in 3 years at an interest rate of 10%. The person in the example would be indifferent between the two amounts. He would look on them as being identical.

Also the present value of a future cash flow is a present day cash equivalent. The person in the example would be indifferent between an offer of Rs 10,000 cash today and Rs 13,310 in 3 years.

The present value of a future cash flow is the amount that an investor would need to invest today to receive that amount in the future. This is simply another way of saying that discounting is the reverse of compounding.

- *Example 13:*

If an investor need to invest now in order to have Rs.1,000 after 12 months, and the compound interest on the investment is 0.5% each month then present value is:

Present value = Rs.1,000 × $[1/(1.005)^{12}]$= Rs.1,000 × 0.942 = Rs.942.

Using present values

Discounting cash flows to their present value is a very important technique. It can be used to compare future cash flows expected at different points in time by discounting them back to their present values thereby aiding in their comparison.

- *Example 14:*

A borrower is due to repay a loan of Rs 120,000 in 3 years.

He has offered to pay an extra Rs 20,000 as long as he can repay after 5 years.

The lender faces interest rates of 7%. Is the offer acceptable?

Existing contract $\text{PV} = 120{,}000 \times \frac{1}{(1.07)^3} = \text{Rs } 97{,}955$

Client's offer $\text{Present value} = 140{,}000 \times \frac{1}{(1.07)^5} = \text{Rs } 99{,}818$

The client's offer is acceptable as the present value of the new amount is greater than the present value of the receipt under the existing contract.

- *Example 15:*

An investor wants to make a return on his investments of at least 7% per year.

He has been offered the chance to invest in a bond that will cost Rs 200,000 and will pay Rs 270,000 at the end of four years.

In order to earn Rs 270,000 after four years at an interest rate of 7% the amount of his investment now would need to be:

$$\text{PV} = 270{,}000 \times \frac{1}{(1.07)^4} = \text{Rs } 206{,}010$$

The investor would be willing to invest Rs 206,010 to earn Rs 270,000 after 4 years.

However, he only needs to invest Rs 200,000.

This indicates that the bond provides a return in excess of 7% per year.

- *Example 16:*

How much would an investor need to invest now in order to have Rs 100,000 after 12 months, if the compound interest on the investment is 0.5% each month?

The investment 'now' must be the present value of Rs 100,000 in 12 months, discounted at 0.5% per month.

$$\text{PV} = 100{,}000 \times \frac{1}{(1.005)^{12}} = \text{Rs } 94{,}190$$

Present values can be used to appraise large projects with multiple cash flows. This is covered later in this chapter.

Annuities

An annuity is a constant cash flow for a given number of time periods. A capital project might include estimated annual cash flows that are an annuity.

Examples of annuities are:

- Rs.30,000 each year for years 1 – 5
- Rs.20,000 each year for years 3 – 10
- Rs.500 each month for months 1 – 24.

The present value of an annuity can be computed by multiplying each individual amount by the individual discount factor and then adding each product. This is fine for annuities of just a few periods but would be too time consuming for long periods. An alternative approach is to use the annuity factor.

An annuity factor for a number of periods is the sum of the individual discount factors for those periods.

- *Example 17:*

The present value of Rs.50,000 per year for years 1 – 3 at a discount rate of 9%.

Year	Cash flow	Discount factor at 9%		Present value
1	50,000	$\frac{1}{(1.09)}$	= 0.917	45,850
2	50,000	$\frac{1}{(1.09)^2}$	= 0 842	42,100
3	50,000	$\frac{1}{(1.09)^3}$	= 0.772	38,600
NPV				126,550
or:				
1 to 3	50,000		2.531	126,550

Annuity discount factors can be used in DCF investment analysis, mainly to make the calculations easier and quicker.

An annuity factor can be constructed by calculating the individual period factors and adding them up but this would not save any time.

In practice a formula or annuity factor tables are used.

- *Formula:*

Annuity factor (discount factor of an annuity)

There are two version of the annuity factor formula:

	Method 1	Method 2
Annuity factor	$= \frac{1}{r}\left(1 - \frac{1}{(1+r)^n}\right)$	$= \left(\frac{1-(1+r)^{-n}}{r}\right)$

Where:

r = discount rate, as a proportion

n = number of time periods

- *Example 18:*

Year	Cash flow	Discount factor	Present value
1 to 3	50,000	2.531 (W)	126,550

Working: Calculation of annuity factor

Method 1:	Method 2:
$= \frac{1}{r}\left(1 - \frac{1}{(1+r)^n}\right)$	$= \left(\frac{1-(1+r)^{-n}}{r}\right)$
$= \frac{1}{0.09}\left(1 - \frac{1}{(1.09)^3}\right)$	$= \left(\frac{1-(1.09)^{-3}}{0.09}\right)$
$= \frac{1}{0.09}\left(1 - \frac{1}{1.295}\right)$	$= \left(\frac{1-0.7722}{0.09}\right)$
$= \frac{1}{0.09}(1 - 0.7722)$	$= \frac{0.2278}{0.09}$
$= \frac{1}{0.09}(0.2278) = 2.531$	$= 2.531$

- *Illustration:*

	Discount rates (r)					
(n)	5%	6%	7%	8%	9%	10%
1	0.952	0.943	0.935	0.926	0.917	0.909
2	1.859	1.833	1.808	1.783	1.759	1.736
3	2.723	2.673	2.624	2.577	**2.531**	2.487
4	3.546	3.465	3.387	3.312	3.240	3.170
5	4.329	4.212	4.100	3.993	3.890	3.791

(Full tables are given as an appendix to this text).

Where:

n = number of periods

- *Example 19:*

The present value of the cash flows for a project, if the cash flows are Rs.60,000 each year for years 1 – 5, and the cost of capital is 9%.

Rs.60,000 × 3.890 (annuity factor at 9%, n = 5) = Rs.233,400.

Note that if an annuity starts at time zero (rather than t1) the annuity factor is adjusted by adding 1 to it.

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▶ *Example 20:*

Year	Cash flow	Annuity factor (9%)	Present value
1 to 3	50,000	2.531 (as before)	126,550
0 to 3	50,000	3.531	176,550

Gap annuities and annuities that start after t1

There may be a gap in the pattern of annuities. The approach in this case is to construct an annuity factor by removing the discount factors that relate to the gap (remembering that the objective is to arrive at a sum of the discount factors that relate to each period in which there is a cash flow).

▶ *Example 21:*

The present value of a cash flow of Rs 60,000 each year for years 1 – 3 and 5 – 7, if the cost of capital is 10%.

	Discount factor (10%)
Annuity factor for t1–7	
$\text{Annuity factor} = \frac{1}{0.1}\left(1 - \frac{1}{(1.1)^7}\right)$	4.868
Less: discount factor that relates to the gap (t4)	
$\text{Discount factor} = \frac{1}{(1.1)^4}$	0.683
Discount factor for 1–3 and 5–7	4.185

Therefore, the PV of 60,000 per annum every year from t1 to t7 except t4:

PV = 60,000 × 4.185 = 251,100

An annuity might be expected to start at some point in the future other than at t1.

There are two approaches to dealing with this.

Method 1: Remove the discount factors that relate to the gap (as above).

Method 2: Apply the annuity factor for the actual number of payments. This will produce a cash equivalent value at a point in time one period before the first cash flow. This is then discounted back to the present value.

▶ *Example 22:*

The annuity factor for a series of cash flows from t4 to t15 at a cost of capital of 12%

Method 1	Discount factor (12%)
Annuity factor for t1–15	
$\text{Annuity factor} = \frac{1}{0.12}\left(1 - \frac{1}{(1.12)^{15}}\right)$	6.811
Less: discount factor that relates to the gap (t1 to 3)	
$\text{Annuity factor} = \frac{1}{0.12}\left(1 - \frac{1}{(1.12)^3}\right)$	2.402
Discount factor for t4 to t15.	4.409

Method 2	Discount factor (12%)
Annuity factor for t1–12 (as there are 12 cash flows)	
$\text{Annuity factor} = \frac{1}{0.12}\left(1 - \frac{1}{(1.12)^{12}}\right)$	6.194
When this is applied to an annuity which starts at t4 it produces a cash equivalent at t3. Therefore it must be discounted back to t0	
$\text{Discount factor} = \frac{1}{(1.12)^{3}}$	0.712
Discount factor for t4 to t15	4.410
The small difference is due to rounding	

Present value of a perpetuity

Perpetuity is a constant annual cash flow 'forever', or into the long-term future. Some countries notably United Kingdom in the times of war have issued bonds without a maturity date.

In investment appraisal, an annuity might be assumed when a constant annual cash flow is expected for a long time into the future.

- *Formula:*

> $\text{Perpetuity factor} = \frac{1}{r}$
>
> Where:
>
> r = the cost of capital

- *Example 23:*

Cash flow	Present value
2,000 in perpetuity, starting in Year 1	
Cost of capital = 8%	$= \frac{1}{r} \times \text{Annual cash flow}$
	$= \frac{1}{0.08} \times 2{,}000 = 25{,}000$

Perpetuity factors that start after t1 or have a gap in the sequence of cash flows are constructed in the same way as those for annuities.

Method 1

Remove the discount factors that relate to the gap.

Method 2

Apply the perpetuity factor to the actual number of payments. This will produce a cash equivalent value at a point in time one period before the first cash flow. This is then discounted back to the present value by using the individual period discount factor.

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▶ *Example 24:*

The present value of Rs. 5,500 in perpetuity, starting in Year 4 at a cost of capital of 11% is:

Method 1	**Discount factor (12%)**
Annuity factor for t1 – ∞	
$\text{Perpetuity factor} = \frac{1}{0.11}$	9.091
Less: discount factor that relates to the gap (t1 to 3)	
$\text{Annuity factor} = \frac{1}{0.11}\left(1 - \frac{1}{(1.11)^3}\right)$	2.444
Discount factor for t4 to ∞.	6.647
Method 2	**Discount factor (10%)**
Annuity factor for t1 – ∞	
$\text{Perpetuity factor} = \frac{1}{0.11}$	9.091
When this is applied to an annuity which starts at t4 it produces a cash equivalent at t3. Therefore it must be discounted back to t0	
$\text{Discount factor} = \frac{1}{(1.11)^3}$	0.731
Discount factor for t4 to t15	6.646
The small difference is due to rounding	
Present value	$= 6.646 \times 5{,}500 = 36{,}553$

Application of annuity arithmetic

<u>Equivalent annual costs</u>

An annuity is multiplied by an annuity factor to give the present value of the annuity.

This can work in reverse. If the present value is known, it can be divided by the annuity factor to give the annual cash flow for a given period that would give rise to it.

▶ *Example 25:*

For example, the present value of 10,000 per annum from t1 to t5 at 10% is:

Time	Cash flow	Discount factor	Present value
1 to 5	10,000	3.791	37,910

The annual cash flow from t1 to t5 at 10% would give a present value of 37,910 is:

	37,910
Divide by the 5 year, 10% annuity factor	<u>3.791</u>
	<u>10,000</u>

This can be used to address the following problem.

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► *Example 26:*

A company is considering an investment of Rs.70,000 in a project. The project life would be five years.

What must be the minimum annual cash returns from the project to earn a return of at least 9% per annum?

Investment = Rs.70,000

Annuity factor at 9%, years 1 – 5 = 3.890

Minimum annuity required = Rs.17,995 (= Rs.70,000/3.890)

Loan repayments

► *Example 27:*

A company borrows Rs 10,000,000.

This to be repaid by 5 equal annual payments at an interest rate of 8%.

The calculation of the payments is as under:

The approach is to simply divide the amount borrowed by the annuity factor that relates to the payment term and interest rate

	Rs
Amount borrowed	10,000,000
Divide by the 5 year, 8% annuity factor	3.993
Annual repayment	2,504,383

Sinking funds (alternative approach to that seen earlier)

A person may save a constant annual amount to produce a required amount at a specific point in time in the future. This is known as a sinking fund.

► *Example 28:*

A man wishes to invest equal annual amounts so that he accumulates 5,000,000 by the end of 10 years.

The annual interest rate available for investment is 6%.

The equal annual amounts that should he set aside are

Step 1: Calculate the present value of the amount required in 10 years.

$$\mathbf{PV = 5,000,000 \times \frac{1}{(1.06)^{10}} = 2,791,974}$$

Step 2: Calculate the equivalent annual cash flows that result in this present value

	Rs
Present value	2,791,974
Divide by the 10 year, 6% annuity factor	7.36
Annual repayment	379,344

If the man invests 379,344 for 10 years at 6% it will accumulate to 5,000,000.

Amount invested to earn a return

Annuity factors express the value of a stream of future cash into a present value. The approach can be used in reverse to show what stream of future cash flows would provide a given return (the discount rate) if an amount was invested today.

▶ *Example 29:*

A company is considering an investment of Rs.70,000 in a project. The project life would be five years.

So the minimum cash returns from the project to earn a return of at least 9% per annum is:

	Rs
Present value (Investment)	70,000
Divide by the 5 year, 9% annuity factor	3.89
Minimum annuity required	17,995

1.4 Step 4: Investment decision based on discounting cash flows methods

For making decision for acceptance or rejection of investment is based on involving capital expenditures is based on discounted cash flows techniques that are:

a) Net present value(NPV) method

b) Internal rate of return (IRR) method

These techniques are explained in detail in next section as under:

2. NET PRESENT VALUE(NPV) METHOD

2.1 Calculating the NPV of an investment project

In NPV analysis, all future cash flows from a project are converted into a present value, so that the value of all the annual cash outflows and cash inflows can be expressed in terms of 'today's value'.

The net present value (NPV) of a project is the net difference between the present value of all the costs incurred and the present value of all the cash flow benefits (savings or revenues).

Approach

Step 1: List all cash flows expected to arise from the project. This will include the initial investment, future cash inflows and future cash outflows.

Step 2: Discount these cash flows to their present values using the cost that the company has to pay for its capital (cost of capital) as a discount rate. All cash flows are now converted and expressed in terms of 'today's value'.

Step 3: The net present value (NPV) of a project is difference between the present value of all the costs incurred and the present value of all the cash flow benefits (savings or revenues).

- If the present value of benefits exceeds the present value of costs, the NPV is positive.
- If the present value of benefits is less than the present value of costs, the NPV is negative.

The decision rule is that, ignoring other factors such as risk and uncertainty, and non-financial considerations, a project is worthwhile financially if the NPV is positive. It is not worthwhile if the NPV is negative.

The net present value of an investment project is a measure of the value of the investment. For example, if a company invests in a project that has a NPV of Rs.2 million, the value of the company should increase by Rs.2 million.

2.2 Assumptions about the timing of cash flows

In DCF analysis, the following assumptions are made about the timing of cash flows during each year:

- All cash flows for the investment are assumed to occur at a discrete point in time (usually the end of the year).
- If a cash flow will occur early during a particular year, it is assumed for the sake of simplicity that it will occur at the end of the previous year. Therefore, cash expenditure early in Year 1, for example, is assumed to occur at time 0.

Time 0 cash flows

Often cash flows are described as occurring in a particular year (e.g. year 1, year 2 etc.). The project commences at time 0. Sometimes time 0 (t0) is described as year 0 but this is misleading. There is no year 0, it can be assumed to be the present time. The first year (year 1) starts at time 0 and ends one year after this.

Cash flows at the beginning of the investment (at time 0) are already stated at their present value.

The discount factor for a cash flow in time 0 is $1/(1 + r)^0$.

Any value to the power of 0 is always = 1. Therefore, the discount factor for time 0 is always = 1.000, for any cost of capital.

This means that the present value of Rs.1 in time 0 is always Rs.1, for any cost of capital.

2.3 Advantages and Disadvantages of the NPV method

The **advantages** of the NPV method of investment appraisal are that:

- NPV takes account of the timing of the cash flows by calculating the present value for each cash flow at the investor's cost of capital.

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- DCF is based on cash flows.
- It evaluates all cash flows from the project.
- It gives a single figure, the NPV, which can be used to assess the value of the investment project. The NPV of a project is the amount by which the project should add to the value of the company, in terms of 'today's value'.
- The NPV method provides a decision rule which is consistent with the objective of maximization of shareholders' wealth. In theory, a company ought to increase in value by the NPV of an investment project (assuming that the NPV is positive).

The main **disadvantages** of the NPV method are:

- The time value of money and present value are concepts that are not easily understood
- There might be some uncertainty about what the appropriate cost of capital or discount rate should be for applying to any project.
- It does not take into account the risk and uncertainty of estimates and scarcity of resources.
- It fails to relate the return of the project to the size of the cash outlay.

2.4 Two methods of presentation

If you are required to present NPV calculations in the answer to an examination question, it is important that you should be able to present your calculations and workings clearly. There are two normal methods of presenting calculations, and you should try to use one of them.

The two methods of presentation are shown below, with illustrative figures.

► *Illustration Format 1:*

Year	Description of item	Cash flow	Discount factor at 10%	Present Value
		Rs.		Rs.
0	Machine	(40,000)	1.000	(40,000)
0	Working capital	(5,000)	1.000	(5,000)
1-3	Cash profits	20,000	2.487	49,740
3	Sale of machine	6,000	0.751	4,506
3	Recovery of working capital	5,000	0.751	3,755
			NPV	13,001

► *Illustration Format 2:*

Year	0	1	2	3
Description of item	Rs.	Rs.	Rs.	Rs.
Machine/sale of machine	(40,000)			6,000
Working capital	(5,000)			5,000
Cash receipts		50,000	50,000	50,000
Cash expenditures		(30,000)	(30,000)	(30,000)
Net cash flow	(45,000)	20,000	20,000	31,000
Discount factor at 10%	1.000	0.909	0.826	0.751
Present value	(45,000)	18,180	16,520	23,281
NPV	12,981			

For computations with a large number of cash flow items, the second format is probably easier. This is because the discounting for each year will only need to be done once.

Note that **changes in working capital** are included as cash flows. An increase in working capital, usually at the beginning of the project in Time 0, is a cash outflow and a reduction in working capital is a cash inflow. Any working capital investment becomes Rs.0 at the end of the project.

Investment decision is not a financing decision so financing cost like financial charges or interest cost are not include while calculating NPV

▶ *Example 30:*

A company with a cost of capital of 10% is considering investing in a project with the following cash flows.

Year	Rs (m)
0	(10,000)
1	6,000
2	8,000

The NPV calculation is:

Year	Cash flow	Discount factor (10%)	Present value
0	(10,000)	1	(10,000)
1	6,000	$\frac{1}{(1.1)}$	5,456
2	8,000	$\frac{1}{(1.1)^2}$	6,612
NPV			2,068

The NPV is positive so the project should be accepted.

▶ *Example 31:*

A company is considering whether to invest in a new item of equipment costing Rs.53,000 to make a new product.

The product would have a four-year life, and the estimated cash profits over the four-year period are as follows:

Year	Rs.
1	17,000
2	25,000
3	16,000
4	12,000

The NPV of the project using a discount rate of 11%

NPV calculation would be as follows:

Year	Cash flow	Discount factor (11%)	Present value
0	(53,000)	1	(53,000)
1	17,000	$\frac{1}{(1.11)}$	15,315

Year	Cash flow	Discount factor (11%)	Present value
2	25,000	$\frac{1}{(1.11)^2}$	20,291
3	16,000	$\frac{1}{(1.11)^3}$	11,699
4	12,000	$\frac{1}{(1.11)^4}$	7,905
NPV			2,210

The NPV is positive so the project should be accepted.

- *Example 32:*

A company is considering whether to invest in a new item of equipment costing Rs.65,000 to make a new product.

The product would have a three-year life, and the estimated cash profits over this period are as follows.

Year	Rs.
1	27,000
2	31,000
3	15,000

The NPV of the project using a discount rate of 8%

NPV calculation:

Year	Cash flow	Discount factor (8%)	Present value
0	(65,000)	1	(65,000)
1	27,000	$\frac{1}{(1.08)}$	25,000
2	31,000	$\frac{1}{(1.08)^2}$	26,578
3	15,000	$\frac{1}{(1.08)^3}$	11,907
NPV			(1,515)

The NPV is negative so the project should be rejected.

- *Example 33:*

A company is considering whether to undertake an investment. The cost of capital is 10%. The initial cost of the investment would be Rs.50,000 and the expected annual cash flows from the project would be:

Year	Revenue	Costs	Net cash flow
	Rs.	Rs.	Rs.
1	40,000	30,000	10,000
2	55,000	35,000	20,000
3	82,000	40,000	42,000

a) The calculation of compounding arithmetic for calculation of investment at the end of year 3 is:

a. Compounding	Rs.
Investment in Time 0	(50,000)
Interest required (10%), Year 1	(5,000)
Return required, end of Year 1	(55,000)
Net cash flow, Year 1	10,000
	(45,000)
Interest required (10%), Year 2	(4,500)
Return required, end of Year 2	(49,500)
Net cash flow, Year 2	20,000
	(29,500)
Interest required (10%), Year 3	(2,950)
Return required, end of Year 3	(32,450)
Net cash flow, Year 3	42,000
Future value, end of Year 3	9,550

b) Using discounting the calculation of NPV of the project is:

Year	Cash flow	Discount factor at 10%	Present value
	Rs.		Rs.
0	(50,000)	1.0	(50,000)
1	10,000	$1/(1.10)^1$	9,091
2	20,000	$1/(1.10)^2$	16,529
3	42,000	$1/(1.10)^3$	31,555
Net present value			+7,175

c) The reconciliation of present value and future value based on above calculations is:

NPV × $(1 + r)^n$ = Future value: Rs.7,175 × $(1.10)^3$ = Rs.9,550

This example shows a simple capital project with an initial capital outlay in Time 0 and cash inflows for three years. The same technique can be applied to much bigger and longer capital projects, and projects with negative cash flows in years other than Time 0.

▶ *Example 34:*

A company has estimated that its cost of capital is 8.8%. It is deciding whether to invest in a project that would cost Rs.325,000.

The NPV if the net cash flows of the project after Year 0 are:

if cash flows form years 1 – 6: Rs.75,000 per year is:

Present value of net cash flows of Rs.75,000 in Years 1 – 6 =

$$\frac{\$75{,}000}{0.088}\left[1-\frac{1}{(1.088)^6}\right]$$

=Rs.852,273 (1 – 0.603)

=Rs.338,352

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Then the NPV is:

Year	Cash flow	Discount factor (8.8%)	PV
	Rs.		Rs.
0	(325,000)	1.000	(325,000)
1 – 6	75,000 per year		338,352
NPV			13,352

The project has a positive NPV and should be undertaken.

For example, if the company has following cash flows pattern

Year	Rs.
1	50,000
2 – 6	75,000

Then the calculation of NPV is:

The annuity PV formula can be used to calculate the 'present value' as at the end of Year 1 for annual cash flows from Year 2 onwards.

End-of-Year 1 'present value' of net cash flows of Rs.75,000 in Years 2 – 6 =

$$\frac{\$75{,}000}{0.088}\left[1-\frac{1}{(1.088)^5}\right]$$

=Rs.852,273 (1 – 0.656)

=Rs.293,182

Year	Cash flow	Discount factor (8.8%)	PV
	Rs.		Rs.
0	(325,000)	1.000	(325,000)
1	50,000	1/1.088	45,956
2 – 6	293,182	1/1.088	269,469
NPV			(9,575)

The project has a negative NPV and should not be undertaken.

For example, if the cash flow of the project after year 0 are Rs. 50,000 every year in perpetuity then calculation of NPV is:

Year	Cash flow	Discount factor (8.8%)	PV
	Rs.		Rs.
0	(325,000)	1.000	(325,000)
1 onwards in perpetuity	50,000	1/0.088	568,182
NPV			243,182

The project has a positive NPV and should be undertaken.

▶ *Example 35:*

Ali & Co. is a medium sized medical research company, engaged in the development of new medical treatments. To date company has invested Rs. 250,000 in the development of a new product called 'Gravia' which can be recovered by selling the formula to an outsider. It is estimated that it will take further two years of development and testing before 'Gravia' is approved by medical industry regulators.

The company believes that it can sell the patent for Gravia to a multinational pharmaceutical company for Rs.1,000,000 when it has been fully developed. The directors of the Ali & co. are currently reviewing the Gravia projects as there is some concern about the size of the required finance to complete the development work.

Following information is relevant to the projects:

- To complete the development Ali & Co. will need to acquire additional type A material expected cost Rs.150,000 per annum over the next two years.
- Type B material will also be required. Currently there is sufficient stock of type B material to last for the two years of the project. The material originally cost Rs. 50,000. Its replacement cost is Rs.75,000. Instead of using it on this project, it could immediately be sold as scrap for Rs. 20,000 It has no further alternative use.
- If it is decided to continue with Gravia project, specialist equipment will need to be purchase immediately for Rs. 100,000. This equipment could eventually be sold at the end of the project for Rs.25,000.
- Two chemists currently employed for an annual salary of Rs.20,000 each will be made redundant whenever Gravia project ends. Redundancy payments are expected to be one full year's salary each.
- Laboratory technicians currently employed by Ali & Co. are working on Gravia project at a total annual cost of Rs. 85,000. The company has a variety of other projects to which the technicians could be transferred whenever the Gravia projects ends.
- Annual fixed overheads are 100,000 of which Rs.60,000 are general overheads, and remaining Rs.40,000 are directly associated with the project.
- Interest cost on borrowed finance is Rs.20,000 per annum.
- All cash flows occur at the end of the year unless otherwise stated.
- The discount rate used by Ali & Co. to appraise its projects is 10%.

The example relates to Ali Co., a medium sized medical research company. That is going to consider a project relating to complete development of product called Gravia that xis partly completed to date.

- Firstly, the future expected cash flows (cash inflows and outflows) will be identified based on relevant costing principles excluding irrelevant cost.
- Following are irrelevant cost for projects.
  a) Original cost and replacement of material B as it is not in regular use.
  b) Current annual salary of two employees who have already employed being a past cost.
  c) Annual fixed overheads other than directly attributable fixed cost.
  d) Interest cost as its affect is automatically considered through discounting.
- Based on above analysis the calculation of net and discounted cash flows is as under:

	Year 0	Year 1	Year 2
Value of Gravia	(250,000)		1000,000
Material A		(150,000)	(150,000)
Material B	(20,000)		
Special list Equipment	(100,000)		25,000
Redundancy Payment			(40,000)
Investment Fixed cost		(40,000)	(40,000)
Net Cash flows	(370,000)	(190,000)	795,000

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	Year 0	Year 1	Year 2
Discount factor	1.000	0.909	0.826
Discount factor	(370,000)	(172,710)	656,670
NPV:	113,960		

Decision:

The project has a positive NPV. The project should be undertaken because it will increase the value of the company and the wealth of its shareholders.

▶ *Example 36:*

Consolidated Oil wants to explore for oil near the coast of Ruritania. The Ruritanian government is prepared to grant an exploration license for a five-year period for a fee of Rs.300,000 per annum. The license fee is payable at the start of each year. The option to buy the license must be taken immediately or another oil company will be granted the license.

However, if it does take the license now, Consolidated Oil will not start its explorations until the beginning of the second year.

To carry out the exploration work, the company will have to buy equipment now. This would cost Rs.10,400,000, with 50% payable immediately and the other 50% payable one year later. The company hired a specialist firm to carry out a geological survey of the area. The survey cost Rs.250,000 and is now due for payment.

The company's financial accountant has prepared the following projected income statements. The forecast covers years 2-5 when the oilfield would be operational.

Projected income statements

	Year			
	2	3	4	5
	Rs.'000	Rs.'000	Rs.'000	Rs.'000
Sales	7,400	8,300	9,800	5,800
Minus expenses:				
Wages and salaries	550	580	620	520
Materials and consumables	340	360	410	370
License fee	600	300	300	300
Overheads	220	220	220	220
Depreciation	2,100	2,100	2,100	2,100
Survey cost written off	250	-	-	-
Interest charges	650	650	650	650
	4,710	4,210	4,300	4,160
Profit	2,690	4,090	5,500	1,640

Notes

The license fee charge in Year 2 includes the payment that would be made at the beginning of year 1 as well as the payment at the beginning of Year 2. The license fee is paid to the Ruritanian government at the beginning of each year.

The overheads include an annual charge of Rs.120,000 which represents an apportionment of head office costs. The remainder of the overheads are directly attributable to the project.

The survey cost is for the survey that has been carried out by the firm of specialists.

The new equipment costing Rs.10,400,000 will be sold at the end of Year 5 for Rs.2,000,000.

A specialized item of equipment will be needed for the project for a brief period at the end of year 2. This equipment is currently used by the company in another long-term project. The manager of the other project has estimated that he will have to hire machinery at a cost of Rs.150,000 for the period the cutting tool is on loan.

The project will require an investment of Rs.650,000 working capital from the end of the first year to the end of the license period.

The company has a cost of capital of 10%. Ignore taxation.

The example relates to a consolidated oil company that is going to consider a project regarding the exploration of oil near the coast of Ruritania.

The project will be evaluated on Net Present Value (NPV) method.

Firstly, the future expected cash flows (cash inflows and out flows) will be identified using relevant costing principles.

Following cost will be irrelevant in the example and should be excluded while considering expected future cash flows.

- Survey cost that is past cost
- Depreciation that is non-cash flows cost
- Apportioned overheads that are not real cash flows
- Interest charges because its affect is automatically considered through discounting of cash flows
- The working capital incurred at start of project assumed to recovered at end of project

Based on above analysis the calculation of discounted cash flows and NPV is as under

Year	0	1	2	3	4	5
	Rs.000	Rs.000	Rs.000	Rs.00	Rs.000	Rs.000
Sales			7,400	8,300	9,800	5,800
Wages			(550)	(580)	(620)	(520)
Materials			(340)	(360)	(410)	(370)
Licence fee	(300)	(300)	(300)	(300)	(300)	
Overheads			(100)	(100)	(100)	(100)
Equipment	(5,200)	(5,200)				2,000
Specialised equipment			(150)			
Working capital		(650)				650
	(5,500)	(6,150)	5,960	6,960	8,370	7,460
Discount factor at 10%	1.000	0.909	0.826	0.751	0.683	0.621
Present value	(5,500)	(5,590)	4,923	5,227	5,717	4,633

NPV = + Rs.9,409,000

Decision:

The project has a positive NPV. The project should be undertaken because it will increase the value of the company and the wealth of its shareholders.

3. INTERNAL RATE OF RETURN (IRR)

The internal rate of return method (IRR method) is another method of investment appraisal using DCF.

The internal rate of return of a project is the discounted rate of return on the investment.

- It is the average annual investment return from the project
- The NPV of the project cash flows is zero when those cash flows are discounted at the IRR.
- The internal rate of return is therefore the discount rate that will give a net present value = Rs.0.

3.1 The investment decision rule with IRR

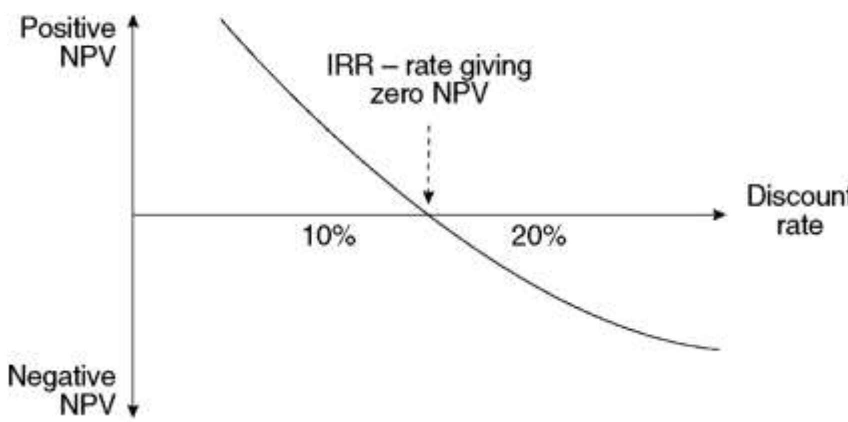
A company might establish the minimum rate of return that it wants to earn on an investment. If other factors such as non-financial considerations and risk and uncertainty are ignored:

- If a project IRR is equal to or higher than the minimum acceptable rate of return, it should be undertaken
- If the IRR is lower than the minimum required return, it should be rejected.

Since NPV and IRR are both methods of DCF analysis, the same investment decision should normally be reached using either method.

The internal rate of return is illustrated in the diagram below:

► *Illustration:*



3.2 Calculating the IRR of an investment project

The IRR of a project can be calculated by inputting the project cash flows into a financial calculator. In your examination, you might be required to calculate an IRR without a financial calculator. An approximate IRR can be calculated using interpolation.

To calculate the IRR, you should begin by calculating the NPV of the project at two different discount rates.

- One discount rate should yield a positive NPV, and the other should give negative NPV. (This is not essential. Both NPVs might be positive or both might be negative, but the estimate of the IRR will then be less reliable.)
- Ideally, the NPVs should both be close to zero, for better accuracy in the estimate of the IRR.

When the NPV for one discount rate is positive and the NPV for another discount rate is negative, the IRR must be somewhere between these two discount rates.

Although in reality the graph of NPVs at various discount rates is a curved line, as shown in the diagram above, using the interpolation method we assume that the graph is a straight line between the two NPVs that we have calculated. We can then use linear interpolation to estimate the IRR, to a reasonable level of accuracy.

- *Formula:*

IRR interpolation formula

$$IRR = A\% + \left(\frac{NPV_A}{NPV_A - NPV_B}\right) \times (B - A)\%$$

Ideally, the NPV at A% should be positive and the NPV at B% should be negative.

Where:

NPV_A = NPV at A%

NPV_B = NPV at B%

3.3 Advantages and Disadvantages of the IRR method

The main **advantages** of the IRR method of investment appraisal are:

- As a DCF appraisal method, it is based on cash flows, not accounting profits.
- Like the NPV method, it recognizes the time value of money.
- It is easier to understand an investment return as a percentage return on investment than as a money value NPV in Rs.
- For accept/reject decisions on individual projects, the IRR method will reach the same decision as the NPV method.

The **disadvantages** of the IRR method are:

- It is a relative measure (% on investment) not absolute measure in Rs.. Because it is a relative measure, it ignores the absolute size of the investment. For example, which is the better investment if the cost of capital is 10%:
  - an investment with an IRR of 15% or
  - an investment with an IRR of 20%?
- If the investments are mutually exclusive, and only one of them can be undertaken the correct answer is that it depends on the size of each of the investments. This means that the IRR method of appraisal can give an incorrect decision if it is used to make a choice between mutually exclusive projects.
- Unlike the NPV method, the IRR method does not indicate by how much an investment project should add to the value of the company.

- *Example 37:*

A business requires a minimum expected rate of return of 12% on its investments.

A proposed capital investment has the following expected cash flows.

Year	Cash flow	Discount factor at 10%	Present value at 10%	Discount factor at 15%	Present value at 15%
0	(80,000)	1.000	(80,000)	1,000	(80,000)
1	20,000	0.909	18,180	0.870	17,400
2	36,000	0.826	29,736	0.756	27,216
3	30,000	0.751	22,530	0.658	19,740
4	17,000	0.683	11,611	0.572	9,724
NPV			+ 2,057		(5,920)

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Using

$$\mathbf{IRR = A\% + \left(\frac{NPV_A}{NPV_A - NPV_B}\right) \times (B - A)\%}$$
$$\mathbf{IRR = 10\% + \left(\frac{2,057}{2,057 - -5,920}\right) \times (15 - 10)\%}$$
$$\mathbf{IRR = 10\% + \left(\frac{2,057}{2,057 + 5,920}\right) \times 5\%}$$
$$\mathbf{IRR = 10\% + \left(\frac{2,057}{7,977}\right) \times 5\%}$$
$$\mathbf{IRR = 10\% + 0.258 \times 5\% = 10\% + 1.3\%}$$
$$\mathbf{IRR = 11.3\%}$$

Conclusion The IRR of the project (11.3%) is less than the target return (12%).

The project should be rejected.

▶ *Example 38:*

The following information is about a project.

Year	Rs.
0	(53,000)
1	17,000
2	25,000
3	16,000
4	12,000

This project has an NPV of Rs.2,210 at a discount rate of 11%

The calculation of expected IRR is:

NPV at 11% is Rs.2,210. A higher rate is needed to produce a negative NPV. (say 15%)

Year	Cash flow	Discount factor at 15%	Present value at 15%
0	(53,000)	1.000	(53,000)
1	17,000	0.870	14,790
2	25,000	0.756	18,900
3	16,000	0.658	10,528
4	12,000	0.572	6,864
NPV			(1,918)

Using

$$IRR = A\% + \left(\frac{NPV_A}{NPV_A - NPV_B}\right) \times (B - A)\%$$

$$IRR = 10\% + \left(\frac{2,210}{2,210 - -1,918}\right) \times (15 - 10)\%$$

$$IRR = 10\% + \left(\frac{2,210}{2,210 + 1,918}\right) \times 5\%$$

$$IRR = 10\% + \left(\frac{2,210}{4,128}\right) \times 5\%$$

$$IRR = 10\% + 0.535 \times 5\% = 10\% + 2.7\%$$

$$IRR = 12.7\%$$

- *Example 39:*

The following information is about a project.

Year	Rs.
0	(65,000)
1	27,000
2	31,000
3	15,000

This project has an NPV of Rs. (1,515) at a discount rate of 8%

The calculation of estimated IRR is:

NPV at 8% is Rs.(1,515). A lower rate is needed to produce a positive NPV. (say 5%)

Year	Cash flow	Discount factor at 5%	Present value at 5%
0	(65,000)	1.000	(65,000)
1	27,000	0.952	25,704
2	31,000	0.907	28,117
3	15,000	0.864	12,960
NPV			1,781

Using

$$\mathrm{IRR} = A\% + \left(\frac{\mathrm{NPV_A}}{\mathrm{NPV_A} - \mathrm{NPV_B}}\right) \times (B - A)\%$$

$$\mathrm{IRR} = 5\% + \left(\frac{1{,}781}{1{,}781 - -1{,}515}\right) \times (8 - 5)\%$$

$$\mathrm{IRR} = 5\% + \left(\frac{1{,}781}{1{,}781 + 1{,}515}\right) \times 3\%$$

$$\mathrm{IRR} = 5\% + \left(\frac{1{,}781}{3{,}296}\right) \times 3\%$$

$$\mathrm{IRR} = 5\% + 0.540 \times 3\% = 5\% + 1.6\%$$

$$\mathrm{IRR} = 6.6\%$$

- *Example 40:*

A company is considering whether to invest in a new item of equipment costing Rs.45,000 to make a new product. The product would have a four-year life, and the estimated cash profits over the four-year period are as follows.

Year	Rs.
1	17,000
2	25,000
3	16,000
4	04,000

The project would also need an investment in working capital of Rs.8,000, from the beginning of Year 1.

The company uses a discount rate of 11% to evaluate its investments.

The expected calculation of IRR is:

The cash outflow in Year 0 = cost of equipment + working capital investment = Rs.45,000 + Rs.8,000 = Rs.53,000.

The cash inflow for year 4 = project's net cash profits + working capital recovered = Rs.4,000 + Rs.8,000 = Rs.12,000.

		Cost of capital 11%		Cost of capital 15%	
Year	Cash flow	Discount factor	PV	Discount factor	PV
	Rs.		Rs.		Rs.
0	(53,000)	1.000	(53,000)	1.000	(53,000)
1	17,000	0.901	15,317	0.870	14,790
2	25,000	0.812	20,300	0.756	18,900
3	16,000	0.731	11,696	0.658	10,528
4	12,000	0.659	7,908	0.572	6,864
NPV			+ 2,221		(1,918)

NPV at 11% cost of capital = + Rs.2,221

$$\text{IRR} = 11\% + \left[\frac{2{,}221}{(2{,}221 + 1{,}918)} \times (15 - 11)\%\right]$$

= 11% + 2.1% = 13.1%

- *Example 41:*

There are two mutually exclusive projects.

Year	Project 1	Project 2
	Rs.	Rs.
0	(1,000)	(10,000)
1	1,200	4,600
2	-	4,600
3	-	4,600
IRR	20%	18%
NPV at 15%	+ Rs.43	+ Rs.503

In the above example project 2 is better, because it has the higher NPV. Project 2 will add to value by Rs.503 but Project 1 will add value of just Rs.43.

- *Example 42:*

Sona Limited (SL) is considering investment in a joint venture. The entire cash outlay of the project is Rs. 175 million which would require to be invested by SL immediately. The joint venture partner, Chandi Limited (CL) would provide all the necessary technical support.

The other details of the project are estimated as follows:

The project would extend over a period of four years.

Sales are estimated at Rs. 155 million per annum for the first two years and Rs. 65 million per annum during the last two years.

Cost of sales and operating expenses excluding depreciation would be 50% and 10% of sales respectively.

CL would be entitled to share equal to 5% of sales and the remaining profit would belong to SL.

At the end of the project, SL would be able to recover Rs. 100 million of the invested amount.

Assume that all cash flows other than the initial cash outlay arise annually in arrears.

The example relates to Sona Limited(SL) that is considering investment in Joint venture. The joint venture partner is Chandi Limited(CL). The company that will provide all necessary technical details in return of 5% share in sales.

- The duration of project is 4 years and all future expected cash flows with timing occurrence are given.
- Based on above the calculation of Net cash flows and discounted cash flows on two discount rate 12% and 15% are given as under:

Project's Internal rate of return	**Year 0**	**1**	**2**	**3**	**4**
	--------------------- Rs. in million ---------------------				
Sales	-	155.00	155.00	65.00	65.00
Cost of sales (50%)	-	(77.50)	(77.50)	(32.50)	(32.50)
Operating expense (10%)	-	(15.50)	(15.50)	(6.50)	(6.50)
5% of sales for technical support by CL	-	(7.75)	(7.75)	(3.25)	(3.25)
Investment	(175.00)	-	-	-	100.00
Net cash flows	(175.00)	54.25	54.25	22.75	**122.75**
Discount factor (15%)	1.00	0.87	0.76	0.66	0.57
Present value	(175.00)	47.20	41.23	15.02	69.97
Net present value at 15% NPV$_A$	(1.58)				
Discount factor (12%)	1.00	0.89	0.79	0.71	0.63
Present value	(175.00)	48.28	42.86	16.15	77.33
Net present value at 12% NPV$_B$	9.62				
After calculation of NPV values at two discount rates that are 12% and 15%, the expected calculation of IRR using interpolation formula is: A%+ [NPVA÷ (NPVA-NPVB)] × (B%-A %)					
Internal rate of return (IRR) 15%+ [-1.58 ÷ (-1.58-9.62)] × (12%-15%)					
	14.58%				

3.4 Summary: comparison of the two investment appraisal methods

The key points to note are that:

- It is often equally as good to use NPV or IRR
- However, NPV has two advantages over IRR
- The NPV method indicates the value that the investment should add (if the NPV is positive) or the value that it will destroy (if the NPV is negative).
- When there are two or more mutually exclusive projects, the NPV will always identify the project that should be selected. This is the project that will provide the highest value (NPV).
- The IRR method has the advantage of being more easily understood by non-accountants
- Another disadvantage of the IRR method is that a project might have two or more different IRRs, when some annual cash flows during the life of the project are negative. (The mathematics that demonstrate this point are not shown here.)

4. DCF AND INFLATION

4.1 Inflation and long-term projects

When a company makes a long-term investment, there will be costs and benefits for a number of years. In all probability, the future cash flows will be affected by inflation in sales prices and inflation in costs.

Inflation increases the return on investments required by investors. In a world without inflation an investor might be content with a 10% return on an investment. With inflation the investor knows that the purchasing power of future cash flows received will be less due to inflation and so wants a higher return to compensate for that.

Inflation should be incorporated in financial planning and decision making.

4.2 General and specific rates of inflation

Inflation is measured by measuring the prices of a set of goods and services (often described as a basket of goods and services having different weightings) at various points in time, and then seeing by how much they have increased or decreased. Some may rise, and some may fall, but the overall change in the price level is an indication of the inflation level.

Within that basket each good and service will inflate at its own specific rate. For example, the rate of inflation specific to fuel oil might be 10% whereas the rate specific to rice might be 1%.

General inflation is the overall change in the price of a basket of goods and services calculated as an average of the specific rates weighted in some way to reflect the relative importance of the good or service in the economy.

4.2.1 Inflation rates for different cash flows

The inflation can be:

- Specific: Different for each cash flow item (e.g sales price may be increasing by 5% whereas variable costs are subject to an inflation rate of 4%.
- General: a single inflation rate for all cash flows

Inflation rates might be:

- Specific for each coming year (e.g 5% for year 1, 8% for year 2, 10% for year 3 and so on.
- General: A single rate for all coming years (e.g Materiel cost is expected to increase by 6% per annum over the life of project

4.3 Definitions: Real cash flows and money (nominal) cash flows

Real cash flows are cash flows expressed in today's price terms. (They ignore the expectation of inflation).

Money (nominal) cash flows are cash flows that include expected inflation. They are the actual amount of cash received at a point in time.

Money cash flows can be derived from real cash flows by inflating the real cash flow by the rate of inflation specific to that cash flow and vice versa.

► *Example 43:*

A vendor sells ice creams. He knows that a bowl of ice cream sells for Rs. 50 today. He is planning future sales and expects to sell 1,000 bowls next year and the year after.

He expects inflation to be 10%.

These future sales can be expressed in real terms or in money terms.

	Real cash flows
Year 1 cash sales (1,000 bowls × Rs. 50)	50,000
Year 2 cash sales (1,000 bowls × Rs. 50)	50,000

	Money cash flows
Year 1 cash sales (1,000 bowls × Rs. 50 × 1.1)	55,000
Year 2 cash sales (1,000 bowls × Rs. 50 × 1.1^2)	60,500

5.4 Definitions: Real cost of capital and money (nominal) cost of capital

Real cost of capital is the return required by investors measured in terms of a constant price level. It excludes the expectation of inflation.

Money (nominal) cost of capital the return required by investors measured in terms of a changing price level. It includes the expectation of inflation

The real cost of capital and the money cost of capital are linked together by the following equation.

▶ *Formula:*

The Fisher equation

$$1 + m = (1 + r) \times (1 + i)$$

Where:

m = money rate

r = real rate

i= rate of inflation

The rate of inflation used above is the general rate of inflation.

▶ *Example 44:*

A company has a money cost of capital of 12% and inflation is 5%.

The real rate can be found as follows:

$1 + m = (1 + r) \times (1 + i)$	$1.12 = (1 + r)(1.05)$
Therefore,	$r = (1.12/1.05) - 1 = 0.0666$ or 6.67%

Available information

There are models that can be used to estimate cost of capital in practice. These models provide a money cost of capital.

When performing DCF analysis a company will know current prices. Cash flow information is available in real terms.

Possible methods

There are two possible approaches to incorporating the expectation of inflation into NPV calculations. Either:

- real cash flows should be discounted at the real cost of capital; or
- money cash flows should be discounted at the money cost of capital.

In order to use one of these approaches and given the information that is likely to be available (real cash flows and money cost of capital) either the real cost of capital has to be derived from the money cost using the Fisher equation or the future cash flows have to be inflated to give the money flows.

The most common approach is to adjust the real cash flows to the money cash flows and discount these by the money cost of capital.

4.5 Discounting money cash flows at the money cost of capital

The cost of capital used in DCF analysis is normally a 'money' cost of capital. This is a cost of capital calculated from current market returns and yields.

When estimates are made for inflation in future cash flows, the rules are as follows:

- Estimate all cash flows at their inflated amount. Since cash flows are assumed to occur at the year-end, they should be increased by the rate of inflation for the full year.
- To estimate a future cash flow at its inflated amount, you can apply a formula.

▶ *Formula:*

CF at time n at inflated amount = CF at current price level × $(1 + i)^n$

Where:

CF = cash flow

i = the annual rate of inflation

All the cash flows must be re-stated at their inflated amounts. The inflated cash flows are then discounted at the money cost of capital, to obtain present values for cash flows in each year of the project.

These are netted to find the NPV of the project.

▶ *Example 45:*

A company is considering an investment in an item of equipment costing Rs. 150,000. The equipment would be used to make a product. The selling price of the product at today's prices would be Rs. 10 per unit, and the variable cost per unit (all cash costs) would be Rs. 6.

The project would have a four-year life, and sales are expected to be:

Year	Units of sale
1	20,000
2	40,000
3	60,000
4	20,000

At today's prices, it is expected that the equipment will be sold at the end of Year 4 for Rs. 10,000. There will be additional fixed cash overheads of Rs. 50,000 each year as a result of the project, at today's price levels.

The company expects prices and costs to increase due to inflation at the following annual rates:

Item	Annual inflation rate
Sales	5%
Variable costs	8%
Fixed costs	8%
Equipment disposal value	6%

The company's money cost of capital is 12%.

The NPV of the project is calculated as follows:

- The example involves real cash flows that needs to be inflated at given rates so that they become money cash flows.
- The cost to capital given in the question is 12% that is money cost of capital.
- The NPV of the project by discounting money cash flows with money cost of capital is

Item	Time 0	Year 1	Year 2	Year 3	Year 4
	Rs.	Rs.	Rs.	Rs.	Rs.
Equipment purchase	(150,000)				
Equipment disposal					
(Rs. 10,000 × $(1.06)^4$)					12,625
Revenue					
At today's prices		200,000	400,000	600,000	200,000
At inflated prices (5% per year)		210,000	441,000	694,575	243,101
Costs					
Variable, today's prices		120,000	240,000	360,000	120,000
Fixed, today's prices		50,000	50,000	50,000	50,000
Total, today's prices		170,000	290,000	410,000	170,000
At inflated prices (8% per year)		183,600	338,256	516,482	231,283
Net cash profit		26,400	102,744	178,093	11,818
Net cash flows	(150,000)	26,400	102,744	178,093	24,443
Discount factor (12%)	1	0.893	0.797	0.712	0.636
	(150,000)	23,575	81,887	126,802	15,546
Net present value					+ 97,810

Discounting real cash flows at the real cost of capital

Instead of calculating the NPV of a project by discounting 'money' cash flows at the money cost of capital, NPV can be calculated using a real cost of capital applied to cash flows at today's prices.

Discounting real cash flows using a real cost of capital will give the same NPV as discounting money cash flows using the money cost of capital, where the same rate of inflation applies to all items of cash flow.

► *Example 46:*

A company is considering an investment in an item of equipment costing Rs.150,000. Contribution per unit is expected to be Rs.4 and sales are expected to be:

Year	Units of sale
1	20,000
2	40,000
3	60,000
4	20,000

Fixed costs are expected to be Rs.50,000 at today's price levels and the equipment can be disposed of in year 4 for Rs.10,000 at today's price levels. The inflation rate is expected to be 6% and the money cost of capital is 15%.

- The example involves real cash flows that need to be discounted using real cost of capital
- The cost to capital given in the question is 15% that is money cost of capital and inflation rate is 6%. This needs to be converted in real cost of capital as:
- The real discount rate = $^{1.15}/_{1.06} - 1 = 0.085 = 8.5\%$

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The NPV of the project by discounting real cash flows with real cost of capital is:

Item	Time 0	Year 1	Year 2	Year 3	Year 4
	Rs.	Rs.	Rs.	Rs.	Rs.
Equipment purchase	(150,000)				
Equipment disposal					10,000
Contribution		80,000	160,000	240,000	80,000
Fixed costs		(50,000)	(50,000)	(50,000)	(50,000)
Net cash flow at today's prices	(150,000)	30,000	110,000	190,000	40,000
Discount factor (8.5%)	1	1/1.085	$1/1.085^2$	$1/1.085^3$	$1/1.085^4$
Present values	(150,000)	27,650	93,440	148,753	28,863
Net present value					148,706

- The example involves real cash flows that need to be converted into money cash flows using inflation rate.
- The cost to capital given in the question is 15% that is money cost of capital.
- This needs to be converted in real cost of capital as:

The NPV of the project by discounting money cash flows with money cost of capital is

Item	Time 0	Year 1	Year 2	Year 3	Year 4
	Rs.	Rs.	Rs.	Rs.	Rs.
Equipment purchase	(150,000)				
Equipment disposal					10,000
Contribution		80,000	160,000	240,000	80,000
Fixed, today's prices		(50,000)	(50,000)	(50,000)	(50,000)
Net cash flow at today's prices	(150,000)	30,000	110,000	190,000	40,000
Inflation adjustment	×1	×1.06	$\times1.06^2$	$\times1.06^3$	$\times1.06^4$
Money cash flows	(150,000)	31,800	123,596	226,293	50,499
Discount factor (15%)	1	0.870	0.756	0.658	0.572
Present values	(150,000)	27,666	93,439	148,901	28,885
Net present value					**148,891**

► *Example 47:*

Badger plc., a manufacturer of car accessories is considering a new product line. This project would commence at the start of Badger plc.'s next financial year and run for four years. Badger plc.'s next year end is 31st December 2012.

The following information relates to the project:

A feasibility study costing Rs.8 million was completed earlier this year but will not be paid for until March 2013. The study indicated that the project was technically viable.

Capital expenditure

If Badger plc. proceeds with the project it would need to buy new plant and machinery costing Rs.180 million to be paid for at the start of the project. It is estimated that the new plant and machinery would be sold for Rs.25 million at the end of the project.

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If Badger plc. undertakes the project it will sell an existing machine for cash at the start of the project for Rs.2 million. This machine had been scheduled for disposal at the end of 2016 for Rs.1 million.

Market research

Industry consultants have supplied the following information:

Market size for the product is Rs.1,100 million in 2012. The market is expected to grow by 2% per annum.

Market share projections should Badger plc. proceed with the project are as follows:

	2013	*2014*	*2015*	*2016*
Market share	7%	9%	15%	15%
Cost data:	**2013**	**2014**	**2015**	**2016**
	Rs.m	**Rs.m**	**Rs.m**	**Rs.m**
Purchases	40	50	58	62
Payables (at the year-end)	8	10	11	12
Payments to sub-contractors,	6	9	8	8
Fixed overheads (total for Badger plc)				
With new line	133	110	99	90
Without new line	120	100	90	80

Labor costs

At the start of the project, employees currently working in another department would be transferred to work on the new product line. These employees currently earn Rs.3.6 million. An employee currently earning Rs.2 million would be promoted to work on the new line at a salary of Rs.3 million per annum. A new employee would be recruited to fill the vacated position.

As a direct result of introducing the new product line, employees in another department currently earning Rs.4 million would have to be made redundant at the end of 2013 resulting in a redundancy payment of Rs.6 million at the end of 2014.

Material costs

The company holds a stock of Material X which cost Rs.6.4 million last year. There is no other use for this material. If it is not used the company would have to dispose of it at a cost to the company of Rs.2 million in 2013. This would occur early in 2013.

Material Z is also in stock and will be used on the new line. It cost the company Rs.3.5 million some years ago. The company has no other use for it, but could sell it on the open market for Rs.3 million early in 2013.

Further information

The year-end payables are paid in the following year.

The company's cost of capital is a constant 10% per annum.

It can be assumed that operating cash flows occur at the year end.

Time 0 is 1st January 2013 (t1 is 31st December 2013 etc.)

The example relates to Badger Plc. A company that is considering investment in new product line. The project life is 4 years and it will be evaluated on NPV model incorporating inflation:

- Firstly, the future expected cash flows (cash inflows and out flows) are identified based on relevant costing principles excluding irrelevant cost.

Following costs are irrelevant:

a) Current earning of employees working in another department being past cost.

b) The original cost of material X being past cost.

c) The original cost of material Z being past cost.

Based on above analysis the calculation of Net, discounted cash flows and NPV (work to the nearest millions) is as under:

	01/01/13	31/12/13	31/12/14	31/12/15	31/12/16
	Rs. m	Rs. m	Rs. m	Rs. m	Rs. m
	0	1	2	3	4
Machine	(180)				25
Existing machine	2				(1)
Operating flows					
Sales **W1**		79	103	175	179
Purchases **W2**		(32)	(48)	(57)	(73)
Payments to subcontractors		(6)	(9)	(8)	(8)
Fixed overhead		(13)	(10)	(9)	(10)
Labor costs:					
Promotion		(3)	(3)	(3)	(3)
Redundancy			(6)		
Material					
X	2				
Y	(3)				
Net operating flows	(1)	25	27	98	109
	(179)	25	27	98	109
Discount factor (10%	1.000	0.909	0.826	0.751	0.683
	(179)	23	22	74	74
NPV					**14**

Working:

1. **Sales**

	2012	2013	2014	2015	2016
	Rs. m	Rs. m	Rs. m	Rs. m	Rs. m
Market size	1,100	1,122	1,144	1,167	1,191
Market share		0.07	0.09	0.15	0.15
Sales		79	103	175	179

2. **Purchases**

	2013	2014	2015	2016
Opening payables	-	8	10	11
Add purchases	40	50	58	62
Less closing payables	(8)	(10)	(11)	-
Cash for purchases	32	48	57	73

Decision: The project has a positive NPV. The project should be undertaken because it will increase the value of the company and the wealth of its shareholders.

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- *Example 48:*

Clear Co. specializes in the production of UPVC windows and doors. It is considering whether to invest in a new machine with a capital cost of Rs. 4 million. The machine would have an expected life of five years at the end of which it would be sold for Rs, 450,000.

If the new machine would be purchased the existing machine could either be sold immediately for Rs.250,000 or hired out to another company at a rental amount of Rs,100,000 per annum, payable in advance for three years, If the machine is hired out rather than sold it will have no residual value at the end of three years period. The existing machine generates annual revenues of Rs.8 million and its running costs are Rs,840,000 per annum.

If the new machine is purchased revenues are expected to increase by 20 %. In Addition to this, however machine running costs are also expected to increase. Estimate have shown that, in the first year with the new machine, running costs will increase by 18%. In every subsequent year thereafter, running costs will continue to 18% higher than each previous years costs.

The company's cost of capital is 10%. All workings should be in Rs.'000'.

The example relates to Clear & Co. with two options:

a) Selling of existing machinery immediately

b) Hiring of existing machinery for three years receiving rent in advance.

The project will be evaluated on NPV and IRR model after allowing for inflation.

- All future cash flows (cash inflows & cash out flows) are given based on relevant costing principles with their timing of occurrence.
- Based on above analysis the calculation on Net cash flows, discounted cash flows and NPV under both option are given as under:

Option (a) Selling of existing machinery

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
	Rs.(000)	Rs.(000)	Rs.(000)	Rs.(000)	Rs.(000)	Rs.(000)
New machinery cost	(4000)					450
Selling price of existing machinery	250					
Revenues (20% income)		9600	9600	9600	9600	9600
Running cost (18% in cash subsequent year)		(991)	(1170)	(1380)	(1629)	(1,922)
Net cash flows	(3,750)	8609	8430	8220	7971	8,128
Discount factor (10%)	1.000	0.909	0.826	0.751	0.683	0.621
Discounted cash flows	(3,750)	7826	6963	6173	5444	5,047
NPV	**27,703**					

Option (b) Hiring of existing machinery

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
	Rs.(000)	Rs.(000)	Rs.(000)	Rs.(000)	Rs.(000)	Rs.(000)
New machinery cost	(4000)					450
Rentals of existing machine	100	100	100			
Revenues (20% income)		9600	9600	9600	9600	9600
Running cost (18% in cash subsequent year)		(991)	(1170)	(1380)	(1629)	(1,922)
Net cash flows	(3900)	8709	8530	8220	7971	8,128
Discount factor (10%)	1.000	0.909	0.826	0.751	0.683	0.621
Discounted cash flows	(3900)	7916	7046	6173	5444	5,047 ~~4936~~
NPV	**27,727**					

Decision: The company should invest in new machinery and should rent out the existing machinery because with this option NPV is 27,727(000) that is higher than the NPV of option 1 relates to selling of existing machinery

- *Example 49:*

Tropical Juices (TJ) is planning to expand its production capacity by installing a plant in a building which is owned by TJ but has been rented out at Rs. 6 million per annum. The relevant details are as under:

i. The cost of the building is Rs. 40 million and it is depreciated at 5% per annum.

ii. The rent is expected to increase by 5% per annum.

iii. Cost of the plant and its installation is estimated at Rs. 60 million. TJ depreciates plant and machinery at 25% per annum on a straight line basis. Residual value of the plant after four years is estimated at 10% of cost.

iv. Additional working capital of Rs. 25 million would be required on commencement of production.

v. defined. Selling price of the juices would be Rs. 350 per liter. Sales quantity is projected as under:

	Year 1	Year 2	Year 3	Year 4
Liters	250,000	300,000	320,000	290,000

vi. Variable cost would be Rs. 180 per liter. Fixed cost is estimated at Rs. 100 per liter based on normal capacity of 280,000 liters. Fixed cost includes yearly depreciation amounting to Rs. 16 million.

vii. Rate of inflation is estimated at 5% per annum and would affect the revenues as well as expenses.

viii. TJ's cost of capital is 15%.

The example to Tropical Juices (TJ) that is considering to expand its production capacity by installing a plant which has been currently rented out. The decision will be evaluated on NPV model incorporating inflation.

- The relevant cash inflows and out flows with their timing of occurrence are given in question except deprecation of machinery being non cash flows cost.
- Based on above analysis the calculation of net cash flows, discounted cash flows and NPV is as under:

	Year 0	Year 1	Year 2	Year 3	Year 4
	Cash inflows/(outflows)				
	---------------------- Rs. in million ----------------------				
Loss of opportunity (Bldg. rent)	-	(6.30)	(6.62)	(6.95)	(7.29)
Cost of plant and its Installation	(60.00)				6.00
Working capital	(25.00)	-	-	-	25.00
Sales		87.50	110.25	123.48	117.50
		(0.25×350)	(0.3×350 ×1.05)	(0.32×350 ×1.05²)	(0.29×350 ×1.05³)
Variable cost		(45.00)	(56.70)	(63.50)	(60.43)
		(0.25×180)	(0.3×180 ×1.05)	(0.32×180 ×1.05²)	(0.29×180 ×1.05³)
Fixed cost		(12.00)	(12.60)	(13.23)	(13.89)
		(0.28×100)-16	(12×1.05)	(12×1.05²)	(12×1.05³)
Net cash flows	**(85.00)**	**24.20**	**34.33**	**39.80**	**66.89**
Present value factor at 15%	1.000	0.870	0.756	0.658	0.572
Present value at 15%	(85.00)	21.05	25.95	26.19	38.26
Net present value (NPV) at 15%					**26.45**

Decision: The project has a positive NPV. The project should be undertaken because it will increase the value of the company and the wealth of its shareholders.

5. DCF & TAXATION

5.1 Taxation cash flows in investment appraisal

In project appraisal, cash flows arise due to the effects of taxation. When an investment results in higher profits, there will be higher taxation. Tax cash flows should be included in DCF analysis. In DCF analysis it is normally assumed that tax is payable on the amount of cash profits in any year.

For example, if taxation on profits is 32% and a company earns Rs.10,000 cash profit each year from an investment, the pre-tax cash inflow is Rs.10,000, but there is a tax payment of Rs.3,200.

Similarly, if an investment results in lower profits, tax is reduced. For example, if an investment causes higher spending of Rs.5,000 each year and the tax on profits is 32%, there will be a cash outflow of Rs.5,000 but a cash benefit from a reduction in tax payments of Rs.1,600.

Working capital flows are not subject to tax.

Where accounting measures are given remember that depreciation is not a tax allowable expense and does not represent cash flows. It should be ignored in drafting cash flows (or perhaps added back if already deducted).

5.2 Interest costs and taxation

Interest cash flows are not included in DCF analysis. This is because the interest cost is in the cost of capital (discount rate).

Interest costs are also allowable expenses for tax purposes, therefore, present values are estimated using the post-tax cost of capital. The post-tax cost of capital is a discount rate that allows for the tax relief on interest payments. This means that because interest costs are allowable for tax purposes, the cost of capital is adjusted to allow for this and is reduced accordingly.

The cost of capital is explained in more detail in a later chapter. Briefly however, the following formula holds in cases where debt is irredeemable.

- *Formula:*

Post-tax interest cost
Post tax-cost of debt = Pre-tax interest cost (1 – tax rate)

- *Example 50:*

  Post-tax interest cost Interest on debt capital is 10% and the rate of tax on company profits is 32%.

  Post tax-cost of debt = Pre-tax interest cost (1 – tax rate)

  = 10% (1 - 0.32) = 6.8%

5.3 Timing of cash flows for taxation

- When cash flows for taxation are included in investment appraisal, an assumption must be made about when the tax payments are made. The actual timing of tax payments depends on the tax rules that apply in the relevant jurisdiction. Usually, one or other of the following assumptions is used. Tax is payable in the same year as the profits to which the tax relates; or
- tax is payable one year later ('one year in arrears'). (For example, tax on the cash profits in Year 1 is payable in Year 2).

Either of these two assumptions could be correct.

- *Example 51:*

  A project costing Rs.60,000 is expected to result in net cash inflows of Rs.40,000 in year 1 and Rs.50,000 in year 2.

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Taxation at 32% occurs one year in arrears of the profits or losses to which they relate.

The post-tax cost of capital is 8%.

Assume that the cost of the project is not an allowable cost for tax purposes (i.e. capital allowances should be ignored).

Year	0	1	2	3
Initial outlay	(60,000)			
Cash inflows		40,000	50,000	
Tax on inflows			(12,800)	(16,000)
Annual cash flows	(60,000)	40,000	37,200	(16,000)
Discount factors	1	0.926	0.857	0.794
Present values	(60,000)	37,040	31,880	(12,704)
NPV				**(3,784)**

The NPV of the project is negative so it should be rejected.

5.4 Tax-allowable depreciation (capital allowances)

- The nature of tax allowable depreciation
- Tax allowable depreciation in Pakistan
- Balancing charge or balancing allowance on disposal

5.5 The nature of tax allowable depreciation

Non-current assets are depreciated in the financial statements. However, depreciation in the financial statements is not an allowable expense for tax purposes.

Instead, the tax rules provide for 'tax-allowable depreciation' according to rules determined by the government.

Tax-allowable depreciation affects the cash flows from an investment by altering the tax payment and the tax effects must be included in the project cash flows.

5.6 Tax allowable depreciation in Pakistan

Tax rules in Pakistan are set out in the *Income Tax Ordinance, 2001 (as amended)*. Exam questions tend to specify the tax rates and allowance percentages to be used.

5.7 Initial allowance

Section 23 of the ordinance allows a deduction of an initial allowance in the year in which an asset used for business purposes is brought into use. This initial allowance is currently set at 25% of the cost of the asset.

5.8 Normal depreciation (written down allowance)

A further deduction of a percentage of the tax written down value on a reducing balance basis is also allowed in each period. The percentage depends on the type of asset as specified in the third schedule to the ordinance. The deduction that relates to machinery and plant is usually 10%. This written down allowance is claimed in addition to the initial allowance in the year in which an asset is purchased.

▶ *Example 52:*

An asset costs Rs.80,000.

Allowable initial allowance is 25% and normal depreciation is 10% under the reducing balance method.

Tax on profits is payable at the rate of 29%.

The cash flow benefits from the tax depreciation are calculated as follows:

Year		TWDV	Tax allowable depreciation	Tax saved (29%)
		Rs.	Rs.	Rs.
0	Cost	80,000		
1	Initial allowance	(20,000)	20,000	5,800
		60,000		
2	Normal depreciation	(6,000)	6,000	1,740
		54,000		
3	Normal depreciation	(5,400)	5,400	1,566
		48,600		
4	Normal depreciation	(4,860)	4,860	1,409
		43,740		
5	Normal depreciation	(4,374)	4,374	1,268
		39,366		
	Normal depreciation	(3,937)	3,937	1,142
	TWDV, end of Year 5	35,429		

- The tax cash flows (tax savings) should be treated as cash inflows in the appropriate year in the DCF analysis.
- Note that the relevant cash flow to be included in DCF analyses are the tax effects of the tax allowable depreciation not the tax allowable depreciation itself.
- The tax saved in the first year Rs. 7,540. This is the sum of the savings on the initial allowance (Rs.5,800) and the normal depreciation in the first year (Rs. 1,740).

5.9 Balancing charge or balancing allowance on disposal

When an asset is scrapped or sold there might be a balancing charge or a balancing allowance. This is the difference between:

- the written-down value of the asset for tax purposes (TWDV); and
- Its disposal value (if any).

The effect of a balancing allowance or balancing charge is to ensure that over the life of the asset the total amount of tax allowable depreciation equals the cost of the asset less its residual value.

5.10 Balancing allowance

This occurs when the written-down value of the asset for tax purposes is higher than its disposal value.

The balancing allowance is an additional claim against taxable profits.

5.11 Balancing charge

This occurs when the written-down value of the asset for tax purposes is lower than the disposal value.

The balancing charge is a taxable amount, and will result in an increase in tax payments.

5.12 Impact on DCF analysis

The cash saving or cash payment is included in the cash flows for DCF analysis.

Note: An annual capital allowance is not claimed in the year of disposal of an asset. Instead, there is simply a balancing allowance (or a balancing charge).

▶ *Example 53:*

A company is considering an investment in a non-current asset costing Rs.80,000. The project would generate the following cash inflows:

Year	Rs.
1	50,000
2	40,000
3	20,000
4	10,000

Allowable initial allowance is 25% and normal depreciation is 10% under the reducing balance method.

Tax on profits is payable at the rate of 32%.

It is expected to have a scrap value of Rs.20,000 at the end of year 4. The post-tax cost of capital is 9%.

The calculation of NPV is as:

	0	1	2	3	4
	Rs.000	Rs.000	Rs.000	Rs.000	Rs.000
Capital flows	(80.0)				20.0
Tax saving on tax					
allowable depreciation (W2)		8.3	1.7	1.6	7.6
Cash inflows		50.0	40.0	20	10.0
Tax on cash inflows		(16.0)	(12.8)	(6.4)	(3.2)
Net cash flows	(80.0)	42.3	28.9	15.2	34.4
Discount factor	1.000	0.917	0.842	0.772	0.708
Present values	(80.0)	38.8	24.3	11.7	24.4
NPV					19.2

Note that the tax saving on tax allowable depreciation in year 1 of Rs. 8,320 is made up of is 6,400 + 1,920.

Working				
Year		TWDV	Tax allowable Depreciation	Tax saved (32%)
		Rs.	Rs.	Rs.
0	Cost	80,000		
1	Initial allowance	(20,000)	20,000	6,400
		60,000		
	Normal depreciation	(6,000)	6,000	1,920
		54,000		
2	Normal depreciation	(5,400)	5,400	1,728
		48,600		
3	Normal depreciation	(4,860)	4,860	1,555
		43,740		
4	Cash proceeds	(20,000)		
	Balancing allowance	23,740	23,740	7,597

The impact of the balancing allowance (charge) is that the amount claimed in allowances is always equal to the cost of the asset less its disposal proceeds.

This means that the amount of tax saved is always the tax rate applied to this difference. Therefore, in the above example:

- Total tax allowable depreciation = 80,000 – 20,000 = 60,000 (20,000 + 6,000 + 5,400 + 4,860 + 23,740).
- Total tax saved = 32% * 60,000 = 19,200 (6,400 + 1,920 + 1,728 + 1,555 + 7,597).

▶ *Example 54:*

Baypack Company is considering whether to invest in a project whose details are as follows.

The project will involve the purchase of equipment costing Rs. 2,000,000. The equipment will be used to produce a range of products for which the following estimates have been made.

Year	1	2	3	4
	Rs.	Rs.	Rs.	Rs.
Average sales price	73.55	76.03	76.68	81.86
Average variable cost	51.50	53.05	49.17	50.65
Incremental annual fixed costs	Rs.1,200,000	Rs.1,200,000	Rs.1,200,000	Rs.1,200,000
Sales units	65,000	100,000	125,000	80,000

The sales prices allow for expected price increases over the period. However, cost estimates are based on current costs, and do not allow for expected inflation in costs. Inflation is expected to be 3% per year for variable costs and 4% per year for fixed costs. The incremental fixed costs are all cash expenditure items. Tax on profits is at the rate of 30%, and tax is payable in the same year in which the liability arises.

Baypack Company uses a four-year project appraisal period, but it is expected that the equipment will continue to be operational and in use for several years after the end of the first four-year period.

The company's cost of capital for investment appraisal purposes is 10%.

The example relates to Baypack a company that is considering an investment for purchase of equipment. The life of project is 4 years. The project will be evaluated on NPV model incorporating inflation and taxation.

- All future cash flows are given on relevant costing principles.
- The only variable cost and fixed cost are required to be inflated at 3% and 4% respectively.
- Based on above analysis the net cash flows, discounted cash flows and NPV are as under.

Year	**0**	**1**	**2**	**3**	**4**
		Rs. 000	**Rs. 000**	**Rs. 000**	**Rs. 000**
Initial investment	(2,000)				
Total contribution **(W)**		1,433	2,298	3,439	2,497
Fixed costs		(1,248)	(1,298)	(1,350)	(1,404)
Taxable cash flow		185	1,117	2,089	1,093
Tax (30%)		(56)	(335)	(627)	(328)
		129	782	1,462	765
Discount factor, 10%	1	0.909	0.826	0.751	0.683
Present values	(2,000)	117	646	1,098	522
NPV = Rs. 383,000					

Workings: Contribution					
Year	**0**	**1**	**2**	**3**	**4**
		Rs.	**Rs.**	**Rs.**	**Rs.**
Average sales price		73.55	76.03	76.68	81.86
Average variable cost		51.50	53.05	49.17	50.65
		22.05	22.98	27.51	31.21
Sales units		65,000	100,000	125,000	80,000
Total contribution		1,433	2,298	3,439	2,497

Decision: The project has a positive NPV. The project should be undertaken because it will increase the value of the company and the wealth of its shareholders.

6. COMPREHENSIVE EXAMPLES

- *Example 01:*

Valika Limited (VL) plans to introduce a new product AX which would be used in hybrid cars.

Following information is available in this regard:

Initial investment in the new plant including installation and commissioning is estimated at Rs. 50 million. The plant is expected to have a useful life of four years and would have annual capacity of 200,000 units.

The demand of AX for the first year is expected to be 180,000 units which would increase by 10% per annum in year 2 and 3. However, in year 4 the demand is expected to decline by 10%.

The contribution margin for the first year is estimated at Rs. 100 per unit which is expected to increase by 5% each year. The new plant would be installed at VL's premises which are presently rented out at Rs. 1.8 million per annum. As per the terms of rent agreement, the rent is received in advance and is subject to 7% increase per annum.

Working capital of Rs. 10 million would be required at the commencement of the project. Working capital is expected to increase by 10% each year.

The new plant would be depreciated at the rate of 25% under the reducing balance method. Tax depreciation is to be calculated on the same basis. The residual value of the plant at the end of useful life is expected to be equal to its carrying value.

VL's cost of capital is 10%.

Tax rate is 30% and is paid in the year in which the tax liability arises.

The example relates to VL limited. That is considering introducing a new product for which investment would be required in new plant. The life of project is 4 years. The project will be evaluated on NPV model incorporating inflation and taxation.

The plant will be installed in premises which are currently rented out. So sacrifice of rental income become opportunity cost for this decision net of tax.

- Tax deprecation and tax payments would be considered in relevant cash flows of project.
- The working capital of state of project is expected to increase 10% in subsequent year and full amount is assumed to record at end of project.
- All other cash flows are straight forward according to their timing.
- Based on above analysis calculation of net and discounted cash flows are as under:

	Year 0	Year 1	Year 2	Year 3	Year 4
	------------------ Rs. in million ------------------				
Contribution margin **(W-1)**	-	18.00	20.79	22.05	22.69
Tax/Accounting depreciation (50×0.25, 0.75)	-	(12.50)	(9.38)	(7.04)	(5.28)
Net profit before tax	-	5.50	11.41	15.01	17.41
Tax liability @ 30%.	-	(1.65)	(3.42)	(4.50)	(5.22)
Net profit after tax	-	3.85	7.99	10.51	12.19
Add back depreciation		12.50	9.38	7.04	5.2 8
Rent income lost 1.8×1.07	(1.93)	(2.07)	(2.21)	(2.36)	

	Year 0	Year 1	Year 2	Year 3	Year 4
	------------------ Rs. in million ------------------				
Tax saved on rent income 1.93×30%		0.58	0.62	0.66	0.71
Residual value receipts (50–34.2 Total dep.)					15.80
Initial investment	(50.00)				
Working capital **(W-2)**	(10.00)	(1.00)	(1.10)	(1.21)	13.31
Net cash (outflows)/inflows	(61.93)	13.86	14.68	14.64	47.29
Discount rate @ 10%	1.0000	0.9091	0.8264	0.7513	0.6830
Present value	(61.93)	12.60	12.13	10.99	32.29
Net present value					**6.08**

W-1: Annual contribution margin	Year 1	Year 2	Year 3	Year 4
Contribution margin per unit (Rs.) **A**	100.00	105.00	110.25	115.76
	100	100×1.05	105×1.05	110.25×1.05
Annual demand (Units)	180,000	198,000	217,800	196,020
		180,000 ×1.10	198,000 ×1.10	217,800 ×90%
Production - Restricted to capacity (Units) (Up to 200,000 units p.a) **B**	180,000	198,000	200,000	196,020
Annual CM (Rs. in million) **(A×B)**	18.00	20.79	22.05	22.69

W-2: Working capital requirement	Year 1	Year 2	Year 3	
Working capital current year	11.00	12.10	13.31	
	10×1.1	11×1.1	12.10×1.1	
Working capital last year	10.00	11.00	12.10	
(Increase)/Decrease	(1.00)	(1.10)	(1.21)	13.31

Decision:

The project has a positive NPV. The project should be undertaken because it will increase the value of the company and the wealth of its shareholders.

- *Example 02:*

Diamond Investment Limited (DIL) is considering to set-up a plant for the production of a single product X-49. The details relating to the investment are as under:

The cost of plant amounting to Rs. 160 million would be payable in advance. It includes installation and commissioning of the plant.

Working capital of Rs. 20 million would be required at the commencement of the commercial operations.

DIL intends to sell X-49 at cost plus 25% (cost does not include depreciation on plant). Sales for the first year are estimated at Rs. 300 million. The sales quantity would increase at 6% per annum.

The plant would be depreciated at the rate of 20% under the reducing balance method. Tax depreciation is to be calculated on the same basis. Estimated residual value of the plant at the end of its useful life of four years would be equal to its carrying value.

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Tax rate is 34% and tax is payable in the year the liability arises.

DIL's cost of capital is 18%. All costs and prices are expected to increase at the rate of 5% per annum.

The example relates to DIL a company, which is considering investment in a plant for production of new product.

The project will be evaluated on NPV and IRR model after incorporating inflation and taxation.

- The sale revenue will be increased yearly (volume 6% and price 5%)
- The cost of sales is calculated at cost plus 25% (sales 1.25)
- All other cash flows are straight forward according to their timings on assumption that all cash flows would arise at the end of the year unless otherwise specified.
- Based on above analysis calculation of net and discounted cash flows arrears under.

Net Present Value (NPV) of the project

	Year 0	Year 1	Year 2	Year 3	Year 4
	Cash inflows/(outflows) - Rupees in million				
Sales (yearly increase: volume 6% & price 5%)	-	300.00	333.90	371.63	413.62
Cost (Sales ÷ 1.25)	-	(240.00)	(267.12)	(297.30)	(330.90)
Plant depreciation at 25% of WDV	-	(32.00)	(25.60)	(20.48)	(16.38)
Net profit	-	28.00	41.18	53.85	66.34
Tax @ 34%	-	(9.52)	(14.00)	(18.31)	(22.56)
Add back depreciation	-	32.00	25.60	20.48	16.38
Cost of plant and its installation	(160.00)	-	-	-	65.54
Working capital	(20.00)	-	-	-	20.00
Projected cash flows	(180.00)	50.48	52.78	56.02	145.70
PV factor at 18%	1.00	0.85	0.72	0.61	0.52
Present value	(180.00)	42.91	38.00	34.17	75.76
NPV at 18% (NPV_A)	**10.84**				

Internal Rate of Return (IRR) of the project:

PV factor at 22%	1.00	0.82	0.67	0.55	0.45
PV at 22% (Projected cash flow × PV factor)	(180.00)	41.39	35.36	30.81	65.57
NPV at 22% (NPV_B)	**(6.87)**				

Based on above calculations the expected IRR using interpolation formula is:

$IRR = A\% + \left(\frac{NPV_A}{NPV_A - NPV_B}\right) \times (B\% - A\%)$	$= 18\% + \left(\frac{10.84}{10.84 - (-6.87)}\right) \times (22\% - 18\%)$	20.45%

Decision: The project has a positive NPV. The project should be undertaken because it will increase the value of the company and the wealth of its shareholders.

The IRR is 20.45% the project should be accepted if the project IRR is more than expected IRR.

- *Example 03:*

Cloudy Company Limited (CCL) manufactures and sells specialized machine X85. A newer version of the machine is gaining popularity in the market and CCL is therefore considering to introduce a similar version i.e. D44. Detailed research in this respect has been carried out during the last six months at a cost of Rs. 3.25 million.

The related information is as under:

i. Initial investment in the new plant for manufacturing D44 would be Rs. 450 million including installation and commissioning of the plant. (ii) Projected production and sales of D44 are as follows:

Year 1	Year 2	Year 3	Year 4
------------------ No. of units ------------------			
20,000	25,000	27,000	29,000

Sales volume of X85 in the latest year was 30,000 units. It is estimated that introduction of D44 would reduce the sale of X85 by 2,000 units every year.

ii. Estimated selling price and variable cost per unit of D44 in year 1 is estimated at Rs. 40,000 and Rs. 32,000 respectively. The contribution margin on X85 in year 1 is estimated at Rs. 5,500 per unit.

iii. Fixed costs in year 1 are estimated at Rs. 45 million. However, if the new plant is installed these costs would increase to Rs. 75 million.

iv. Impact of inflation on selling price, variable cost and fixed cost would be 10% for both the machines/plants.

v. The new plant would be depreciated at the rate of 25% under the reducing balance method. Tax depreciation is to be calculated on the same basis. The residual value of the plant at the end of its useful life of four years is expected to be equal to its carrying value.

vi. Applicable tax rate is 30% and tax is paid in the year in which the liability arises.

vii. CCL's cost of capital is 12%.

By computing Internal rate of return (IRR) of the new plant CCL may decide whether it should introduce D44. (Assume that all cash flows would arise at the end of the year unless stated otherwise) as follows:

	Year 0	Year 1	Year 2	Year 3	Year 4
Projected production and sales of D44 Units (A)	-	20,000	25,000	27,000	29,000
	------------------ Rs. in million ------------------				
Contribution margin of D44 (40,000-32,000)×1.1×A	-	160.00	220.00	261.36	308.79
Research cost To be ignored	-	-	-	-	-
Loss of CM of X85 (5,500×2,000×1.1)	-	(11.00)	(24.20)	(39.93)	(58.56)
Existing fixed cost To be ignored	-	-	-	-	-
Incremental fixed cost (75-45)×1.1	-	(30.00)	(33.00)	(36.30)	(39.93)
Tax/Accounting depreciation 450×0.25	-	(112.50)	(84.38)	(63.29)	(47.47)
Net profit before tax	-	6.50	78.42	121.84	162.83

	Year 0	Year 1	Year 2	Year 3	Year 4
Tax liability @ 30%	-	(1.95)	(23.53)	(36.55)	(48.85)
Net (loss)/profit after tax	-	4.55	54.89	85.29	113.98
Add back non-cash item of depreciation	-	112.50	84.38	63.29	47.47
Plant cost/residual value at the end of useful life	(450.00)	-	-	-	142.36
Total cash (outflows) / inflows	(450.00)	117.05	139.27	148.58	303.81
Net cash inflows	258.71				
Discount factor at 15%	1.0000	0.8696	0.7561	0.6575	0.5718
Present value	(450.00)	101.79	105.30	97.69	173.72
Net present value at 15% NPV_a	28.50				
Discount factor at 20%	1.0000	0.8333	0.6944	0.5787	0.4823
Present value	(450.00)	97.54	96.71	85.98	146.53
Net present value at 20% NPV_b	(23.24)				
IRR = A% + [NPV_a ÷ (NPV_a - NPV_b) × (B% - A%)]	15%+[28.50÷{28.50-(-23.24)} × (20%-15%)]				17.7 %

Conclusion:

IRR 17.75% is higher than CCL's cost of capital (12%), therefore, CCL should introduce D44.

- *Example 04:*

Modern Transport Limited (MTL) is considering an investment proposal from Burraq Cab Services (BCS). As per the proposal, MTL would provide branded cars to BCS under the following terms and conditions:

i. BCS would pay rent of Rs. 1.8 million per annum per car to MTL. The cars would operate on a 24-hour basis. The payment would be made at the end of year.

ii. Cost of the drivers and maintenance cost of the car would initially be paid by BCS but would be adjusted against car rentals payable to MTL at the end of each year.

iii. MTL would provide a smart mobile to each driver.

MTL has estimated the following costs for deployment of a car with BCS:

Description	Rupees	Remarks
Car purchase price	2,000,000	Estimated useful life and residual value of the car is 4 years and Rs. 0.75 million respectively.
Car registration fee	35,000	One-time payment on registration of the car.
Mobile phone price per set	15,000	To be charged-off in the year of purchase.
Insurance premium	50,000	To be paid at the beginning of each year. It would reduce by Rs. 5,000 each year due to decrease in WDV of the car.
Annual salaries per driver	300,000	Would work in 8-hour shifts.
Annual maintenance cost	60,000	Due to ageing of cars, cost would increase by 10% each year.

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Additional information:

- The car would be depreciated at the rate of 25% under the reducing balance method.
- Tax depreciation is to be calculated on the same basis.
- Applicable tax rate is 30% and tax is payable in the year in which the liability arises.
- Inflation is estimated at 5% per annum.
- MTL's cost of capital is 12% per annum.

MTL's decision to accept or reject the proposal would require following analysis:

Evaluation of BRC's proposal

	Year 0	Year 1	Year 2	Year 3	Year 4
	---------------------- [Cash inflows/(outflows)] ---------------------				
	------------------------------ Rupees ------------------------------				
Car's (cost) / residual value	(2,000,000)	-	-	-	-
Registration charges	(35,000)	-	-	-	-
Initial investment **(A)**	(2,035,000)	-	-	-	-
Cost of three mobile phones (15,000×3)	(45,000)	-	-	-	-
Revenue (1,800,000×1.05)	-	1,800,000	1,890,000	1,984,500	2,083,725
Salaries/meals of drivers (3×300,000×1.05)	-	(900,000)	(945,000)	(992,250)	(1,041,863)
Maintenance cost (60,000×1.05×1.10)	-	(60,000)	(69,300)	(80,042)	(92,448)
Insurance premium (50,000-5,000)	(50,000)	(45,000)	(40,000)	(35,000)	-
(B)		795,000	835,700	877,208	949,414
Taxation 30% (B-W.1)× 30%	-	(70,875)	(134,741)	(175,811)	(241,769)
Residual value of car					750,000
Net cash flows	(2,130,000)	724,125	700,959	701,397	1,457,644
Discount factor @ 12%	1.0000	0.8929	0.7972	0.7118	0.6355
Present value	(2,130,000)	646,571	558,805	499,254	926,333
Net present value	500,963				

Conclusion: The net present value is positive; therefore, the proposal should be accepted.

W.1: Adjustment for tax liability					
Accounting/tax depreciation (A×25%) (C)	-	(508,750)	(381,563)	(286,172)	(214,629)*
Profit on disposal of car 750 – (A–C)	-	-	-	-	106,114*
Mobiles' cost charged off	-	(45,000)	-	-	-
Insurance premium allowable for tax-next year	-	45,000	40,000	35,000	-
Insurance premium allowable for tax this year	-	(50,000)	(45,000)	(40,000)	(35,000)
	-	(558,750)	(386,563)	(291,172)	(143,515)

- *Example 05:*

Golf Limited (GL) is engaged in the manufacturing and sale of a single product 'Smart-X'. The existing manufacturing plant is being operated at full capacity but the production is not sufficient to meet the growing demand of Smart-X. GL is considering to replace it with a new Japanese plant. The production capacity of new plant would be 50% more than the existing capacity.

To assess the viability of this decision, the following information has been gathered:

i. The purchase and installation cost of new plant would be Rs. 500 million and Rs. 25 million respectively. The supplier would send a team of engineers to Pakistan for final inspection of the plant before it is commissioned. 50% of the total cost of Rs. 12 million to be incurred on the visit, would be borne by GL.

ii. As a result of installation of the new plant, fixed costs other than depreciation would increase by Rs. 30 million.

iii. The existing plant has an estimated life of 10 years and is in use for the last 6 years. Plant's tax carrying value is Rs. 50 million. A machine supplier has offered to purchase the existing plant immediately at Rs. 45 million.

iv. During the latest year, 6 million units were sold at an average selling price of Rs. 550 per unit. Variable manufacturing cost was Rs. 450 per unit. GL expects that it can increase the sales volume by 25% in the first year after the plant's installation. Thereafter, the sales volume would increase by 4% per annum.

v. The new plant would be depreciated under the straight line method. Tax depreciation is calculated on the same basis. The residual value of the plant at the end of its useful life of 4 years is estimated at Rs. 60 million.

vi. Applicable tax rate is 30% and tax is paid in the year in which the liability arises.

vii. Rate of inflation is estimated at 5% per annum and would affect the revenues as well as expenses.

viii. GL's cost of capital is 12%.

ix. All receipts and payments would arise at the end of the year except cost of setting up the plant which would arise at the beginning of the year. It may be assumed that the new plant would commence operations at the start of year 1.

On the basis of internal rate of return (IRR), advise whether GL should acquire the new plant.

Please see below evaluation of IRR for the said requirement

Descriptions	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
	-------------------- Rs. in million -----------------------				
Incremental contribution margin (W-1)	-	157.50	198.45	244.25	295.37
Incremental fixed cost (30×1.05)	-	(30.00)	(31.50)	(33.08)	(34.73)
Tax depreciation [{500+25+(12×50%)-60)×25%}]	-	(117.75)	(117.75)	(117.75)	(117.75)
Net profit / (loss) before tax	-	9.75	49.20	93.42	142.89
Tax @ 30%	-	(2.93)	(14.76)	(28.03)	(42.87)
Tax savings on loss of disposal of old plant (50m–45m)×30%	-	1.50	-	-	-
Net profit / (loss) after tax	-	8.32	34.44	65.39	100.02
Adding back depreciation (Non-cash item)	-	117.75	117.75	117.75	117.75

Descriptions	Year 0	Year 1	Year 2	Year 3	Year 4
	-------------------- Rs. in million	----------------------			
Initial investment [500m+25m+(12m×50%)–45m]	(486.00)	-	-	-	-
Receipts from residual value	-	-	-	-	60.00
Total cash (outflows) / inflows (A)	(486.00)	126.07	152.19	183.14	277.77
Discount factor at 12% (B)	1.0000	0.8929	0.7972	0.7118	0.6355
Present value (A×B)	(486.00)	112.57	121.33	130.36	176.52
Net present value at 12% NPVb	54.78				
Discount factor @ 18% (C)	1.0000	0.8475	0.7182	0.6086	0.5158
Present value (A×C)	(486.00)	106.84	109.30	111.46	143.27
Net present value at 18% NPVc	(15.13)				
IRR = B%+[NPVb/(NPVb–NPVc)×C%–B%)] = 12%+[54.78/(54.78+15.13)×{18%–12%}]					17%

Conclusion: Since IRR is higher than the GL's cost of capital existing plant should be replaced.

W-1:	Year 1	Year 2	Year 3	Year 4
	-------- Units in million	------------		
Production with new plant (6×1.25), (LY×1.04)	7.50	7.80	8.11	8.43
Production with old plant	6.00	6.00	6.00	6.00
Incremental production (A)	1.50	1.80	2.11	2.43
Contribution margin per unit(550–450)×1.05(B)	105.00	110.25	115.76	121.55
Incremental contribution margin (A×B)	157.50	198.45	244.25	295.37

- *Example 06:*

The following information has been extracted from the projected financial statements of Lotus Enterprises (LE) for the year ending 30 September 2016:

	Rs. in million
Sales (100% credit sales)	3,000
Raw material consumption	900
Raw material inventory (including imports of Rs. 98 million)	158
Conversion cost: Variable	570
Fixed (including depreciation of Rs. 16 million)	40
Operating cost: Variable	730
Fixed (including depreciation of Rs. 27 million)	120
Trade creditors (local purchases)	95
Advance to suppliers for import of raw material	30

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LE is in the process of preparing its budget for the next year. The relevant information is as under:

i. Sale volume is projected to increase by 30%. In order to finance the additional working capital, the management has decided to adopt the following measures:

- Introduce cash sales at a discount of 2%. It is estimated that 20% of the customers would avail the discount.
- The present average collection period is 45 days. LE has decided to improve follow-ups which would ensure collection within 40 days.
- 40% of the raw material consumed is imported which is paid in advance on placement of purchase order. The delivery is made within 30 days after the placement of order. LE has negotiated with the foreign suppliers and agreed that from the next year, payments would be made on receipt of the goods.
- Local purchases would be paid in 50 days.

ii. As a result of increased production, economies of scale would reduce variable conversion cost per unit by 5%.

iii. Due to price increases, cost of raw material and all other costs (excluding depreciation) would increase by 10% and 8% respectively.

iv. Average days for payment of other costs would remain the same i.e. 25 days.

v. There is no opening and closing finished goods inventory.

vi. Quantity of closing local and imported raw material as a percentage of raw material consumption would remain the same.

vii. LE uses FIFO method of valuation of inventory.

Cash budget for the next year would be prepared as follows. (Assuming that all transactions occur evenly throughout the year (360 days) unless otherwise specified)

Inflows:		**Rs. in million**
Sale proceeds from:		
– Cash sales (net of cash discount)	(3,000×1.3)×20%×98%	764.40
– Credit sales:		
Credit sales for the year	(3,000×1.3)×80%	3,120.00
Trade debtors – closing balance	3,120×40÷360	(346.67)
		2,773.33
Trade debtors – opening balance	3,000×45÷360	375.00
Collection from credit sales		3,148.33
	(A)	**3,912.73**

Outflows:				
Payments for raw material imports and local purchases:		**Imports**	**Local purchases**	
Imports and local purchases for the year	**W.1**	544.14	792.00	1,336.14
Trade creditors - closing balance	792×50÷360	-	(110.00)	(110.00)
		544.14	682.00	1,226.14
Adjustment of advance for imports		(30.00)	-	(30.00)
Trade creditors - opening balance		-	95.00	95.00
		514.14	777.00	
			(B)	**1,291.14**

Payments for expenses:					
	Conversion cost		Operating cost		
	Variable	Fixed	Variable	Fixed	
Cost for the year	760.27	25.92	1,024.92	100.44	1,911.55
	570×1.3× 95%×1.08	*(40–16)× 1.08*	*730× 1.3×1.08*	*(120–27) ×1.08*	
Closing–payables	(52.80)	(1.80)	(71.18)	(6.97)	(132.75)
	(760.27÷ 360×25)	*(25.92÷ 360×25)*	*(1,024.92 ÷360×25)*	*(100.44) ÷360×25*	
	707.47	24.12	953.74	93.47	1,778.80
Opening–payables	39.58	1.67	50.69	6.46	98.40
	570÷ 360×25	*(40-16)÷ 360×25*	*730÷ 360×25*	*(120-27) ÷360×25*	
Payments	747.05	25.79	1,004.43	99.93	
				(C)	**1,877.20**
Net cash inflows				**(A-B-C)**	**744.39**

W-1: Imports/purchases for the next year:		Imports	Local purchases
		--------- Rs. in million ---------	
Raw material consumption using FIFO:			
- From current year's import : at old price		30.00	-
at revised price	[(900×1.3×40%)–(98+30)]×1.1	374.00	-
- Current year's purchases: at revised price	[(900×1.3×60%)–60]×1.1	-	706.20
		404.00	706.20
Closing raw material inventory	(98×1.3×1.1), (60×1.3×1.1)	140.14	85.80
Total imports/local purchases for the next year		544.14	792.00

- *Example 07:*

Omega Limited (OL) is the sole distributor of goods produced by ABC Limited which is a leading brand in the international market. OL is now planning to establish a factory in collaboration with ABC Limited. The factory would be established on a land which was purchased at a cost of Rs. 20 million in 2005. The existing market value of the land is Rs. 40 million. The cost of factory building and plant is estimated at Rs. 30 million and Rs. 100 million respectively.

The factory will produce goods which are presently supplied by ABC Limited. The sale for the first year of production is estimated at Rs. 300 million. The existing profit margin is 20% on sales. As a result of own production, cost per unit would decrease by 10%. The sale price and cost of production per unit (excluding depreciation) are expected to increase by 10% and 8% respectively, each year.

Following further information is available:

- ABC Limited would assist in setting up of the factory for which it would be paid an amount of Rs. 10 million at the time of signing the agreement. In addition, ABC Limited would be paid a royalty equal to 3% of sales.
- The factory building and installation of plant would be completed and commercial production would start one year after signing the agreement.
- 50% of the cost of plant would be financed through a five year loan with interest payable annually at 10% per annum. Principal would be repaid at the end of 5th year.
- A working capital injection of Rs. 15 million would be required at the commencement of commercial production.
- OL charges depreciation on factory building and plant under the straight line method.
- OL uses a five year project appraisal period. The residual value of the factory building
- and plant after five years is estimated at 50% and 10% of cost respectively.
- The market value of the land after five years is estimated at Rs. 70 million.
- OL's cost of capital is 12%.

The net present value of the project assuming that unless otherwise specified, all cash inflows/outflows would arise at the end of year, would be calculated as follows. (taxation is ignored)

	Year 0	1	2	3	4	5	6
	Cash inflows/(outflows) – Rs. in million						
Land	(40.00)	-	-	-	-	-	70.00
Factory building	[2] (10.00)	[1] (20.00)					[1] 15.00
Plant installation		(100.00)					10.00
Loan		50.00	-	-	-	-	(50.00)
Working capital		(15.00)	-	-	-	-	15.00
Sales (10% growth)	-	-	300.00	330.00	363.00	399.30	439.23
Cost of goods sold (8% growth)			W.1 (195.00)	(210.60)	(227.45)	(245.64)	(265.30)
Royalty (3% of sales)			(9.00)	(9.90)	(10.89)	(11.98)	(13.18)
Interest on loan			-	-	-	-	-
Net cash flows	(50.00)	(85.00)	96.00	109.50	124.66	141.68	220.75
PV factor at 12%	1.00	0.89	0.80	0.71	0.64	0.57	0.51
Present value	(50.00)	(75.65)	76.80	77.75	79.78	80.76	112.58
Net present value of the project							302.02

W.1 - Cost of goods sold:		Rs. in million
Cost of own production (Including depreciation)	(300×80%×90%)	216.00
Depreciation – factory building	(30×50%)÷5	(3.00)
Depreciation – Plant	(100×90%)÷5	(18.00)
		195.00

- *Example 08:*

Larkana Fabrication Limited is considering an investment in a new machine, with a maximum output of 200,000 units per annum, in order to manufacture a new toy. Market research undertaken for the company indicated a link between selling price and demand, and the research agency involved has suggested two sales strategies that could be implemented, as follows:

	Strategy 1	Strategy 2
Selling price (in current price terms)	Rs.8.00 per unit	Rs.7.00 per unit
Sales volume in first year	100,000 units	110,000 units
Annual increase in sales volume after first year	5%	15%

The services of the market research agency have cost Rs.75,000 and this amount has yet to be paid.

Larkana Fabrication Limited expects economies of scale to reduce the variable cost per unit as the level of production increases. When 100,000 units are produced in a year, the variable cost per unit is expected to be Rs.3.00 (in current price terms). For each additional 10,000 units produced in excess of 100,000 units, a reduction in average variable cost per unit of Rs.0.05 is expected to occur. The average variable cost per unit when production is between 110,000 units and 119,999 units, for example, is expected to be Rs.2.95 (in current price terms); and the average variable cost per unit when production is between 120,000 units and 129,999 units is expected to be Rs.2.90 (in current price terms), and so on.

The new machine would cost Rs.1,600,000 and would not be expected to have any resale value at the end of its life.

Operation of the new machine will cause fixed costs to increase by Rs.110,000 (in current price terms). Inflation is expected to increase these costs by 4% per year. Annual inflation on the selling price and unit variable costs is expected to be 3% per year.

The company has an average cost of capital of 10% in money (nominal) terms

a) the sales strategy which maximizes the present value of total contribution. Ignore taxation in this part of the question is determined as follows:

Contribution

Strategy 1					
Year	**1**	**2**	**3**	**4**	**5**
Demand (units)	100,000	105,000	110,250	115,762	121,551
Selling price (unit)	8.00	8.00	8.00	8.00	8.00
Variable cost (unit)	3·00	3.00	2.95	2.95	2.90
Contribution (unit)	5.00	5.00	5.05	5.05	5.10
Inflated contribution	5.15	5.30	5.52	5.68	5.91
Total contribution (Rs.)	515,000	556,500	608,580	657,528	718,366
10% discount factors	0.909	0.826	0.751	0.683	0.621
PV of contribution (Rs.)	468,135	459,669	457,044	449,092	446,105

Total PV of Strategy 1 contributions = Rs.2,280,045.

Strategy 2					
Year	1	2	3	4	5
Demand (units)	110,000	126,500	145,475	167,296	192,391
Selling price (unit)	7.00	7.00	7.00	7.00	7.00
Variable cost (unit)	2.95	2.90	2.80	2.70	2.55
Contribution (unit)	4.05	4.10	4.20	4.30	4.45
Inflated contribution	4.17	4.35	4.59	4.84	5.16
Total contribution (Rs.)	458,700	550,275	667,730	809,713	992,738
10% discount factors	0.909	0.826	0.751	0.683	0.621
PV of contribution (Rs.)	416,958	454,527	501,465	553,034	616,490

Total PV of strategy 2 contributions = Rs.2,542,474.

Strategy 2 is preferred as it has the higher present value of contributions.

b) Evaluating the investment in the new machine using internal rate of return:

Year	1	2	3	4	5
	Rs.	Rs.	Rs.	Rs.	Rs.
Total contribution	458,700	550,275	667,730	809,713	992,738
Fixed costs	(114,400)	(118,976)	(123,735)	(128,684)	(133,832)
Profit	344,300	431,299	543,995	681,029	858,906
10% discount factors	0.909	0.826	0.751	0.683	0.621
Present value	312,969	356,253	408,540	465,143	533,381
20% discount factors	0.833	0.694	0.579	0.482	0.402
Present value of profits	286,802	299,322	314,973	328,256	345,280

Including the cost of the initial investment to give the present values at two discount rates:

	10% discount rate	20% discount rate
	Rs.	Rs.
Sum of present values of profits	2,076,285	1,574,633
Initial investment	(1,600,000)	(1,600,000)
Net present value	476,285	(25,367)

IRR = 10% + [476,285/(476,285+ 25,367)] × (20 – 10)% = 19.5%

Since the internal rate of return is greater than the company's cost of capital of 10%, the investment is financially acceptable.

STICKY NOTES

Time value of money can be used for evaluation of investment projects using NPV or IRR methods.

Core principles and 4 steps model

1. **The estimation of expected future cash flows from projects (cash receipt & cash payments) using relevant costing principles.**
2. **The determination of expected future period where estimated expected future cash flows (cash inflows & cash outflows) will be occurred.**
3. **Apply the time value of money concept and discount future cash flows to present values using discount factor or cost of capital.**
4. **To make decision for acceptance or rejection of proposed investment project using discounted cash flows techniques(DCF).**

Net present value method (NPV)

Step 1: List all cash flows expected to arise from the project.

Step 2: Discount these cash flows to their present values using the cost that the company has to pay for its capital (cost of capital) as a discount rate.

Step 3: Identify the net present value (NPV) of a project is difference between the present value of all the costs incurred and the present value of all the cash flow benefits (savings or revenues).

When discounted are IRR rate, NPV of project is zero.

$$IRR = A\% + \left(\frac{NPV_A}{NPV_A - NPV_B}\right) \times (B\% - A\%)$$

Inflation and taxation impacts DCF. Inflation applies when in long run projects are affected by inflation in sales prices or costs. Also tax saving on tax allowable depreciation/allowances can impact decision making.

CHAPTER 18

SUSTAINABILITY REPORTING

IN THIS CHAPTER

AT A GLANCE

The term "business" used to be defined as an economic system where goods and services are exchanged for one another or for money. Accordingly, the annual reports of organizations used to disclose and communicate the performance in terms of financial profit attributable to shareholders for the period.

The objective of understanding the concept of Sustainability report is to recognize the corporate social responsibility (CSR) of corporate entities in a structured way. Sustainability report is a report published by a company or organization about the economics, environmental and social impacts caused by its everyday activities.

Sustainability reporting introduces the concept of integrated reporting. An integrated report is a concise communication about how an organization strategy, governess, performance and prospects in the context of its external environment lead to criteria of financial as well as non-financial value over short, medium and long term.

Sustainability report combines the analysis of financial and non-financial performance which is and intense of integrated reporting.

Reporting on sustainability is considered by International Federation of Accountants (IFAC) but it is still a voluntary requirement in most of justification.

1. SUSTAINABILITY & INTEGRATED REPORTING

1.1 Integrated Reporting

An integrated report is a concise communication about how an organization's strategy, governance, performance and prospects, in the context of its external environment, lead to the creation of value over the short, medium and long term.

It provides an insight about the external environment that affects an organization, the capital used and affected by the organization and how the organization interacts with the external environment and the capitals to create value over the short, medium and long term.

The capitals are stocks of value that are increased, decreased or transformed through the activities and outputs of the organization. They are categorized as financial, manufactured, intellectual, human, social and relationship, and natural capital. Existing practices of measuring capital other than financial are in evolution stage and have yet to attain the level of generally accepted standards.

Integrated reporting requires the process of integrated thinking, and the application of principles such as connectivity of information. The process takes into consideration the relationships between its various operating and functional units and the capitals that the organization uses or affects.

The idea of sustainability reporting is evolved from the concept of integrating reporting.

- *Example 01:*

In the context of integrated reporting, the term 'capitals' refers to the stocks of value that are increased, decreased or transformed through the activities of an organization. There are different categories of capitals, in the context of integrated reporting. These may be listed below:

(i)	Financial	(ii)	Human
(iii)	Manufactured	(iv)	Social and relationship
(v)	Intellectual	(vi)	Natural

1.2 Sustainability Reporting

The concept of Corporate Citizenship evolved further and took shape of a structured initiative in the corporate world and was termed 'sustainability'. The term smartly communicates the concept behind the process covering most important essence of organization's ability to (a) last and (b) contribute to the society for a long time or indefinitely. Accordingly, it requires performance in four key areas, namely:

- Economic
- Environmental
- Social
- Governance performance

Reporting on sustainability - sometimes referred to as environmental, social, and governance reporting is still a standalone and voluntary requirement in most of the jurisdiction.

Global Reporting Initiative (GRI) explained the sustainability report is a report published by a company or organization about the economic, environmental and social impacts caused by its everyday activities. The report also presents the organization's values and governance model, and demonstrates the link between its strategy and its commitment to a sustainable global economy.

A program of data collection, communication, and responses is necessary to produce a regular sustainability report. Moreover, the sustainability performance is monitored on an on-going basis. To shape the organization's strategy and policies, and improve performance the data can be provided regularly to decision makers.

Sustainability reporting has emerged as a vital resource for managing change towards a sustainable global economy that combines long term profitability with ethical behavior, social justice and environmental care. Sustainability reporting can be considered as synonymous with other terms for non-financial reporting; triple bottom line reporting, corporate social responsibility (CSR) reporting, and more.

A more recent development in sustainability reporting is that it combines the analysis of financial and non-financial performance which is an intrinsic element of integrated reporting. The recent trend shows that the uptake of sustainability reporting is increasing among organizations of all types and sizes.

A focus on sustainability helps organizations manage their social and environmental impacts and improve operating efficiency and natural resource stewardship, and it remains a vital component of shareholder, employee, and stakeholder relations. Firms continuously seek new ways to improve performance, protect reputational assets, and win shareholder and stakeholder trust.

Sustainability disclosure can serve as a differentiator in competitive industries and foster investor confidence, trust and employee loyalty. Analysts often consider a company's sustainability disclosures in their assessment of management quality and efficiency, and reporting may provide firms better access to capital.

Sustainability reporting requires companies to gather information about processes and impacts that they may not have measured before. This new data, in addition to creating greater transparency about firm performance, can provide firms with knowledge necessary to reduce their use of natural resources, increase efficiency and improve their operational performance.

Besides, sustainability reporting can prepare organizations to avoid or mitigate environmental and social risks that might have material financial impacts on their business while delivering better business, social, environmental and financial value.

For reporting to be as useful as possible for managers, executives, analysts, shareholders and stakeholders, a unified standard that allows reports to be quickly assessed, fairly judged and simply compared is a critical asset

Difference between financial performance based reporting & Sustainability Reporting

There is a difference between financial performance based reporting & Sustainability Reporting.

Financial performance based reporting is based on the concept of explaining final performance of business for the period. The final report objective is to explain the impact of financial performance in creating shareholders' wealth assuming that management is only responsible for maximizing the wealth of shareholders.

The term sustainability communicates the concept behind the covering most important essence of organization ability to last and contribute to the society for a long time or indefinitely. Sustainability reporting is based on the concept of corporate citizenship and explaining it in structural way.. Accordingly, it requires performance in four key areas namely:

a) Economic

b) Environmental

c) Social

d) Governance performance

Relationship between integrated reporting and sustainability reporting

The relationship between integrated reporting and sustainability reporting is vital. The sustainability report uses the concepts of different capitals used by an organization for its long term survival as:

Integrated reporting is a method of presentation about how the organization interacts with the external environment and how an organization's strategy, governance, performance and prospects, in the context of its external environment, lead to the creation of value over the short, medium and long term.

The integrated report uses different categories of 'capitals' that are:

i. Financial

ii. Human

iii. Manufactured

iv. Social and relationship

v. Intellectual

vi. Natural

As the idea of sustainability report is emerged from integrating reporting so the Global Reporting Initiative (GRI), sustainability report is published by a company or organization about the economic, environmental and social impacts caused by its everyday activities. The report also presents the organization's values and governance model. It demonstrates the link between its strategy and its commitment to a sustainable global economy.

1.3 Benefits of sustainability reporting

According to GRI an effective sustainability reporting cycle should benefit all reporting organizations.

Internal benefits for companies and organizations can include:

- Increased understanding of risks and opportunities
- Emphasizing the link between financial and non-financial performance
- It provides supports in the development of long term management strategy and policy, and business plans
- It helps in streamlining processes, reducing costs and improving efficiency
- It helps benchmarking and assessing sustainability of performance with respect to laws, norms, codes, performance standards, and voluntary initiatives
- It helps avoiding being implicated in publicized environmental, social and governance failures
- It helps in comparing performance internally, and between organizations and sectors

External benefits of sustainability reporting can include:

- Mitigating – or reversing – negative environmental, social and governance impacts
- Improving reputation and brand loyalty
- Enabling external stakeholders to understand the organization's true value, and tangible and intangible assets
- Demonstrating how the organization influences, and is influenced by, expectations about sustainable development

2. INTERNATIONAL FEDERATION OF ACCOUNTANTS (IFAC) SUSTAINABILITY FRAMEWORK 2.0

The IFAC Sustainability Framework (the Framework) primarily targets professional accountants working in commerce, industry, financial services, education, and the public and not-for-profit sectors. IFAC strongly believes that these professional accountants can influence the way organizations integrate sustainability into:

- Mission,
- Goals and objectives
- Strategies
- Management and operations
- Definitions of success
- Stakeholder communications

2.1 The role of professional accountants

a) Sustainable Organizational Success

Professional accountants can broadly be categorized as creators, enablers, preservers, and reporters of sustainable value for their organizations. The principal expectations of professional accountants in business as derived from the activities they will need to perform to support the development of sustainable organizational success. How an accountant's professional background and orientation equip them with the necessary qualities to support their contribution, and particularly to act as integrators by incorporating sustainability factors into their organizational strategy, operations, and reporting. This will allow organizations to simultaneously deliver improved business performance and to contribute to a better world.

The role of professional accountants is more than simply that of preparers or assurers of financial and sustainability reports. More than one-half of all professional accountants globally work in organizations and are adapting to a world in which sustainability is the key to long-term organizational performance.

The Framework helps professional accountants to understand how, in their diverse roles, they can influence change. In clearly defining the different facets of sustainability and corporate responsibility, the Framework can help professional accountants grasp all the important aspects of sustainability that they may encounter, directly or indirectly, and that will be important to their organizations.

b) Finance Function

The Framework will provide professional accountants with an opportunity to consider themselves as knowledgeable change agents. Professional accountants are well positioned to help organizations interpret sustainability issues in a relevant way for their organizations, and to integrate those issues into the way they do business.

Although developing a sustainable organization is a multi-disciplinary responsibility, the finance function needs to be clear on its role in providing and supporting sustainability leadership for several reasons:

- The finance function is well placed to influence behavior and outcomes through incorporating sustainability considerations into strategies and plans, business cases, capital expenditure decisions, and into performance management and costing systems.
- Integrated sustainability management involves managing opportunity and risk, measuring and managing performance, and providing insight and analysis to support decision making. This plays to the strengths of professional accountants working in finance functions and offers opportunities to provide higher value business partnering.

- Improving the quality of stakeholder communications and the reporting of sustainability information and how it connects to an organization's strategy and operations requires the same rigor as the process of financial reporting. Materiality, relevance, comparability, accuracy, and completeness continue to be essential qualitative characteristics of information. Professional accountants understand the need for, and how to implement quality data and robust systems to capture, maintain, and report performance. They also have the project management skills needed to put such systems in place, applying appropriate processes and controls.
- To rise to the challenge, professional accountants, on an individual level, will need to understand how sustainability does or might affect their role, and to identify and utilize the continuing professional development resources available from their own professional body, IFAC, and other sources. Continuing education will help accountants learn more about the applied aspects of sustainability and determine approaches to organizational improvement and transformation. Accountants working in audit and advisory roles, particularly in SMEs, can consider how they could embrace sustainability issues (using the Framework as a starting point) to add value to their client service/advisory role. Importantly, when acting in a public interest-related reporting or advisory capacity, it might be necessary to consider whether sustainability issues have been properly addressed and disclosed.

These Key Perspectives on Key Themes on Key consideration are explained in detail as under in the next section

3. KEY THEMES & KEY CONSIDERATION OF IFAC FRAMEWORK ON SUSTAINABILITY

The details of Key themes and Key consideration is as under:

3.1 Business strategy perspective

The role of leadership and business strategy is to promote the integration of sustainability issues at a strategic level, so that they are embedded in organizational development covering strategy, planning, enterprise risk management, and operations. The importance of tone at the top encourages the integration of governance and sustainability into strategy, operations, and reporting of an organization. This philosophy revolves around leadership, sustainability and corporate citizenship. Responsible leaders direct company strategies and operations with a view to achieve sustainable economic, social and environmental performance.

3.1.1 Defining sustainability and the business case

Key Theme: Establishing an understanding and definition of sustainability that helps to ensure that an organization is both socially and environmentally responsible at the same time as being economically viable. Developing a strong business case to highlight what sustainable development means for an organization, and how improved social and environmental performance can translate into enhanced business performance, will contribute to a better understanding of the benefits that might be achieved with a more holistic business approach.

Key considerations for professional accountants

- Create awareness of how the finance function can get involved in establishing a business case
- Ensure clarity on uses of the business case
- Focus the business case on linking sustainability to strategy and the impacts of organizational activity on society and the environment
- A business case evolves as the business environment changes
- Identifying significant, material, and relevant environmental and social issues

3.1.2 Vision and leadership

Key theme: Integrating a more sustainable approach into the way an organization does business requires change and leadership from senior management.

Key considerations for professional accountants

- A strategic approach to sustainability helps to identify a range of competitive strategies
- Values guide behaviors and decisions
- Integration of sustainability into the key business drivers requires leadership and ownership within the governing body and at all management levels
- Managerial and operational structures deliver the vision and strategy and ensure accountability and ownership

3.1.3 Stakeholder engagement

Key theme: Stakeholder engagement has emerged as a vital tool to develop an understanding of what sustainability means for organizations, and how it can contribute to value creation and the viability of their operations. Failure to identify and engage with stakeholders is likely to lead to poor performance by:

- Hurting customer satisfaction and perceptions
- Adversely affecting employee motivation and morale
- Damaging relationships in the supply chain

- Possibly compromising an organization's reputation with the wider community
- The quality of sustainability reporting also depends on constructive stakeholder engagement.

Key considerations for professional accountants

- Reinforce the importance of stakeholder engagement
- Establish a systematic and carefully planned approach to entering a dialogue with stakeholders
- Stakeholder dialogue can help managers consider how best to deal with the trade-offs between economic, social, and environmental performance
- Ensure that ongoing stakeholder engagement initiatives are continuous, dynamic, and periodically reviewed
- Build the knowledge and professional skills needed to deal with the challenges of understanding and balancing stakeholder expectations

3.1.4 Goals and target setting

Key theme: To develop qualitative and quantitative goals and targets to facilitate the delivery of high-level vision and strategy.

Key considerations for professional accountants

- Establish goals, targets, and performance measures
- Identify outcomes where possible
- Engage employees involved in executing strategy
- Link to rewards
- Establish a baseline against which progress can be monitored

3.1.5 Integration with risk management

Key theme: Integrating sustainability issues into a rigorous and adaptive risk management approach that allows for the interpretation of opportunities, risk factors, and causation.

Key considerations for professional accountants

- Integrate sustainability issues into risk management and other management systems
- Gather information and assess cost benefit
- Assess potential impact
- Interpreting risk and causation
- Dealing with opportunity and risk

3.1.6 Engagement of suppliers

Key theme: Working closely with suppliers to improve sustainability performance and procurement.

Key considerations for professional accountants

- The overriding importance of values and a risk-based perspective to guide decisions
- Identify the opportunities associated with sustainable procurement
- Supplier monitoring and support is ongoing via periodic meetings and training, and with the consideration of collaborative opportunities
- Consider a systematic process for supplier selection that is clear to all potential and current suppliers
- Communicate how an organization builds relationships and does business with business partners and suppliers

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Professional competence and the due care for Professional Accountants. The role of financial accountants in defining sustainability and business case is very important. The professional accountants should use the professional competence and the due care in performing his duty as it:

- Create awareness of how the finance function can get involved in establishing a business case
- Ensure clarity on uses of the business case
- Focus the business case on linking sustainability to strategy and the impacts of organizational activity on society and the environment
- A business case evolves as the business environment changes
- Identifying significant, material, and financial value for reporting to be as useful as possible for managers, executives, analyst, shareholders and stakeholders, a unified standard that allows reports to be quickly assessed, fairly judge and simple compared is critical asset.

3.2 Operational perspectives

3.2.1 Management and accounting activities to improve sustainability performance

The operational perspective covers a range of management and management accounting activities to support and improve (a) an organization's sustainability performance, and (b) its integration into management and operational activities. Traditional management practices tend to focus solely on the financial or economic outcome of operational activities. Integration or embedding sustainability considerations into business practice involves considering the social and environmental outcomes of activities in addition to their economic impacts. Leading organizations are bringing these factors into their decision-making processes with support from professional accountants.

3.2.2 Cutting costs by minimizing waste

Key theme: Clearly understanding the possibilities for quickly improving environmental performance. Improving environmental performance need not just involve complex plans and activities requiring significant investment.

Organizations have many opportunities for quick wins through energy efficiency and waste minimization, to make an immediate positive impact on the environment, and to achieve efficiencies and cost savings.

Key considerations for professional accountants

<u>Energy efficiency</u>

- Identifying large environmental costs that could be reduced
- Monetizing procedures for costs, savings, and revenues related to any business activities with a potential environmental impact
- Using measurement and targets and ensuring accountability
- Small (and no cost) changes can lower energy costs and reduce carbon emissions
- Spreading awareness

<u>Waste and water minimization</u>

- Minimizing materials waste
- Tracking physical accounting information
- Reviewing and understanding the impact of legislation regarding waste
- Changing processes

3.2.3 Carbon foot printing

Key theme: Using carbon accounting to calculate organizational carbon footprint in order to (a) manage GHG emissions and make reductions over time, (b) report the footprint accurately to external stakeholders, and (c) invest in lower energy technologies and more efficient methods of operating.

Key considerations for professional accountants

- Moving beyond a GHG inventory
- Determine how to manage carbon emissions data
- Distinguish between boundaries, in terms of organizational and product footprints, and between entities in the supply chain
- Establish principles of a carbon audit report and the key issues to be disclosed in external reports for stakeholders
- Greenhouse gas inventory audit

3.2.4 Improving information to support decisions and reporting

Key theme: Improved social and environmental performance and transparency requires information flows to support the strategic and operational management of sustainability issues. The required environmental and social information to support management and operational decisions is not, however, often readily available, either being non-existent or limited to measuring liabilities for compliance purposes.

Key considerations for professional accountants

- Moving from a conformance- to an integrated performance-based view of accounting for sustainability impacts
- Identifying, defining, and classifying costs to motivate desired activities and behaviors
- Working across organizational functions, particularly integrating accounting, procurement and operations
- Accounting for social costs and valuing social impacts
- Using environmental and social cost and other non-financial information for project appraisal and capital budgeting

3.2.5 Integrated management control systems

Key theme: Developing integrated management and (internal) control systems to ensure alignment of sustainability performance to organizational objectives.

Key considerations for professional accountants

- MCSs should incorporate specific activities that support sustainability goals and objectives into the organization's overall management and control cycle
- MCSs should ideally help to integrate social and environmental factors alongside financial and quality factors
- (Internal) control effectiveness depends on effective governance and risk management
- Setting out the role of internal auditing
- Integrating sustainability (and particularly environmental) factors into financial processes, such as budgeting and forecasting

3.2.6 Performance measurement and KPIs

Key theme: Using strategic performance measurement systems, performance measures, and KPIs to ensure the delivery of strategic and sustainability-related objectives.

Key considerations for professional accountants

- Integrate sustainability measures where they have been identified as an important driver of strategy
- Judge how scientific cause-and-effect relationships between measures need to be to inform decisions
- Consider how sector or industry norms can influence KPI selection
- Develop and use eco-efficiency indicators to link monetary and physical information for decision making
- Develop and use socio-efficiency indicators to better understand social impacts
- Consider how to usefully present metrics and KPIs in internal and external reporting

3.2.7 Integrating performance and Professional accountants

Sustainability reporting introduces the concept of Integrating performance that is not only based on financial performance so the role of professional accountant is very critical for improving information to support decision and reporting.

In the above context the key considerations for professional accountants are:

- Moving from a conformance- to an integrated performance-based view of accounting for sustainability impacts
- Identifying, defining, and classifying costs to motivate desired activities and behaviors
- Working across organizational functions, particularly integrating accounting, procurement and operations
- Accounting for social costs and valuing social impacts
- Using environmental and social cost and other non-financial information for project appraisal and capital budgeting

3.3 Reporting perspective

External reporting by organizations has evolved over the years from providing financial statements and accompanying notes to the present day, where the trend is to provide an annual report, consisting of financial statements, some form of management commentary, some form of environment, social, and governance performance data, and, particularly from many larger organizations, a separate report covering nonfinancial sustainability and corporate social responsibility disclosures. In addition, many jurisdictions, either by way of statute or listing rules, impose rules relating to continuous disclosure of information about specified events or matters that would be of concern to participants in the securities market. Jurisdictions likewise adopt different approaches to annual, half-year, and quarterly cycles of reporting.

3.3.1 Developing an organizational reporting strategy

Key theme: A reporting strategy that will yield a complete picture of an organization's performance for a range of stakeholders is needed. This will involve using sustainability reporting frameworks and principles, such as GRI's Reporting Framework, and ensuring that their use contributes to meaningful sustainability and integrated reporting. Integrated reporting is a new paradigm in reporting that requires connecting an organization's strategy, its financial performance, and its performance on environmental, social, and governance issues.

Key considerations for professional accountants

- Determine the range of users and their needs for various types of reports and disclosures
- Project planning and management, and structured processes, will underpin a successful reporting regime
- Break down functional silos to facilitate effective integrated reporting
- Use reporting frameworks and guidelines to help develop reporting processes and to ensure that all relevant sustainability information is disclosed
- Disclosing performance across the value supply chain
- Meeting stakeholder needs in local markets

3.3.2 Reflecting sustainability impacts in financial statements

Key theme: Incorporating environmental and social issues into financial statements to support an organization's stewardship role and to enable users to make more well-informed decisions regarding environmental and social impacts on assets, liabilities, income, and expenditures.

Key considerations for professional accountants

- Establishing how to reflect environmental (and, where applicable, other sustainability-related) liabilities and costs in financial statements prepared under IFRSs
- Determining specific sustainability disclosure requirements under national securities regulations and Generally Accepted Accounting Principles (GAAP)

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- Considering additional information and disclosure to improve transparency on environmental performance
- Determining materiality in the context of what information management believes is important for investors to make informed financial decisions about an organization

3.3.3 Narrative reporting for enhanced transparency to investors

Key theme: Using narrative reporting to provide greater transparency on business performance and to ensure that sustainability-related disclosures are useful to investors.

Key considerations for professional accountants

- Avoiding over-disclosure and clutter
- Ensuring a forward-looking orientation
- Viewing narrative reporting as a fair reflection of the management information used internally

3.3.4 Determining materiality

Key theme: Understanding and reconciling approaches to applying materiality to sustainability and integrated reporting.

Key considerations for professional accountants

- In defining report content, materiality should be considered along with the need for other important information characteristics
- Accountability for materiality thresholds and judgments
- Linking the determination of materiality to strategy, risk management, and sector benchmarks
- Determining a process for resolving different expectations regarding materiality
- Where information is reported can help (a) to reinforce materiality criteria, and (b) to keep the length of disclosures manageable (particularly where the application of materiality might vary between reporting for wider stakeholders from investors)

3.3.5 External review and assurance of sustainability disclosures

Key theme: Establishing an approach to external assurance that adds credibility to an organization's reporting and provides internal benefits, such as helping to improve underlying reporting processes.

Key considerations for professional accountants

- The quality of external assurance is directly linked to stakeholder inclusiveness
- Clarifying the purpose and scope of the assurance
- The choice of service provider
- Establishing the type of engagement
- Enhancing the assurance statement

STICKY NOTES

Integrating Reporting is a process of integrating thinking and connectivity of information. It describe the relationship between operating and functional using with capital that organization uses

Sustainability Reporting explains economic, environmental and social impacts caused by its everyday activities. It requires performance in four areas namely, economic, environmental, social and governance performance

International Federation of Accountants (IFAC) Sustainability Framework describes role of professional accountants in driving sustainability organizational success as well as financial accountants and finance functions

Key themes and considerations are provided with respect to three areas namely Business Strategy perspectives, operational perspectives and reporting perspective

Present value table

This table shows the discount factor for an amount at the end of *n* periods at r%.

	Interest rates (r)									
Periods										
(n)	**1%**	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
1	.990	.980	.971	.962	.962	.943	.935	.926	.917	.909
2	.980	.961	.943	.925	.907	.890	.873	.857	.842	.826
3	.971	.942	.915	.889	.864	.840	.816	.794	.772	.751
4	.961	.924	.888	.855	.823	.792	.763	.735	.708	.683
5	.951	.906	.863	.822	.784	.747	.713	.681	.650	.621
6	.942	.888	.837	.790	.746	.705	.666	.630	.596	.564
7	.933	.871	.813	.760	.711	.665	.623	.583	.547	.513
8	.923	.853	.789	.731	.677	.627	.582	.540	.502	.467
9	.914	.837	.766	.703	.645	.592	.544	.500	.460	.424
10	.905	.820	.744	.676	.614	.558	.508	.463	.422	.386
11	.896	.804	.722	.650	.585	.527	.475	.429	.388	.350
12	.887	.788	.701	.625	.557	.497	.444	.397	.356	.319
13	.879	.773	.681	.601	.530	.469	.415	.368	.326	.290
14	.870	.758	.661	.577	.505	.442	.388	.340	.299	.263
15	.861	.743	.642	.555	.481	.417	.362	.315	.275	.239
16	.853	.728	.623	.534	.458	.394	.339	.292	.252	.218
17	.844	.714	.605	.513	.436	.371	.317	.270	.231	.198
18	.836	.700	.587	.494	.416	.350	.296	.250	.212	.180
19	.828	.686	.570	.475	.396	.331	.277	.232	.194	.164
20	.820	.673	.554	.456	.377	.312	.258	.215	.178	.149

	Interest rates (r)									
Periods										
(n)	**11%**	**12%**	**13%**	**14%**	**15%**	**16%**	**17%**	**18%**	**19%**	**20%**
1	.901	.893	.885	.877	.870	.862	.855	.847	.840	.833
2	.812	.797	.783	.769	.756	.743	.731	.718	.706	.694
3	.731	.712	.693	.675	.658	.641	.624	.609	.593	.579
4	.659	.636	.613	.592	.572	.552	.534	.516	.499	.482
5	.593	.567	.543	.519	.497	.476	.456	.437	.419	.402
6	.535	.507	.480	.456	.432	.410	.390	.370	.352	.335
7	.482	.452	.425	.400	.376	.354	.333	.314	.296	.279
8	.434	.404	.376	.351	.327	.305	.285	.266	.249	.233
9	.391	.361	.333	.308	.284	.263	.243	.225	.209	.194
10	.352	.322	.295	.270	.247	.227	.208	.191	.176	.162
11	.317	.287	.261	.237	.215	.195	.178	.162	.148	.135
12	.286	.257	.231	.208	.187	.168	.152	.137	.124	.112
13	.258	.229	.204	.182	.163	.145	.130	.116	.104	.093
14	.232	.205	.181	.160	.141	.125	.111	.099	.088	.078
15	.209	.183	.160	.140	.123	.108	.095	.084	.074	.065
16	.188	.163	.141	.123	.107	.093	.081	.071	.062	.054
17	.170	.146	.125	.108	.093	.080	.069	.060	.052	.045
18	.153	.130	.111	.095	.081	.069	.059	.051	.044	.038
19	.138	.116	.098	.083	.070	.060	.051	.043	.037	.031
20	.124	.104	.087	.073	.061	.051	.043	.037	.031	.026

Cumulative present value

This table shows the annuity factor for an amount at the end of each year for *n* years at r%.

	Interest rates (r)									
Periods										
(n)	**1%**	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	8.495
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201
19	17.226	15.679	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365
20	18.046	16.351	14.878	13.590	12.462	11.470	10.594	9.818	9.129	8.514

Periods	Interest rates (r)									
(n)	**11%**	**12%**	**13%**	**14%**	**15%**	**16%**	**17%**	**18%**	**19%**	**20%**
1	0.901	0.893	0.885	0.877	0.870	0.862	0685	0.847	0.840	0.833
2	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	6.492	6.194	5.918	5.660	5.421	5.197	4.968	4.793	4.611	4.439
13	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730
17	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843
20	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870

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