

2

Decision Making Using Cost Concepts and CVP Analysis

LEARNING OBJECTIVES

After studying this unit you will be able to :

- Understand the meaning and prerequisites of relevant costs.
- Understand different cost concepts used in decision making
- Learn and apply the various cost concepts in management decision making.
- Apply the Incremental/Differential cost techniques in managerial decisions.
- Ascertain the ways of optimising the investment plan.
- Make use of cash flow technique regarding decision relating to investment alternatives.
- Understand the Marginal cost concepts
- Understand the meaning of Cost-Volume-Profit analysis and its application in managerial decision making.

2.1 Introduction

Cost has different meaning in different settings and the kind of cost concepts used in a particular situation depends upon the circumstances/requirement of each case. The costs reported by financial accountants are actual costs. For the purpose of decision making and control, costs are distinguished on the basis of their relevance to the different type of decisions and control functions. For business decision making purposes, relevant costs rather than actual costs are considered. Relevant costs constitute a practical basis of decision making which is different from historical cost approach.

2.2 Different Cost Concepts

To make appropriate decision a management accountant needs to understand different functions related to costs. Though mainly cost concepts for decision making can be broadly classified as relevant cost and non-relevant cost. However, it is very essential to understand different cost concepts separately as to make the process of decision making easier and to make correct decision making for a business organization.

2.2.1 Relevant cost and Non-relevant cost: Relevant Costs may be understood as expected future costs which are different for every alternative course of action being planned. As per

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CIMA terminology relevant costs are those which will be affected by the decision being taken. All relevant costs should be considered in management decision-making.

Non-relevant costs will remain unaltered regardless of the decision being taken. Examples of non relevant costs are fixed overhead which remain constant regardless of the decision being taken, committed costs i.e. expenditure that will be incurred in future due to present obligation.

Following two conditions need to be satisfied for a cost to be called a relevant cost:-

1. **Occur in the Future** - every decision deals with selecting a course of action based on its expected future results
2. **Differ among the alternative courses of action** -costs and revenues that do not differ will not matter and will have no bearing on the decision being made.

For example, while considering a proposal for plant replacement by discarding the existing plant, the original cost and the present depreciated book value of the old plant are irrelevant as they have no impact on the decision for replacement just going to be taken place. However the expected sales value of the discarded plant is relevant, as it just goes to reduce the amount of investment to be made in the new plant and so it has an influence on the decision. Moreover, outcome of the investment is also taken into consideration for decision making.

Relevant cost analysis helps in drawing the attention of managers to those elements of cost which are relevant for the decision.

The following examples pin-point those costs which are not relevant to a decision at hand. These irrelevant costs do not play any role in the decision making:

- (i) Historical or sunk costs are irrelevant as they do not play any role in the decision making process.* But they are the best basis for predicting future costs. For example, if old and obsolete spare parts worth ₹5,00,000 are to be scrapped and sold for ₹15,000, the original cost of ₹5,00,000 is irrelevant to the decision.
- (ii) Even among future costs, those variable costs which will not differ under various alternatives are irrelevant.* For example, a company proposes to re-arrange plant facilities and estimates its future costs under two alternative choices, as under:

Particulars	Do not re-arrange	Re-arrange
	(₹)	(₹)
Direct materials cost/unit	10.00	10.00
Direct labour cost/unit	5.00	4.00

In the above example, the direct material cost remains constant under both the alternatives, hence it is irrelevant to the decision "as to whether plant facilities are to be re-arranged or not". Only direct labour cost which differs under the two alternatives is relevant. Since there is a saving of ₹1/- per unit in the second alternative, the company is advised to go in for re-arrangement of plant facilities.

(iii) *If fixed expenses remains un-changed under different alternatives such expenses are irrelevant to the decision at hand.* Consider, for example, the following data given for a hypothetical firm:

Expected sales	50,000 units
Variable costs	₹2.50 per unit
Fixed costs	₹1.50 per unit
Selling price	₹5.00 per unit

The firm expects to get a special export order for 10,000 units at a price of ₹3.75 per unit. Advise whether the export order should be accepted or not.

In order to advise the firm, we may analyse the figures as under:

Particulars	Sales at 50,000 units	Sales at 60,000 units	Difference
	(₹)	(₹)	(₹)
Sales values	2,50,000	2,87,500	+37,500
Less : Variable costs	1,25,000	1,50,000	-25,000
Contribution margin	1,25,000	1,37,500	+12,500
Less : Fixed expenses	75,000	75,000	—
Net profit	50,000	62,500	+12,500

The unit total cost is ₹4.00 (₹2.50 variable plus ₹1.50 fixed). If we use this unit total cost in taking a decision to accept the sale of additional 10,000 units, our decision will be wrong because the additional unit will incur a loss of ₹0.25 (₹3.75 – ₹4.00). If, however, we analyse the costs, we find that fixed expenses are irrelevant to the decision and, hence by excluding them we find that the new order is profitable.

Fixed costs should, however, be considered as relevant if they are expected to be altered by the decision at hand. Suppose, in the above example, the plant capacity is only 50,000 units and additional 10,000 units can only be manufactured by expanding capacity which entails additional fixed expenses of ₹50,000. This increase in fixed expenses is relevant to the decision and will be compared with the incremental contribution of ₹12,500. This will alter the earlier choice.

(iv) *Quite often question arises whether the book value of equipment is relevant or not.*

Three points as described below emerge in such circumstances:

- Book value of old equipment is irrelevant because it is a past cost.
- The disposal value of equipment is relevant because it adds to the cash inflow arising from the decision.
- Cost of new equipment is relevant because cash outflow arises by the decision to buy the new equipment.

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Consider the following example as an illustration of the principle. A firm is considering the replacement of an existing machine whose written down value is ₹4,000 and has four years life to run. The data are analysed as under:

Particulars	For a period of four years		
	Keep	Replace	Difference
	(₹)	(₹)	(₹)
Sales : (A)	40,000	40,000	—
Costs	32,000	22,400	+ 9,600
<i>Depreciation:</i>			
Old machine	4,000		+ 4,000
New machine		6,000	- 6,000
Write off of old machine		4,000	- 4,000
Disposal of the old machine		- 400	+ 400
Total expenses : (B)	36,000	32,000	+ 4,000
Operating income : {(A) - (B)}	4,000	8,000	+ 4,000

The above analysis shows that the replacement of the machine will be advantageous by ₹ 4,000.

It may be noted that in the above example, the written down value of the old machine has been written off in replacing old machine as loss because it is sunk cost. Thus it appears in both the proposals and cancels out and proves that it is irrelevant to the decision. Since the disposal value goes to reduce costs, or increases revenue and the depreciation cost of the new equipment affects such outflow, both these expenses are relevant to the decision.

In decisions involving the retention or replacement of a machine, the relevant cost concept may help in arriving at the proper decision. However, such decisions are best taken through discounted cash flow analysis.

This is because the relevant cost concept ignores the fact that under the two alternatives, cash inflows and outflows will accrue at different points of time. In the case cited above, we have taken data for four years. However, if we replace the machine, the new machine will run for more than four years. Thus, the two machines have different number of years to serve and they give rise to different cash flows. The best course is to work out the cash flows and discount them at proper rate. This will give correct result.

2.2.2 Opportunity costs: The opportunity cost of the value of opportunity foregone is taken into consideration when alternatives are compared. Opportunity Cost is the value of the next best alternative. In other words, it is the opportunity cost lost by diversion of an input factor from one use to another. It is the measure of the benefit of opportunity foregone. It is defined in the CIMA Terminology as '*the value of the benefit sacrificed when one course of action is chosen, in preference to an alternative. The opportunity cost is represented by the forgone potential benefit from the best rejected course of action.*'

The opportunity cost is helpful to managers in evaluating the various alternatives available when multiple inputs can be employed for multiple uses. These inputs may nevertheless have a cost and this is measured by the sacrifice made by the alternative action in course of choosing another alternatives.

Examples of opportunity cost:

- (a) The opportunity cost of using a machine to produce a particular product is the earnings foregone that would have been possible if the machine was used to produce other products.
- (b) The opportunity cost of funds invested in a business is the interest that could have been earned by investing the funds in bank deposit.
- (c) The opportunity cost of one's time is the salary which he would have earned by his profession.

2.2.3 Notional Cost: As per CIMA terminology '*Cost used in product evaluation, decision making and performance measurement to reflect the use of resources that have no actual (observable) cost*'. For example, notional interest for internally generated funds or notional rent for use of space.

Notional costs are relevant for the decision making only if company is actually forgoing benefits by employing its resources to alternative course of action. For example, notional interest on internally generated fund is treated as relevant notional cost only if company could earn interest from it.

2.2.4 Avoidable Costs: Avoidable costs are cost that can be skipped if the decision on activity in consideration will not be taken up. As per CIMA terminology avoidable costs are the '*Specific cost of an activity or sector of a business that would be avoided if the activity or sector did not exist*'. For example, if a company wants to discontinue a product line to manufacture, then the cost that can be saved due to discontinuation of a product line is called avoidable cost.

2.2.5 Historical Costs: Cost that has been already incurred in the past is called historical cost. Amount invested in purchase of machinery, for example is historical cost and is not relevant for decision making.

2.2.6 Sunk Cost: Costs which do not change under given circumstance and do not play any role in decision making process are known as sunk costs. These are the costs which have been incurred by a decision made in past and cannot be changed by any decision made in the future. CIMA defined sunk cost as '*Cost that has been irreversibly incurred or committed and cannot therefore be considered relevant to a decision. Sunk costs may also be termed irrecoverable costs*'. All sunk costs are irrelevant for decision making but all irrelevant cost may not be sunk cost.

2.2.7 Out of Pocket cost: This is that portion of costs which involves payments to outsiders i.e. it gives rise to cash expenditure as opposed to such costs as depreciation, which do not involve any cash expenditure. Such costs are relevant for price fixation during recession or when make or buy decisions are to be made. These costs include cost incurred under some

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heads for which separate cost accounting records are not maintained and they are sometimes termed as miscellaneous cost.

2.2.8 Discretionary cost: These are the costs which can be changed with the discretion of a manager or appropriate decision making authority. *CIMA defines discretionary costs as 'Cost whose amount within a time period is determined by a decision taken by the appropriate budget fluctuations in the levels of activity (output or turnover)'*. Examples of discretionary costs are maintenance, research and development, employees training, advertisement etc.

2.2.9 Committed cost: Committed costs are the cost which can not be changed during the budgeted period. *As per CIMA terminology 'Cost arising from prior decisions, which cannot, in the short run, be changed. Committed cost incurrence often stems from strategic decisions concerning capacity with resulting expenditure on plant and facilities. Initial control of committed costs at the decision point is through investment appraisal techniques'*. Examples of committed costs are depreciation of assets, lease rentals, other contractual costs etc.

2.2.10 Shut down cost: When an organization suspends its manufacturing, certain fixed expenses can be avoided and certain extra fixed expenses may be incurred depending upon the nature of the industry. By closing down the manufacturing, the organization will save variable cost of production as well as some discretionary fixed costs. This particular discretionary cost is known as shut-down cost.

2.2.11 Engineered costs: Engineered costs results from a defined mathematical relationship with the cost object and resources consumed to produce an output. For example, to produce one unit of a leather shoe requires known amount of leather and time to be spent in stitching is also known. The leather, labour and machine hours are therefore engineered costs.

2.2.12 Inventoriable costs: Costs that are considered as part of merchandise and considered as asset when these are incurred and these costs become cost of goods sold when the final output is sold. In other words inventoriable costs are cost of purchase plus cost expended to make final product in saleable condition. For a manufacturer, cost of raw material issued to production plus labour cost plus manufacturing overheads are inventoriable cost.

2.2.13 Period cost: Period costs are all costs other than cost of goods sold and treated as expense in income statement. *CIMA defines it as 'Cost relating to a time period rather than to the output of products or services'*. A period cost is charged to expense in the period incurred. This type of cost is not included within the cost of goods sold on the income statement. This type of expenses is generally included within the selling and administrative expenses. Example of period costs are: depreciation expenses, commission, advertisement expenses, sales expenses etc.

2.2.14 Differential cost, Incremental cost and Incremental revenue: Differential cost (which may be incremental or decremental cost) is the difference in total cost that will arise from the selection of one alternative instead of another. It involves the estimation of the impact of decision alternatives on costs and revenues. The two basic concepts which go together with this type of cost analysis are *incremental revenue* and *incremental costs*. *Incremental revenue* is the change in the total income resulting from a decision. *Incremental costs* represent a

change in the total costs resulting from a decision. Such a change in cost is not necessarily variable in nature.

2.2.15 Limiting factor or key factor: A limiting factor is any factor that is in scarce supply and without that further activities cannot be performed i.e. it limits the organizations activity. CIMA defines limiting factor or key factor as 'Anything which limits the activity of an entity. An entity seeks to optimise the benefit it obtains from the limiting factor. Examples are a shortage of supply of a resource or a restriction on sales demand at a particular price'. Key factor may be anything i.e. materials, labour, machine time, sales quantity etc.

2.3 Application of Cost Concepts in Decision Making

2.3.1 Decision on Acceptance of New Offer

Illustration1

A company has been making a machine to order for a customer, but the customer has since gone into liquidation, and there is no prospect that any money will be obtained from the winding up of the company.

Costs incurred to-date in manufacturing the machine are ₹ 50,000 and progress payments of ₹15,000 have been received from the customer prior to the liquidation.

The sales department has found another company willing to buy the machine for ₹34,000 once it has been completed.

To complete the work, the following costs would be incurred:

- (a) Materials-these have been bought at a cost of ₹6,000. They have no other use, and if the machine is not finished, they would be sold as scrap for ₹2,000.*
- (b) Further labour costs would be ₹8,000. Labour is in short supply, and if the machine is not finished, the work force would be switched to another job, which would earn ₹30,000 in revenue, and incur direct costs (not including direct labour) of ₹12,000 and absorbed fixed overhead of ₹8,000.*
- (c) Consultancy fees, ₹4,000. If the work is not completed, the consultant's contract would be cancelled at a cost of ₹1,500.*
- (d) General overheads of ₹ 8,000 would be added to the cost of the additional work.*

Should the new customer's offer be accepted? Prepare a statement showing the economics of the proposition.

Solution

Working notes:

- (i) Costs incurred in the past are sunk costs and revenue received in the past is also not relevant because they do not have a bearing on a decision at hand. Hence costs of ₹50,000 incurred to date in manufacturing the machine and progress payment (revenue) of ₹15,000 received are irrelevant and should be ignored.

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- (ii) The price paid in the past for the material is irrelevant. The only relevant cost of materials affecting the decision is the opportunity cost in the form of revenue from scrap which would be foregone i.e. ₹2,000.
- (iii) *Labour costs:* (₹)
 Contribution from the use of labour at another job foregone is opportunity cost and is relevant
 (₹30,000 – ₹8,000 – ₹12,000) 10,000
- (iv) Differential (Incremental) cost of consultancy for completing the work
 Cost of completing the work 4,000
 Less: Cost of cancelling the contract 1,500
 Incremental cost of completing the work 2,500
- (v) Absorbed overheads and general overheads are allocated costs and should be ignored.

Statement showing the economics of the proposition

(Only relevant costs considered)	(₹)	(₹)
Revenue from completing work : (A)		34,000
Less: Relevant cost of:		
Material – Opportunity cost	2,000	
Labour – Cost to be incurred	8,000	
Opportunity cost	10,000	
Incremental cost of consultancy	2,500	
Cost of completing work : (B)		<u>22,500</u>
Extra profit to be earned by accepting the offer of the new customer to complete the work : {(A) – (B)}		<u>11,500</u>

Since the acceptance of the offer would yield an extra profit of ₹11,500, the offer should be accepted.

Alternative solution on cash flow basis :

Statement showing economics of the proposition

	When machine is completed	When machine is not completed	Incremental cash flow
	(₹)	(₹)	(₹)
Cash inflow from sale of machine	34,000	—	34,000
<i>Cash inflow from :</i>			
Sale of material as scrap	—	2,000	-2,000
Use of labour at another job			

₹ 30,000 – (₹ 8,000 + ₹ 12,000)	—	10,000	-10,000
Total cash inflow : (A)	34,000	12,000	22,000
Cash outflow on :			
Labour	8,000	—	-8,000
Consultancy fees	4,000	1,500	-2,500
Total cash outflow : (B)	12,000	1,500	-10,500
Net cash inflow {(A) – (B)}	22,000	10,500	11,500

Completion of machine would result in an incremental cash inflow of ₹11,500; hence the machine should be completed.

2.3.2 Cost Sheet of a product with relevant cost

Illustration 2

Tiptop Textiles manufactures a wide range of fashion fabrics. The company is considering whether to add a further product the "Superb" to the range. A market research survey recently undertaken at a cost of ₹50,000 suggests that demand for the "Superb" will last for only one year, during which 50,000 units could be sold at ₹18 per unit. Production and sale of "Superb" would take place evenly throughout the years. The following information is available regarding the cost of manufacturing "Superb".

Raw Materials: Each "Superb" would require 3 types of raw material Posh, Flash and Splash. Quantities required, current stock levels and cost of each raw material are shown below. Posh is used regularly by the company and stocks are replaced as they are used. The current stock of Flash is the result of overbuying for an earlier contract. The material is not used regularly by Tiptop Textiles and any stock that was not used to manufacture "Superb" would be sold. The company does not carry a stock of Splash and the units required would be specially purchased.

Raw Material	Quantity required per unit of Superb (metres)	Current stock level (metres)	Costs per metre of raw material		
			Original Cost	Current replacement cost	Current resale value
			(₹)	(₹)	(₹)
Posh	1.00	1,00,000	2.10	2.50	1.80
Flash	2.00	60,000	3.30	2.80	1.10
Splash	0.5	0	—	5.50	5.00

Labour : Production of each "Superb" would require a quarter of an hour of skilled labour and two hours of unskilled labour. Current wage rates are ₹3 per hour for skilled labour and ₹2 per hour for unskilled labour. In addition, one foreman would be required to devote all his working time for one year in supervision of the production of Superb. He is currently paid an annual salary of ₹15,000. Tiptop Textiles is currently finding it very difficult to get skilled labour. The skilled workers needed to manufacture "Superb" would be transferred from another job, on

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which they are earning a contribution surplus of ₹1.50 per labour hour, comprising sales revenue ₹10.00 less skilled labour wages of ₹3.00 and other variable cost of ₹5.50. It would not be possible to employ additional skilled labour during the coming year. If "superb" are not manufactured, the company expects to have available 2,00,000 surplus unskilled labour hours during the coming year. Because the company intends to expand in the future, it has decided not to terminate the services of any unskilled worker in the foreseeable future. The foreman is due to retire immediately on an annual pension of ₹6,000 payable by the company. He has been prevailed upon to stay on for a further year and to defer his pension for one year in return for his annual salary.

Machinery: Two machines would be required to manufacture "Superb" MT 4 and MT 7. Details of each machine are as under:

		Start of the year (₹)	End of the year (₹)
MT 4	Replacement cost	80,000	65,000
	Resale value	60,000	47,000
MT 7	Replacement cost	13,000	9,000
	Resale value	11,000	8,000

Straight line depreciation has been charged on each machine for each year of its life. Tiptop Textiles owns a number of MT 4 machines, which are used regularly on various products. Each MT 4 is replaced as soon as it reaches the end of its useful life. MT 7 machines are no longer used and the one which would be used for "Superb" is the only one the company now has. If it was not used to produce "Superb", it would be sold immediately.

Overheads: A predetermined rate of recovery for overhead is in operation and the fixed overheads are recovered fully from the regular production at ₹3.50 per labour hour. Variable overhead costs for "Superb" are estimated at ₹1.20 per unit produced.

For the decision-making, incremental costs based on relevant costs and opportunity costs are usually computed.

You are required to compute such a cost sheet for "Superb" with all details of materials, labour, overhead etc., substantiating the figures with necessary explanations.

Solution

Details of relevant costs with explanations:

- (i) Market Research Survey expenses of ₹50,000 is sunk cost and hence not relevant for the decision on hand.
- (ii) **Raw materials:**
 - (a) Posh is used regularly and stocks are replaced as they are used. Therefore, its current replacement cost of ₹2.50 is relevant.
Posh: 50,000 metres (50,000 units x 1 mtr) × ₹2.50 = ₹1,25,000
 - (b) 1,00,000 metres (50,000 units x 2 mtr) of Flash are required for the output of "Superb". There are already 60,000 metres in stock as a result of overbuying for an earlier contract purchased @ ₹3.30 per metre, and 40,000 metres additionally

would be purchased at the current replacement cost of ₹2.80 per metre. If "Superb" were not produced, the company would have sold 60,000 metres of Flash at ₹1.10. This is an opportunity foregone and relevant. Hence

Flash : –

<i>Incremental cost</i>		(₹)
40,000 metres × ₹2.80	=	1,12,000
<i>Opportunity cost</i>		
60,000 metres × ₹1.10	=	<u>66,000</u>
		<u>1,78,000</u>

(c) 25,000 metres (50,000 units x 0.5 mtr) of splash would be specially purchased for the output

Splash 25,000 metres × ₹5.50 = ₹1,37,500

(iii) *Labour:*

To manufacture 50,000 units of "Superb"

Skilled labour required: 50,000 × ¼ = 12,500 hours, and

Unskilled labour required: 50,000 × 2 = 1,00,000 hours.

Wage rate for skilled labour is ₹3 per hour. If "Superb" were not manufactured and the skilled labour were not transferred, they would have given a clean contribution of ₹1.50 per hour. This is the cost of an opportunity foregone:

Therefore,

<i>Cost of skilled labour:</i>		(₹)
Cost of deployment		37,500
(12,500 × ₹3)		
<i>Add: Opportunity cost</i>		18,750
(12,500 × ₹1.50)		
		<u>56,250</u>

Unskilled labour:

No work has suffered and no extra cost is involved hence cost of unskilled labour: Zero

Foreman:

		(₹)
Annual salary		15,000
<i>Less: Pension saved</i>		<u>6,000</u>
Effective cost		<u>9,000</u>

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(iv) *Machinery:*

MT 4 machines are used and replaced regularly. The difference of the replacement cost between start and end of the year is relevant.

Hence, MT 4 cost of using: ₹15,000

MT 7 machine is not in vogue and will be sold now or in near future. The fall in its resale value represents the relevant cost.

Hence, cost of using MT 7: ₹11,000 – ₹8,000 = ₹ 3,000

(v) *Overheads:*

Fixed overheads have been recovered fully from existing production. So its rate of recovery is not relevant.

Variable overheads: 50,000 × ₹1.20 = ₹60,000

Now we can prepare the cost sheet.

Cost sheet for 50,000 units of "Superb"

	(₹)	(₹)
<i>Raw material:</i>		
Posh	1,25,000	
Flash	1,78,000	
Splash	<u>1,37,500</u>	4,40,500
<i>Labour:</i>		
Skilled	56,250	
Unskilled	0	
Foreman	<u>9,000</u>	65,250
<i>Machinery costs</i>		
MT4	15,000	
MT7	<u>3,000</u>	18,000
Variable overheads		<u>60,000</u>
Total cost		5,83,750
Profit (₹9,00,000 – ₹ 5,83,750)		<u>3,16,250</u>
Sales revenue (50,000 × ₹18)		<u>9,00,000</u>

2.3.3 Decisionmaking on choosing profitable course of action

Illustration3

The Officers' Recreation Club of a large public sector undertaking has a cinema theatre for the exclusive use of themselves and their families. It is a bit difficult to get good motion pictures for show and so pictures are booked as and when available.

The theatre has been showing the picture "Blood Bath" for the past two weeks. This picture which is strictly for Adults only has been great hit and the Manager of the theatre is convinced

that the attendance will continue to be above normal for another two weeks, if the show of "Blood Bath" is extended. However, another popular movie, eagerly looked forward to by both adults and children alike, - "Appu on the Airbus" is booked for the next two weeks. Even if "Blood Bath" is extended, the theatre has to pay the regular rental on "Appu on the Airbus" as well.

Normal attendance at the theatre is 2,000 patrons per week, approximately one-fourth of whom are children under the age of 12. Attendance for "Blood Bath" has been 50% greater than the normal total. The manager believes that this would taper off during a second two weeks, 25% below that of the first two weeks during the third week and 33.1/3% below that of the first two weeks during the fourth week. Attendance for "Appu on the Airbus" would be expected to be normal throughout its run, regardless of the duration.

All runs at the theatre are shown at the regular price of ₹ 2 for adults and ₹ 1.20 for children under 12. The rental charge for "Blood Bath" is ₹ 900 for one week or ₹ 1,500 for two weeks. For "Appu on the Airbus" it is ₹ 750 for one week or ₹ 1,200 for two weeks. All other operating costs are fixed ₹ 4,200 per week, except for the cost of potato wafers and cakes which average 60% of their selling price. Sales of potato wafers and cakes regularly average ₹ 1.20 per patron, regardless of age.

The Manager can arrange to show "Blood Bath" for one week and "Appu on the Airbus" for the following week or he can extend the show of "Blood Bath" for two weeks; or else he can show "Appu on the Airbus" for two weeks, as originally booked.

Show by computation, the most profitable course of action he has to pursue.

Solution

THE OFFICERS' RECREATION CLUB Comparative predicted income for two weeks

	Three decision alternatives		
	Show "Blood Bath" for two weeks	Show "Blood Bath" for one week and "Appu on the Airbus" for the following week	Show "Appu on the Airbus" for two weeks
Attendance:			
<i>Adults:</i>			
First week	2,250	2,250	1,500
Second week	<u>2,000</u>	<u>1,500</u>	<u>1,500</u>
	4,250	3,750	3,000
<i>Children:</i>			
First week	—	—	500
Second week	<u>—</u>	<u>500</u>	<u>500</u>
Total attendance	<u>4,250</u>	<u>4,250</u>	<u>4,000</u>

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Revenue:	(₹)	(₹)	(₹)
<i>Sale of Tickets:</i>			
Adults @ ₹2/-	8,500	7,500	6,000
Children @ ₹1.20	—	600	1,200
Sale of Potato Wafers & Cakes @ ₹1.20 per patron	<u>5,100</u>	<u>5,100</u>	<u>4,800</u>
Total revenue: (A)	<u>13,600</u>	<u>13,200</u>	<u>12,000</u>
<i>Costs (only relevant):</i>			
Hire charges of "Blood Bath"	1,500	900	—
Cost of Potato Wafers & Cakes (60% of their selling price)	<u>3,060</u>	<u>3,060</u>	<u>2,880</u>
Total relevant cost: (B)	<u>4,560</u>	<u>3,960</u>	<u>2,880</u>
Profit: {(A) – (B)}	<u>9,040</u>	<u>9,240</u>	<u>9,120</u>

It is seen from the above statement that the most profitable course of action is to show each film for one week. Hence, the manager should arrange to show "Blood Bath" for one week and "Appu on the Airbus" for the following week.

Note: The hire charges for "Appu on the Airbus" and the fixed operating costs of ₹4,200 per week are irrelevant to this analysis as these are committed fixed costs.

2.3.4 Decision making on pricing against a special order

Illustration 4

- (a) A machine which originally cost ₹12,000 has an estimated life of 10 years and is depreciated at the rate of ₹1,200 per year. It has been unused for some time, however, as expected production orders did not materialise. A special order has now been received which would require the use of the machine for two months.

The current net realisable value of the machine is ₹8,000. If it is used for the job, its value is expected to fall to ₹7,500. The net book value of the machine is ₹8,400. Routine maintenance of the machine currently costs ₹40 per month. With use, the cost of maintenance and repairs would increase to ₹60 per month.

What would be the relevant cost of using the machine for the order so that it can be charged as the minimum price for the order?

- (b) X Ltd. has been approached by a customer who would like a special job to be done for him and is willing to pay ₹22,000 for it. The job would require the following materials:

Material	Total units required	Units already in stock	Book value of units in stock ₹/unit	Realisable value ₹/unit	Replacement cost ₹/unit
A	1,000	0	—	—	6

B	1,000	600	2	2.5	5
C	1,000	700	3	2.5	4
D	200	200	4	6	9

- (i) Material B is used regularly by X Ltd. and if stocks are required for this job, they would need to be replaced to meet other production demand.
- (ii) Materials C and D are in stocks as a result of previous excess purchase and they have restricted use. No other use could be found for material C but material D could be used in another job as substitute for 300 units of material E which currently costs ₹5 per unit (of which the company has no units in stock at the moment).

What are the relevant costs of material, in deciding whether or not to accept the contract? Assume all other expenses on this contract to be specially incurred besides the relevant cost of material is ₹550.

Solution

(a) Relevant costs of using the machine for the order

		(₹)
(i)	Loss in the net realisable value of machine by using it on the order (₹8,000 – ₹7,500)	500
(ii)	Additional maintenance and repair for two months, i.e., (₹ 60 – ₹40) × 2	40
	Minimum price	540

- Notes (a)**
- (i) Books value of ₹8,400 is irrelevant for decision.
- (ii) Net realisable value of the machine fall from ₹8,000 to ₹7,500. This loss of ₹500 is relevant for decision, because it is influenced exclusively by the decision.
- (iii) ₹7,500 will be realised after months at least. Therefore, time value of ₹7,500 for two months atleast. Therefore, present value of future realisable value of ₹7,500 should be found out and this present value should be deducted from ₹8,000. This will be the correct relevant cost in place of ₹500 shown above in the absence of discounting factor.
- (b)**
- (i) Material A is not yet owned. It would have to be purchased in full at the replacement cost of ₹6.00 per unit. Relevant cost is therefore 1,000 units at the replacement Cost.
- (ii) Material B is used by the company regularly. There is already existing a stock of 600 units. If these are used in the contract, a further 400 units would have to be purchased.
Relevant cost is therefore 1,000 units at the replacement Cost.
- (iii) Material C: 1,000 units of material C are required. 700 units are already in stock. If it is used for the contract, a further 300 units will have to be

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purchased at a replacement cost of ₹4.00 each. The existing stock of 700 units will not be replaced. If they are used for the contract, they cannot be sold @ ₹ 2.50 each unit. The realisable value of these units 700 units @ ₹2.50 per unit represent opportunity cost.

- (iv) Material D is already in stock and will not be replaced. There is an opportunity cost of using D in the contract. It has following two uses:

It can be sold to fetch ₹1,200 i.e., $200 \times ₹6$

It can also be used for E, which would cost ₹1,500 i.e., $300 \times ₹5$.

Since substitution is more useful, ₹1,500 is the opportunity cost.

(c) Summary of relevant costs:

		(₹)
Material A	1,000 units × ₹6	6,000
Material B	1,000 units × ₹5	5,000
Material C	700 units × ₹2.5	1,750
	300 units × ₹4	1,200
Material D	300 units × ₹5	1,500
Other expenses		550
Total relevant cost		<u>16,000</u>

- (d) Contract should be accepted since offer is of ₹22,000 in relation to relevant cost of ₹16,000.

2.3.5 Budgeting overhead cost and pricing decision

Illustration 5

Forward Foundry Ltd., is feeling the effects of a general recession in the industry. Its budget for the coming year is based on an output of only 500 tonnes of castings a month, which is less than half of its capacity. The prices of castings vary with the composition of the metal and the shape of the mould, but they average ₹175 a tonne. The following details are from the monthly Production Cost Budget at the 500 tonne level:

	Core Making (₹)	Melting and Pouring (₹)	Moulding (₹)	Cleaning and Grinding (₹)
Labour	10,000	16,000	6,000	4,500
Variable overhead	3,000	1,000	1,000	1,000
Fixed overhead	5,000	9,000	2,000	1,000
Total	18,000	26,000	9,000	6,500
Labour and Overhead per direct labour hr.	9.00	6.50	6.00	5.20

Operating at this level has brought the company to the brink of break-even. It is feared that if the lack of work continues, the company may have to lay off some of the most highly skilled workers whom it would be difficult to get back when the volume picks up later on. No wonder, the Works Manager at this juncture, welcomes an order for 90,000 castings, each weighing about 40 lb. to be delivered on a regular schedule during the next six months. As the immediate concern of the Works Manager is to keep his work force together, occupied, he does not want to lose the order and is ready to recommend a quote on a no profit no loss basis.

Materials required would cost ₹1 per casting after deducting scrap credits. The direct labour hours per casting required for each department would be:

Core making	0.09
Melting and pouring	0.15
Moulding	0.06
Cleaning and grinding	0.06

Variable overhead would bear a normal relationship to labour cost in the melting and pouring department and in the moulding department. In core making, cleaning and grinding, however, the extra labour requirements would not be accompanied by proportionate increases in variable overhead. Variable overhead would increase by ₹1.20 for every additional labour hour in core making and by 30 paise for every additional labour hour in cleaning and grinding. Standard wage rates are in operation in each department and no labour variances are anticipated.

To handle an order as large as this, certain increases in fixed factory overhead would be necessary amounting to ₹1,000 a month for all departments put together. Production for this order would be spread evenly over the six months period.

You are required to:

- (a) Prepare a revised monthly labour and overhead cost budget, reflecting the addition of this order,
- (b) Determine the lowest price at which quotation can be given for 90,000 castings without incurring a loss.

Solution

(a)

FORWARD FOUNDRY LTD.
Revised Monthly Labour and Overhead Cost Budget
(After the acceptance of an order for 90,000 castings)

	DEPARTMENTS				
	Core Making (₹)	Melting and pouring (₹)	Moulding (₹)	Cleaning and Grinding (₹)	Total (₹)
Labour	16,750	25,000	9,600	7,740	59,090

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Variable overhead	4,620	1,563	1,600	1,270	9,053
Fixed overhead	5,000	9,000	2,000	1,000	17,000
	26,370	35,563	13,200	10,010	85,143
Incremental fixed factory overhead for all departments					1,000
Total labour and overhead cost					86,143

Working notes :

- (i) Current labour hours per month in each department are obtained by dividing the total labour and overheads by the figure of labour and overheads per direct labour hour as follows:

Core Making	Melting and Pouring	Moulding	Cleaning and Grinding
<u>₹ 18,000</u>	<u>₹ 26,000</u>	<u>₹ 9,000</u>	<u>₹ 6,500</u>
9 hrs.	6.50 hrs.	6 hrs.	5.2 hrs.
= 2,000 hrs.	= 4,000 hrs.	= 1,500 hrs.	= 1,250 hrs.

- (ii) 90,000 castings spread over 6 months give a production of 15,000 castings per month. Incremental labour hours per month are got by multiplying the 15,000 castings by direct labour hour per casting as under:

Core Making	Melting and pouring	Moulding	Cleaning and Grinding
$15,000 \times 0.09$	$15,000 \times 0.15$	$15,000 \times 0.06$	$15,000 \times 0.06$
= 1,350 hrs.	= 2,250 hrs.	= 900 hrs.	= 900 hrs.

- (iii) Wage rate per hour is found by dividing labour cost by direct labour hours as under:

Core Making	Melting and Pouring	Moulding	Cleaning and Grinding
<u>₹10,000</u>	<u>₹16,000</u>	<u>₹6,000</u>	<u>₹4,500</u>
2,000 hrs.	4,000 hrs.	1,500 hrs.	1,250 hrs.
= ₹5	= ₹4	= ₹4	= ₹3.60

- (iv) Revised monthly labour cost:

In Core Making	:	₹10,000 + (1,350 × ₹5)	= ₹16,750
In Melting and Pouring	:	₹16,000 + (2,250 × ₹4)	= ₹25,000
In Moulding	:	₹6,000 + (900 × ₹4)	= ₹9,600
In Cleaning & Grinding	:	₹4,500 + (900 × ₹3.60)	= ₹7,740

- (v) Revised monthly variable overhead cost:

In Core Making, existing charges ₹3,000 plus ₹1.20 × 1,350 (incremental hours)
= ₹3,000 + ₹1,620 = ₹4,620

In the Melting and Pouring Department, it is 1/16 of labour cost. Hence revised variable overhead cost

$$= ₹25,000 \times 1/16 = ₹1,563$$

In Moulding Department, it is 1/6 of labour cost. Hence revised variable overhead cost

$$= ₹9,600 \times 1/6 = ₹1,600$$

In Cleaning and Grinding, existing charges ₹1,000 plus ₹0.30 × 900 (incremental hours)

$$= ₹1,000 + ₹270 = ₹1,270$$

(b) Determination of the lowest price at which quotation can be given for 90,000 castings without incurring a loss:

	(₹)	(₹)
Materials cost: 15,000 castings per month @ ₹1 each		15,000
Labour and overhead cost:		
Revised budget (above)	86,143	
Less: Current budget		
(₹18,000 + ₹26,000 + ₹9,000 + ₹6,500)	59,500	26,643
Total incremental cost for 15,000 castings		41,643

Lowest price at which quotation can be given for 90,000 castings:

$$\frac{₹41,643}{15,000 \text{ castings}} \times 90,000 \text{ castings} = ₹2,49,858$$

2.3.6 Decision making with Opportunity Cost and Sunk Cost

Illustration 6

Estimated direct material requirements of a business concern viz., ABC Ltd. for the year 2011-12 are 1,00,000 units. Unit cost for orders below 1,20,000 units is ₹10. When size of order equals 1,20,000 units or more the concern received a discount of 2% on the above quoted per unit price. Keeping in view the following two alternatives:

- (i) Buy 1,20,000 units at the start of the year;
- (ii) Buy 10,000 units per month.

Calculate the opportunity cost, if the concern has the facility of investing surplus funds in government bonds at the rate of 10% interest.

Solution

Average investment in inventory under the given two alternatives is:

- (i) $(1,20,000 \text{ units} \times ₹9.80)/2 = ₹ 5,88,000$
- (ii) $(10,000 \text{ units} \times ₹10)/2 = ₹ 50,000$

Difference between the average investment in inventory under:

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Alternatives (i) and (ii) is (₹5,88,000 – ₹50,000) = ₹5,38,000

The concern can invest ₹5,38,000 at 10 percent and can earn ₹53,800 as interest annually. The sum of ₹53,800 is an opportunity foregone if alternative (i) is chosen. Hence ₹53,800 is the opportunity cost of the 1,20,000 units purchase order.

Note: ₹53,800 would not ordinarily be recorded in the accounting system as it is a foregone cost.

Illustration 7

A company produces a certain waste which can be sold at a salvage price of ₹ 0.90 per kg. The company wants to process the waste product further at a labour and overhead cost of ₹ 0.75 per kg. and sell it at a higher price of ₹ 1.60 per Kg. Here the sale value of processed waste has no meaning unless we take into account the opportunity cost, viz, the disposal value of waste product. While analysing the profitability of processing the waste further, the salvage value of waste should, therefore, be taken into consideration as opportunity cost as under:

	Waste sold (₹)	Waste processed (₹)
Income per kg. : (A)	0.90	1.60
Labour & overheads	—	0.75
Opportunity cost of waste	—	<u>0.90</u>
Total cost : (B)	<u>—</u>	<u>1.65</u>
Net gain (loss) : {(A)–(B)}	<u>0.90</u>	<u>(0.05)</u>

Solution

It is not advisable to process the waste further since it incurs a loss of 5 paise per kg, after taking into account the opportunity cost of waste. Thus the opportunity cost represents the maximum contribution foregone by using the limited resources for a particular purpose.

Illustration 8

An owner of a plot of land has three proposals as under:

- Sell the plot now for a net income of ₹ 1,00,000*
- Rent out the land at an annual net rental of ₹ 8,000 for 25 years and thereafter sell it for a value of ₹ 1,50,000.*
- Spend ₹ 10,00,000 in construction of building now and thereafter rent out the building at a net annual rental of ₹ 1,10,000 for 25 years. Thereafter sell the building for ₹ 3,00,000.*

Taking the rate of return at 10% advise as to which of the three alternatives is the most profitable course of action.

Solution

Taking the rate of return at 10% the result may be tabulated as under:

	A Sell now the land (₹)	B Rent out building (₹)	C Construct (rent out) (₹)
0 (Initial year)	1,00,000	Nil	-10,00,000
1 to 25 years	-	2,00,000	27,50,000
After 25 years	-	1,50,000	3,00,000
Net cash inflow	1,00,000	3,50,000	20,50,000
Net present value of cash inflow @ 10%	1,00,000	86,416*	26,070**

* $8000 \times PVIFA(10\%,25) + 1,50,000 \times PVIF(10\%,25)$

$8000 \times 9.077 + 1,50,000 \times 0.092 = 86,416$

** $(1,10,000 \times 9.077 + 3,00,000 \times 0.092) - 10,00,000 = 26,070$

The opportunity costs of three alternatives are shown explicitly. The first alternative, namely, to sell now yields the highest net present value and hence it is acceptable.

2.3.7 Decision making on acceptance of an offer**Illustration9**

ZED Ltd. operates two shops. Product A is manufactured in Shop - 1 and customers' jobs against specific orders are being carried out in Shop - 2. Its annual statement of income is:

	Shop - 1 (Product -A) (₹)	Shop - 2 (Job works) (₹)	Total (₹)
Sales/Income	1,25,000	2,50,000	3,75,000
Material	40,000	50,000	90,000
Wages	45,000	1,00,000	1,45,000
Depreciation	18,000	31,500	49,500
Power	2,000	3,500	5,500
Rent	5,000	30,000	35,000
Heat and light	500	3,000	3,500
Other expenses	4,500	2,000	6,500
Total costs	1,15,000	2,20,000	3,35,000
Net Income	10,000	30,000	40,000

The depreciation charges are for machines used in the shops. The rent and heat and light are apportioned between the shops on the basis of floor area occupied. All other costs are current expenses identified with the output in a particular shop.

A valued customer has given a job to manufacture 5,000 units of X for Shop - 2. As the company is already working at its full capacity, it will have to reduce the output of product - A

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by 50%, to accept the said job. The customer is willing to pay ₹25 per unit of X. The material and labour will cost ₹10 and ₹18 respectively per unit. Power will be consumed on the job just equal to the power saved on account of reduction of output of A. In addition the company will have to incur additional overheads of ₹10,000.

You are required to compute the following in respect of this job:

- Differential cost;
- Full cost;
- Opportunity cost; and
- Sunk cost

Advise whether the company should accept the job

Solution

(a) Differential cost of the job:

	Increase (₹)	Decrease (₹)
Material cost	50,000	20,000
Labour cost	90,000	22,500
Additional overheads	10,000	—
Other expenses	—	2,250
Total	1,50,000	44,750

Net differential cost of the jobs: ₹1,05,250

(₹1,50,000 – ₹44,750)

Note: Depreciation, rent, heat and light and power are not going to affect the costs.

(b) Full cost of the jobs:

Cost as above at (a) (i.e. increased costs)	1,50,000
Depreciation	9,000
Power	1,000
Rent	2,500
Heat & light	<u>250</u>
	<u>1,62,750</u>

(c) Opportunity cost of taking the order:

	(₹)	(₹)
Sale of product A		62,500
Less:		
Material	20,000	
Labour	22,500	
Power	1,000	

Other expenses	2,250	45,750
		<u>16,750</u>

(d) Sunk cost of the jobs:

	(₹)
Depreciation	9,000
Power*	1,000
Rent	2,500
Heat & light	<u>250</u>
	<u>12,750</u>

*If a student treats power as a relevant cost, in that case it would not appear here.

Advice regarding the jobs:

ZED Ltd., should not accept the job as there will be a cash disadvantage of ₹ 42,750/- as computed below:

	(₹)	(₹)
Incremental revenue		
5,000 units @ ₹25	1,25,000	
Less: Sale of Product A	62,500	62,500
Differential cost(a)		1,05,250
Cash disadvantage		42,750

Illustration 10

The Aylett and Co., Ltd has been offered a contract, if accepted would significantly increase next year's activity levels. The contract requires the production of 20,000 kg. of product X and specifies a contract price of ₹100 per kg. The resources used in the production of each kg. of X include the following:

Resources per kg. of Product X

Labour	Grade -1	2 hours
	Grade -2	6 hours
Materials	A	2 units
	B	1 litre

Grade 1 labour is highly skilled and although it is currently under utilised in the firm it is Aylett's policy to continue to pay grade 1 labour in full. Acceptance of the contract would reduce the idle time of grade 1 labour. Idle time payments are treated as non-production overheads.

Grade 2 is unskilled labour with a high turnover and may be considered a variable cost.

The costs to Aylett of each type of labour are:

Grade 1	₹ 4 per hour
Grade 2	₹ 2 per hour

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The materials required to fulfil the contract would be drawn from those materials already in stock. Materials A is widely used within the firm and any usage for this contract will necessitate replacement. Materials B was purchased to fulfil an expected order that was not received, if material B is not used for the contract, it will be sold. For accounting purposes FIFO is used. The various values and costs for A and B are:

	A Per Unit (₹)	B Per Litre (₹)
Book value	8	30
Replacement cost	10	32
Net realisable value	9	25

A single recovery rate for fixed factory overheads is used throughout the firm even though some fixed production overheads could be attributed to single products or Departments. The overhead is recovered per productive labour hour and initial estimates of next year's activity, which excludes the current contract, show fixed production overheads of ₹6,00,000 and productive labour hours of 3,00,000. Acceptance of the contract would increase fixed production overheads by ₹2,28,000. Variable production overheads are accurately estimated at ₹3/- per productive hour.

Acceptance of the contract would be expected to encroach on the sale and production of another product, Y which is also made by Aylett Ltd. It is estimated that sales of Y, would then decrease by 5,000 units in the next year only. However this forecast reduction in sales of Y would enable attributable fixed factory overheads of ₹58,000 to be avoided. Information on Y is as follows:

	Per unit
Sales price	₹ 70
Labour - Grade 2	4 hours
Materials -relevant variable costs	₹ 12

All activity undertaken by Aylett is job costed using full, absorption, costing in order to derive a profit figure for each contract if the contract for X is accepted it will be treated as a separate job for routine costing purposes. The decision to accept or reject the contract will be taken in sufficient time to enable its estimated, effects to be incorporated in the next year's budgets and also in the calculations carried out to derive the overhead recovery rate to be used in the forthcoming year.

Required:

- Advise Aylett on the desirability of the contract
- Show how the contract, if accepted, will be reported on by the routine job costing system used by Aylett.
- Briefly explain the reasons for any differences between the figures used in (a) and (b) above.

Solution**(a) Statement of profit on the basis of historical costing system**

		(₹)	(₹)
Sales: 20,000 kg @ ₹100 : (A)			20,00,000
Less: Costs			
Material A:	20,000 kg × 2 units @ ₹8	3,20,000	
Material B:	20,000 kg × 1 litre @ ₹30	6,00,000	
Labour grade 1 :	20,000 kg × 2 hrs. @ ₹4	1,60,000	
Labour grade 2 :	20,000 kg × 6 hrs. @ ₹2	2,40,000	
Variable overheads:	20,000 kg × 8 hrs. @ ₹3	4,80,000	
Fixed overheads:	20,000 kg × 8 hrs. @ ₹1.75	2,80,000	
Total cost : (B)			20,80,000
Loss : {(A) – (B)}			80,000

Working note:

<i>The fixed overhead rate/hr is computed as below:</i>	(₹)
Total fixed overheads for 3,00,000 hrs	6,00,000
Add: Additional fixed overheads for 1,60,000 hrs.	2,28,000
Less: Fixed costs saved due to the reduction of production of Y for 20,000 hrs. (5,000 units × 4 hours)	<u>58,000</u>
Total fixed overheads	<u>7,70,000</u>

Total number of hours:

3,00,000 hrs. + 1,60,000 hrs. – 20,000 hrs. = 4,40,000 hrs.

Therefore: Fixed overhead rate/hr

$$\frac{\text{(Total fixed overheads)}}{\text{(Total number of hours)}} = \frac{\text{₹7,70,000}}{440,000 \text{ hrs}}$$

Conclusion: On the basis of Historical Costing approach (similar to cost sheet workings) the offer should be rejected as it incurs loss

(b) Statement of profit under relevant costing system

	(₹)	(₹)
Sales: 20,000 kg @ ₹100 : (A)		20,00,000
Less : Costs		
Material A: 20,000 kg × 2 units × ₹10 (Refer to working note: A)	4,00,000	
Material B: 20,000 kg × 1 litre × ₹25 (Refer to working note: B)	5,00,000	
Labour grade 1	Sunk cost	

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(Refer to working note: C)		
Labour grade 2 : 20,000 kg × 6 hrs × ₹2	2,40,000	
(Refer to working note: D)		
Variable overheads: 20,000 kg × 8 hrs. × ₹3	4,80,000	
(Refer to working note: E)		
Fixed costs	2,28,000	
(Refer to working note: F)		
Loss of profit due to Y (opportunity cost)	1,32,000	
(Refer to working note: G)		
Total costs : (B)		19,80,000
Profit : {(A) – (B)}		20,000

Working notes :

- A: Material A & B required for this contract are already available in stores. Therefore, the original purchase price is considered as sunk cost. Since A is a regularly used item the present stock is not meant for this job. Therefore the requirement will have to be purchased therefore, the replacement cost is considered as relevant.
- B: Material B will be sold if not used for this contract. Therefore, the resale value should be considered. (Loss of cash inflow is treated as cash outflow).
- C: Grade 1 labour is at present under utilised. Acceptance of the contract will only reduce the idle time, the wages will be paid on time basis. Therefore the cost should be treated as sunk cost and is not relevant for decision making.
- D: Grade 2 labour is considered as a variable cost, i.e. out of pocket cost and hence relevant for decision making.
- E: Variable overheads are out of pocket costs are therefore relevant for decision making.
- F: Fixed cost already incurred is a sunk cost whereas fixed costs to be incurred is relevant. Hence, only the additional fixed costs are considered.
- G: Because of accepting of this contract, production and sale of Y to the extent of 5,000 units (which is included in the original budget) is affected resulting in a loss of cash flow of ₹1,32,000, which should be treated as an opportunity cost.

Computation of opportunity cost:

	(₹)	(₹)
Sales: 5,000 units @ ₹70		3,50,000
Material: 5,000 units × ₹12	60,000	
Labour: 5,000 units × 4 hours × ₹2	40,000	
Variable overhead: 5,000 units × 4 hours × ₹3	60,000	
Fixed overheads	<u>58,000</u>	<u>2,18,000</u>
Opportunity costs		<u>1,32,000</u>

- (c) **Reasons:** Under the relevant cost approach only the out of pocket costs have been considered. The adjustment A to G can be classified into either actual cash outflows or loss of cash inflows which are also treated as cash outflows.

Conclusion: We should accept the contract as it will improve the overall profitability.

Illustration 11

Ranka Builders has been offered a contract by Excel Ltd. to build for it five special Guest Houses for use by top management. Each Guest House will be an independent one. The contract will be for a period of one year and the offer price is ₹1 crore. In addition, Excel Ltd. will also provide 2 grounds of land, free of cost for the purpose of construction. The Chief Accountant of Ranka Builders has prepared an estimate on the basis of which he has advised that the contract should not be accepted at the price offered. His estimate was as follows:

		(₹) in Lacs
Land (3 Grounds at ₹ 20 lakhs each)		60
Drawings and Design		7
Registration		10
Materials :	Cement and Sand	6
	Bricks and Tiles	4
	Steel	10
	Others (including interior decoration)	10
Labour	– Skilled	12
	– Unskilled	8
	– Supervisor's Salary	5
Overheads	General	12
	Depreciation	6
Total Cost		150

The Accountant also provides the following information:

Land: The total requirement of land is 3 grounds costing ₹ 20 lakhs per ground. Excel Ltd. will provide 2 grounds free of cost.

Drawing and Design: These have already been prepared and 50% of the cost has already been incurred.

Materials:

- (i) *Cement and sand are already in stock and are in regular use. If used for this contract, they have to be replaced at a cost of ₹ 8 lacs.*
- (ii) *Bricks and tiles represent purchases made several months before for a different contract. They could be sold readily for a net ₹5 lakhs after meeting all further expenses.*
- (iii) *Others: Materials worth ₹ 2 lakhs relating to interior decoration are in stock for which no alternative use is expected in the near future. However they can be sold for ₹ 1 lac.*

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Labour:

- (i) Skilled workers will be transferred to this project from another project. The Project Manager claimed that if the men were returned to him, he could have earned the company an additional ₹ 2 lakhs in terms of profits.
- (ii) The supervisor undertakes various tasks in the sites and his pay and continuity of employment will not be affected by the new contract. If the contract is taken, he will devote half of his time.

Overheads:

- (i) The equipment that would be used on the contract was bought one year before for ₹ 30 lakhs and is expected to last for five years. It can also be used on other contracts and the current replacement price will be ₹ 32 lakhs and in a year's time it will be ₹ 25 lacs.
- (ii) The general overheads includes both specific and absorbed overheads. If the contract is not undertaken, ₹ 4 lakhs of the same can be avoided.

Ranka Builders has also on hand another project, which would not be executed if the contract from Excel Ltd. were to be accepted. The estimated profit on that project is ₹ 10 lacs.

In the light of information given above, you are required to indicate with reasons whether the contract from Excel Ltd. should be accepted or not.

Solution

M/s. Ranka Builder's Statement of relevant costs on the Acceptance of contract from Excel Ltd.

(Figures in lakhs of ₹)

Sl. No.	Particulars	Basis for the cost to be relevant	Relevant cost if contract is accepted (₹)	Irrelevant cost if the contract is accepted (₹)
1.	Land cost	(working note 1)	20	
2.	Drawings and design		—	7 (Sunk cost)
3.	Registration	Incremental	10	—
4.	<i>Materials:</i>			
	Cement and sand	Replacement	8	
	Bricks and tiles	Opportunity	5	
	Steel	Incremental	10	
	Others	(working note 2)	9	
5.	<i>Labour:</i>			
	Skilled	Opportunity	2	

6.	Unskilled Supervisor's salary	Incremental	8	5 (Sunk cost)
	<i>Overheads:</i> General Depreciation	Relevant (avoidable)	4	
7.	Replacement cost of machine	(working note 3)	7	6 (Sunk cost)
	Estimated profit foregone on other project	Opportunity foregone	10	
	Total cost		93	

Decision: Since the offer price of contract is ₹ 1 crore and its total relevant cost is ₹ 93 lacs; these figures clearly show that the offer should be accepted.

Working notes:

- (₹ in lakhs)
- Total cost of 3 grounds of land 60
Cost of 2 grounds of land will be borne by Excel Ltd. 40
Cost of 1 ground of land will be borne by M/s. Ranka Builders 20
 - Others material cost of ₹ 10 lakhs includes material worth ₹ 2 lakhs relating to interior decoration, which is a sunk cost, this material can be sold for ₹ 1 lakh (which is a relevant opportunity cost) and ₹ 8 lakhs material is an incremental cost. Hence total relevant cost of others material is ₹ 9 lakhs (₹ 8 lakhs incremental + ₹ 1 lakh opportunity cost).
 - Since the equipment can also be used on this contract its current replacement price is ₹ 32 lakhs and after one year its cost will be ₹ 25 lakhs. Therefore the relevant opportunity cost of machine is : ₹ 7 lakhs (₹ 32 lakhs – ₹ 25 lakhs).

Illustration 12

Intervero Ltd., a small engineering company, operates a job order costing system. It has been invited to tender for a comparatively large job, which is outside the range of its normal activities, and, since there is surplus capacity, the management are keen to quote as low a price as possible. It is decided that the opportunity should be treated in isolation without any regard to the possibility of its leading to further work of a similar nature (although such a possibility does exist). A low price will not have repercussions on Intervero's regular work.

The estimating department has spent 100 hours on work in connection with the quotation and they have incurred travelling expense of ₹550 in connection with a visit to the prospective customers' factory. The following cost estimates has been prepared on the basis of their study.

Cost Estimate	Inquiry 205 H 81	
	(₹)	(₹)
<i>Direct material and components:</i>		
2,000 units of A at ₹ 25 per unit	50,000	
200 units of B at ₹ 10 per unit	2,000	
Other material and components to be bought is (specified)	12,500	
		64,500
<i>Direct labour:</i>		
700 hrs. of skilled labour at ₹ 3.50 per hour		2,450
1,500 hrs. of unskilled labour at ₹ 2 per hour		3,000
<i>Overhead:</i>		
Department P- 200 hrs. at ₹ 25 per hour		5,000
Department Q- 400 hrs. at ₹ 20 per hour		8,000
<i>Estimating Department:</i>		
100 hours at ₹ 5 per hour		500
Travelling expenses		550
<i>Planning Department:</i>		
300 hours at ₹ 5 per hour		1,500
		85,500

The following information has been brought together:

Material A: This is a regular stock item. The stock holding is more than sufficient for this job. The material currently held has an average cost of ₹ 25 per unit but the current replacement cost is ₹ 20 per unit.

Material B: A stock of 4,000 units of B is currently held in the stores. This material is slow moving and the stock is the residue of a batch bought seven years ago at a cost of ₹ 10 per unit. B currently costs ₹ 24 per unit but the resale value is only ₹ 18 per unit. A foreman has pointed out that B could be used as a substitute for another type of regularly used raw material which costs ₹ 20 per unit.

Direct Labour: The work force is paid on a time basis. The company has adopted no redundancy policies which mean that skilled workers are frequently moved to jobs which do not make proper use of their skills. The wages included in the cost estimate are for the mix of labour which the job ideally requires. It seems likely, if the job is obtained, that most of the 2,200 hours of direct labour will be performed by skilled staff receiving ₹ 3.50 per hour.

Overhead: Department P : It is a department of Intervero Ltd., that is working at full capacity. The department is treated as a profit centre and it uses a transfer price of ₹ 25 per hour for charging out its processing time to other departments. This charge is calculated as follows:

	(₹)
<i>Estimated variable cost per machine hour</i>	10
<i>Fixed departmental overhead</i>	8
<i>Departmental profit</i>	<u>7</u>
	<u>25</u>

Department P's facilities are frequently hired out to other firms and a charge of ₹ 30 per hour is made. There is a steady demand from outside customers for the use of these facilities.

Overhead :Department Q : Department Q uses a transfer price of ₹ 20 for charging out machine processing time to other Departments. This charge is calculated as follows :

	(₹)
<i>Estimated variable cost per machine hour</i>	8
<i>Fixed departmental overhead</i>	9
<i>Departmental profit</i>	<u>3</u>
	<u>20</u>

Estimating department: This department charges out its time to specific jobs using a rate of ₹ 5/- per hour. The average wage rate within the department is ₹ 2.50 per hour but the higher rate is justified as being necessary to cover departmental overheads and the work done on unsuccessful quotations.

Planning department: This department also uses a charging out rate which is intended to cover all departmental costs.

The offer received for the above contract is ₹ 70,000.

You are required to restate the cost estimate by using an opportunity cost approach. Make any assumptions that you deem to be necessary and briefly justify each of the figures that you give.

Solution

Statement of cost of Intervero Ltd.

	(₹)
<i>Direct material:</i>	
A: 2,000 units @ ₹20 <i>(Refer to working note 1)</i>	40,000
B: 200 units @ ₹20 <i>(Refer to working note 2)</i>	4,000
Other Material and components	12,500
Direct labour (skilled)	sunk
Direct labour (Unskilled) <i>(Refer to working note 3)</i>	sunk

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<i>Overheads:</i>	
Dept. P: 200 hrs. @ ₹30 <i>(Refer to working note 4)</i>	6,000
Dept. Q: 400 hrs. @ ₹8	3,200
Estimating department	sunk
Travelling expenses	sunk
Planning department	sunk
Total cost	65,700

Working notes:

1. Material A is a regularly used item. Therefore, the present stock is not meant for this contract. Hence, the replacement cost is considered.
2. Material B will be sold if not used for this contract. Therefore, the resale value (₹20 or ₹18 whichever is more should be considered).
3. The entire job will be performed by skilled workers (unskilled jobs also). This implies skilled workers are idle at present and since the company follows no redundancy policy and their wages will be paid on time basis whether the contract is accepted or not. Hence, they are treated as a sunk cost.
4. Department P is a profit centre and is working at full capacity at present and has a steady demand from outside for its facilities at ₹30 per hour. Therefore, we should consider this ₹30/hr. as relevant (out of pocket cost ₹10 + opportunity cost of ₹20).
5. Department Q: Only the out of pocket costs being the variable overheads of ₹8 hr. should be considered.
6. All other costs mentioned are sunk costs.

Conclusion: We should accept this offer.

2.3.8 Decision making on different option of services

Illustration13

A Ltd. produces and markets a range of consumer durable appliances. It ensures after-sales service through X Ltd. The big appliances are serviced at customer's residence while small appliances are serviced at workshop of X Ltd.

The material supplied to X Ltd. is charged at cost at 10%. X Ltd. charges customers at 25% over the above price. For labour, the company receives 10% of the rate fixed for work done under the after-sales service agreement and 15% of the rate fixed in case of jobs not covered under the agreement from X Ltd. 60% by value of the total work undertaken by X Ltd. was for big appliances and rest accounted for small appliances during the previous year.

The company decides to carry out all or some of the work itself and has chosen one area in the first instance. During the previous year the company earned a profit of ₹2,16,000 as detailed below from X Ltd. for the area chosen :

	Material (₹)	Labour (₹)
Under after-sales service agreement	60,000	1,00,000
For jobs not covered under the agreement	20,000	36,000

The company forecasts same volume of work in that area for the ensuing period. The following three options are under consideration of the management:

- (1) To set up a local service centre to provide service for small appliances only. The existing system is to continue for big appliances.
- (2) To set up a local service centre to provide service for big appliances only. The existing system is to continue for small appliances.
- (3) To set up a local service centre to provide service to all appliances. The existing system then stands withdrawn.

The relevant costs for carrying out jobs under the above options are as under:

	Option -1	Option-2	Option-3
Heat, rent, light etc.	125	50	150
Management costs	108	83	150
Service staff costs	230	440	750
Transport costs	25	220	230

(₹ '000)

You are required to find out the most profitable option.

Solution

Statement showing value of total work undertaken by X Ltd. at customer's price

	(₹ '000)
Material cost (for appliances covered under agreement) [Refer to working note 1(i)]	825
Material cost (for appliances not covered under agreement) [(Refer to working note 2(i)]	275
Labour cost (for appliances covered under agreement) [Refer to working note 1(ii)]	1,000
Labour cost (for appliances not covered under agreement) [Refer to working note 2(ii)]	240
Total receipts	<u>2,340</u>

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Break up of receipts:

Big appliances	60%	1,404
Small appliances	40%	936

Profitability Statement

(₹ '000)

	Option 1	Option 2	Option 3
<i>Income:</i>			
Big appliances	129.6 (60% × ₹216)	1,404	1,404
Small appliances	936	86.4 (40% × ₹216)	936
Total receipts : (A)	1,065.6	1,490.4	2,340
<i>Costs :</i>			
Material	320 40% × (825 + 275) 137.5%	480 60% × (825 + 275) 137.5%	800 (825 + 275) 137.5%
Heat, rent, light etc.,	125	50	150
Management costs	108	83	150
Service staff costs	230	440	750
Transport costs	25	220	230
Total costs : (B)	808	1,273	2,080
Profit : [(A) – ((B)]	257.6	217.4	260

Recommendation:

Option 3 is most profitable one.

Working Notes :

1. *Material and labour cost (for appliances under after sales agreement) :*

(₹)

(i) Cost of material per unit charged to customer's by X Ltd.

$$(\text{₹}100 + 10\% (\text{₹}100 + 25\% \times \text{₹}110))$$

137.50

Cost of material charged to customer's by X Ltd.

$$\left(\frac{\text{₹} 60,000}{10} \times 137.50 \right)$$

8,25,000

(ii) Cost of labour charged to customers by X Ltd.

$$\left(\frac{\text{₹ } 1,00,000}{10} \times 100 \right) \quad 10,00,000$$

2. *Material and Labour cost (for appliances not covered under sales agreement) :*

(₹)

(i) Cost of material charged to customers by X Ltd.

$$\left(\frac{\text{₹ } 20,000}{10} \times 137.50 \right) \quad 2,75,000$$

(ii) Cost of labourer charged to customers by X Ltd.

$$\left(\frac{\text{₹ } 36,000}{15} \right) \times 100 \quad 2,40,000$$

2.3.9 Decision on use of alternative resources

Illustration 14

B Ltd. is a company that has in stock, materials of type XY that cost ₹ 75,000, but that are now obsolete and have a scrap value of only ₹ 21,000. Other than selling the material for scrap, there are only two alternative uses for them.

Alternative 1 – Converting the obsolete materials into a specialised product, which would require the following additional work and materials –

Material A *600 units*

Material B *1,000 units*

Direct Labour

5,000 hours unskilled

5,000 hours semi-skilled

5,000 hours highly skilled

Extra selling and delivery expenses *₹ 27,000*

Extra advertising *₹ 18,000*

The conversion would produce 900 units of saleable product and these could be sold for ₹ 300 per unit.

Material A is already in stock and is widely used within the firm. Although present stocks, together with orders already planned, will be sufficient to facilitate normal activity and extra material used by adopting this alternative will necessitate such materials being replaced immediately. Material B is also in stock, but it is unlikely that any additional supplies can be obtained for some considerable time because of an industrial dispute. At the present time material B is normally used in the production of product Z, which sells at ₹ 390 per unit and incurs total variable (cost excluding Material B) of ₹ 210 per unit. Each unit of product Z uses four units of Material B. The details of Materials A and B are as follows:

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	Material A (₹)	Material B (₹)
Acquisition cost at the time of purchase	100 per unit	₹ 10 per unit
Net realizable value	85 per unit	₹ 18 per unit
Replacement cost	90 per unit	—

Alternative 2 – Adopting the obsolete materials for use as a substitute for a sub-assembly that is regularly used within the firm. Details of the extra work and materials required are as follows:

Material C 1,000 units

Direct Labour

4,000 hours unskilled

1,000 hours semi-skilled

4,000 hours highly skilled

1,200 units of the sub-assembly are regularly used per quarter at a cost of ₹ 900 per unit. The adaptation of material XY would reduce the quantity of the sub-assembly purchased from outside the firm to 900 units for the next quarter only. However, since the volume purchased would be reduced, some discount would be lost and the price of those purchased from outside would increase to ₹ 1,050 per unit for that quarter.

Material C is not available externally though 1,000 units required would be available from stocks, it would be produced as extra production. The standard cost per unit of Material C would be as follows :

	(₹)
Direct labour 6 hours unskilled labour	18
Raw materials	13
Variable overhead : 6 hours at ₹ 1	6
Fixed overhead : 6 hours at ₹ 3	18
	<u>55</u>

The wage rates and overhead recovery rates for B Ltd are :

Variable overhead ₹ 1 per direct labour hour

Fixed overhead ₹ 3 per direct labour hour

Unskilled labour ₹ 3 per direct labour hour

Semi-skilled labour ₹ 4 per direct labour hour

Highly skilled labour ₹ 5 per direct labour hour

The unskilled labour is employed on a casual basis and sufficient labour can be acquired to exactly meet the production requirements. Semi-skilled labour is part of the permanent labour force, but the company has temporary excess supply of this type of labour at the present time.

Highly skilled labour is in short supply and cannot be increased significantly in the short-term, this labour is presently engaged in meeting the demand for product L, which requires 4 hours of highly skilled labour. The contribution from the sale of one unit of product L is ₹ 24.

Given the above information, you are required to present cost information advising whether the stocks of Material XY should be sold, converted into a specialised product (Alternative 1) or adopted for use as a substitute for a sub-assembly (Alternative 2).

Solution

Alternative 1 – (Conversion versus immediate sale)

	(₹)	(₹)	(₹)
Sales revenue 900 units at ₹ 300 per unit (Refer to working note 1)			2,70,000
Less : Relevant costs			
Material XY opportunity cost (Refer to working note 2)		21,000	
Material A – 600 units @ ₹ 90 per unit (Refer to working note 3)		54,000	
Material B – 1,000 units @ ₹ 45 per unit (Refer to working note 4)		45,000	
Direct Labour :			
Unskilled - 5,000 hours @ ₹ 3 per hour	15,000		
Semi-skilled	NIL		
Highly skilled - 5,000 hours @ ₹ 11 (Refer to working note 5)	55,000	70,000	
Variable overheads 15,000 hours @ ₹ 1 (Refer to working note 6)		15,000	
Extra selling and delivery expenses	27,000		
Extra advertising	18,000	45,000	
Fixed overheads (To remain same, not relevant)		NIL	2,50,000
Excess of relevant revenues			20,000

Alternative 2 – (Adaptation versus immediate sale)

<i>Saving on purchase of sub-assembly :</i>			
Normal spending - 1,200 units @ ₹ 900 per unit		10,80,000	
Less : Revised spending - 900 units @ ₹ 1,050 per unit (Refer to working note 7)		9,45,000	1,35,000
Less : Relevant costs			

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Material XY opportunity cost (Refer to working note 2)		21,000	
Material C - 1,000 units @ ₹ 37 (Refer to working note 8)		37,000	
<i>Direct labour</i>			
Unskilled – 4,000 hours @ ₹ 3 per hour	12,000		
Semi-skilled	NIL		
Highly skilled – 4,000 hours @ ₹ 11 per hour (Refer to working note 5)	44,000	56,000	
Variable overheads – 9,000 hours @ ₹ 1/- per hour (Refer to working note 6)		9,000	
Fixed overheads (To remain same not relevant)		NIL	1,23,000
Net relevant savings			12,000

Evaluation :

The evaluation of two alternatives clearly shows that Alternative 1, yields higher net revenue of ₹ 8,000 (₹ 20,000 – ₹ 12,000). Hence because of higher net revenue of Alternative 1, it is advisable to convert material XY into a specialised product.

Working notes :

- There will be an additional sales revenue of ₹ 2,70,000 if Alternative 1 is chosen.
- Acceptance of either Alternative 1 or 2 will mean a loss of revenue of ₹ 21,000 from the sale of the obsolete material XY and hence it is an opportunity cost for both of the alternatives. The original purchase cost of ₹ 75,000 is a sunk cost and thus not relevant.
- Acceptance of Alternative 1 will mean that material A must be replaced at an additional cost of ₹ 54,000.
- Acceptance of Alternative 1 will mean diversion of material B from the production of product Z. The excess of relevant revenues over relevant cost for product Z is ₹ 180 (₹ 390 – ₹ 210) and each unit of product Z uses four units of material B. The lost contribution (excluding the cost of material B which is incurred for both alternatives) will therefore be ₹ 45 for each unit of material B, that is used for converting the obsolete materials into a specialised product.
- Unskilled labour can be matched exactly to the company's production requirements. Hence acceptance of either alternative 1 or 2 will cause the company to incur additional unskilled labour cost at ₹ 3 for each hour. It is assumed that the semi-skilled labour will be able to meet the extra requirements of either alternatives at no extra cost to the company. Hence, cost of semi-skilled labour will not be relevant. Skilled labour is in short supply and can only be obtained by reducing the production of product L, resulting

in a loss of contribution of ₹ 24 (given) or ₹ 6 per hour of skilled labour. Hence the relevant labour cost will be ₹ 6 (contribution lost per hour) + ₹ 5 (hourly rate of skilled labour) i.e. ₹ 11 per hour.

6. It is assumed that for each direct labour of input, variable overhead will increase by ₹ 1, hence for each alternative using additional direct labour hours, variable overheads will increase.
7. The cost of purchasing the sub-assembly will be reduced by ₹ 1,35,000 if the second alternative is chosen and so these savings are relevant to the decision.
8. The company will incur additional variable costs of ₹ 37 for each unit of material C that is manufactured, so the fixed overheads for material C viz. ₹ 18/- per unit is not a relevant cost.

2.4 Application of Incremental/Differential Cost Techniques in Managerial Decisions

It is a technique used for arriving at managerial decisions in which only cost and income differences between alternative courses of action are taken into consideration. This technique is applicable to situations where fixed costs alter. This technique emphasizes on comparing the incremental costs with incremental revenues for taking a managerial decision. So long as the incremental revenue is greater than incremental costs, the decision should be in favour of the proposal.

The areas in which the above techniques of cost analysis can be used for making managerial decisions are:

- (i) Whether to process a product further or not.
- (ii) Dropping or adding a product line.
- (iii) Making the best use of the investment made.
- (iv) Acceptance of an additional order from a special customer at lower than existing price.
- (v) Opening of new sales territory and branch.
- (vi) Make or Buy decisions.
- (vii) Submitting tenders
- (ix) Lease or buy decisions
- (x) Equipment replacement decision.

2.4.1 Decision on further processing of a product

Whether to process a product further or not: Many companies manufacture products which can be sold or subjected to further processing. It is also possible that waste emanating from one operation of a factory can be sold as such or sold after further processing in the company's plant.

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Examples of such companies are: meat processing, manufacture of copper or aluminium, etc. In such cases, the matter for consideration is whether the incremental revenue arising from the processing of the product further is sufficient to cover the incremental cost involved in such additional processing and still leave a contribution towards profit.

Illustration 15

A company produces product 'A' which is at present being sold at ₹7 each; the monthly production is 25,000 units. The company can, as an alternative make product 'F', by using one unit of 'A', as raw material, in each unit of 'F'. Product 'F' can be sold at ₹10/- each. The company pays sales commission at 10 percent on sales value. Capacity to manufacture 'F' is available to the extent of 12,500 units per month without additional capital cost. Taking the following additional information advise whether or not the company should go in for the manufacture of product 'F'.

Product	'A' (₹)	'F' (₹)
Raw material cost	1.50	0.50
Labour & overheads	2.10	1.40

The figures given for 'F' represent expenses incurred in addition to those incurred for the manufacture of 'A'. The supervision charges for manufacturing 'F' will be ₹4,000 per month extra.

Solution

Particulars	Product 'A' 12,500 units		Product 'F' 12,500 units		Incremental Revenue/ Cost (₹)
	Per unit (₹)	Total (₹)	Per unit (₹)	Total (₹)	
Sales revenue	7.00	87,500	10.00	1,25,000	37,500
Less: Commission @ 10%	0.70	8,750	1.00	12,500	3,750
Net revenue : (i)	6.30	78,750	9.00	1,12,500	33,750
Raw materials	1.50	18,750	2.00	25,000	6,250
Labour & overheads	2.10	26,250	3.50	43,750	17,500
Additional fixed expenses			0.32	4,000	4,000
Total cost : (ii)	3.60	45,000	5.82	72,750	27,750
Profit : (i) – (ii)	2.70	33,750	3.18	39,750	6,000

The above table shows that by resorting to further processing of 12,500 units the company can earn an additional profit of ₹6,000 per month and hence the proposal is recommended.

Note: In the above problem it is likely that the company, instead of utilising its capacity to make product 'F' may go in for a further increase in production of product 'A' to the

extent possible. In such circumstances, the incremental profit of the second alternative should be compared with the incremental profit as obtained above.

Illustration16

X Ltd. is in the Food Processing Industry. In one of its processes, three joint products are manufactured. Traditionally, the company has apportioned costs incurred up to the Joint Products' pre-separation point on the basis of weight of outputs of the product.

You have been recently appointed Cost Accountant, and have been investigating process cost and accounting procedure.

You are required to prepare statements for management to show:

- The profit or loss of each product as ascertained using weight basis of apportioning pre-separation joint costs.*
- The optimal contribution which could be obtained from the manufacture of these products.*

The following process data for December are given. Cost incurred up to separation point are ₹ 96,000 :

	Product A	Product B	Product C
Cost incurred after separation point (₹)	20,000	12,000	8,000
Selling price per Ton of completed product (₹)	500	800	600
Estimated, if sold at separation point (₹)	250	700	450
Output (Tons)	100	60	80

The cost of any unused capacity after the separation point should be ignored.

Solution

- Statement showing profit or loss of each product using weights as the basis of apportioning pre-separation joint costs

	Total (₹)	Product A (₹)	Product B (₹)	Product C (₹)
Cost upto the point of separation in the ratio of (100: 60: 80) or (5:3:4)	96,000	40,000	24,000	32,000
Cost after separation point	40,000	20,000	12,000	8,000
Total costs	1,36,000	60,000	36,000	40,000
Sales revenue	1,46,000	50,000	48,000	48,000
Profit/(Loss)	10,000	(10,000)	12,000	8,000

- (b) To ascertain optimal contribution, first, the incremental profit or loss from each product, if products are further processed after separation point is to be computed. The statement below shows the incremental profit or loss after further processing:

	Product A	Product B	Product C
Output (Tons)	100	60	80
	(₹)	(₹)	(₹)
Incremental revenue from further processing	25,000	6,000	12,000
	(₹500-₹250)×100	(₹800-₹700)×60	(₹600-₹450)×80
Less: Incremental cost	20,000	12,000	8,000
Incremental profit (loss)	5,000	(6,000)	4,000

It can be seen from the above statement that there will be a loss of ₹6,000 if further processing of product B is done after the separation point. It is, therefore, recommended that Product B should be sold at separation point. The optimal contribution based on this recommendation will be as follows:

Statement showing optimal contribution

	Product A	Product B	Product C	Total
Output (Tons)	100	60	80	
	(₹)	(₹)	(₹)	(₹)
Sales revenue	50,000	42,000	48,000	1,40,000
	(100×₹500)	(60×₹700)	(80×₹600)	
Less: Post separation cost	20,000	—	8,000	28,000
Contribution	30,000	42,000	40,000	1,12,000

2.4.2 Dropping or adding a product line: Often firms manufacturing a number of products may find that one or more of its products are not worthwhile for producing from the profitability point of view. Since the objective of any business organisation is to maximise its profits, the firm can in such cases consider the economies of dropping such unprofitable products, and adding a more profitable product(s). In such cases, the firm may have two alternatives as under:

- To drop the unprofitable product and to leave the capacity unutilised.
- To drop the unprofitable product and to utilise the capacity for the manufacture of a more remunerative product.

If we consider alternative (a) above, what is more important is the amount of fixed expenses apportioned to the product which is going to be discontinued. If the capacity relating to the product in question is going to be left unutilised, the contribution which the product is making towards recovery of fixed expenses will not be forthcoming. Thus continuance of a product line which is adjudged as unprofitable, on the basis of absorption costing may make matters

worse. The use of contribution approach will help the firm to take a sound decision on such occasions. As some of the fixed expenses can be reduced by dropping a product line, such fixed costs become relevant while making a decision about the discontinuance of product line.

If we take alternative (b) the fixed expenses apportioned to the product line discontinued will remain the same for being absorbed by the new product. The comparison is now between discontinuance of the product line and introduction of another remunerative product line. Since the fixed expenses are not going to be reduced in this alternative, the product which yields the highest contribution is preferred because it will maximise the overall profitability of the firm.

Illustration 17

A firm produces three products, the details of sales, contribution margin and the fixed costs apportioned to the products are as under:

	Products		
	A	B	C
Sales values (₹)	10,00,000	8,00,000	2,00,000
Contribution (₹)	40%	30%	25%
Fixed expenses (₹)	3,40,000	1,80,000	90,000

Fixed expenses attributable to product 'C' are ₹40,000.

Product C incurs a loss and hence the management wishes to consider two alternatives:

- Discontinue product 'C' to save the loss.
- Discontinue product 'C' and utilise the capacity to manufacture product 'D'. In this case the sales value of product D is ₹2,00,000 and the contribution is 35%.

Which alternative should be adopted?

Solution

- Let us tabulate the results of the firm as under:

Profitability of the firm:

	Products			Total
	A	B	C	
Sales value (₹)	10,00,000	8,00,000	2,00,000	20,00,000
Contribution (%)	40%	30%	25%	34.5%*
Contribution (₹)	4,00,000	2,40,000	50,000	6,90,000
Fixed costs (₹)	3,40,000	1,80,000	90,000	6,10,000
Net profit (loss) (₹)	60,000	60,000	(40,000)	80,000

$$\frac{\text{₹ } 6,90,000}{\text{₹ } 20,00,000} \times 100 = 34.5\% \text{ Average}$$

Under alternative (i), a comparison between the total profitability and the profitability without product 'C' is relevant, shown as under:

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Particulars	Products A,B &C	Products A&B only	Difference
Sales value (₹)	20,00,000	18,00,000	2,00,000
Contribution (₹)	6,90,000	6,40,000	50,000
Fixed expenses (₹)	6,10,000	5,70,000	40,000
Net profit (₹)	80,000	70,000	10,000

It may be observed from the above table that discontinuance of product 'C' reduced the total profit from ₹80,000 to ₹70,000. In other words, product 'C' was yielding a contribution sufficient to cover more than the incremental fixed costs of ₹40,000 attributable to its manufacture.

- (ii) Under alternative (ii), comparison between the profitability of product 'C' and product 'D' is relevant as under:

Particulars	Product 'C'	Product 'D'	Difference
Sales value (₹)	2,00,000	2,00,000	–
Contribution (%)	25%	35%	
Contribution (₹)	50,000	70,000	20,000

Since product D yields a higher contribution, the total profitability will increase by ₹20,000. The fixed expenses remain constant. This is illustrated below:

Product	A	B	D	Total
Sales value (₹)	10,00,000	8,00,000	2,00,000	20,00,000
(%)	40%	30%	35%	35.5%*
Contribution (₹)	4,00,000	2,40,000	70,000	7,10,000
Fixed expenses (₹)	3,40,000	1,80,000	90,000	6,10,000
Net profit (loss) (₹)	60,000	60,000	(20,000)	1,00,000

$$\frac{₹ 7,10,000}{₹ 20,00,000} \times 100 = 35.5\% \text{ Average}$$

2.4.3 Optimization of profit under a limiting factor condition

Illustration 18

Something More Ltd. is considering adding products to its product line. After a lot of deliberations between the sales and production personnel, it is decided that Products P, Q and R would be the most desirable additions to the company's product range on account of the technical competency, marketing potential and production flexibility as regards these products. In fact P, Q and R can all be made on the same kind of plant as that already in use and therefore as regards production, all products can be readily interchanged. However, it is considered necessary to build further plant facilities to cater for this additional production.

In this connection the following data are relevant:

Products	P (₹)	Q (₹)	R (₹)
Direct materials per unit	100	120	90
Direct labour per unit	50	70	90
Variable overheads per unit	50	130	100
Selling price per unit	350	420	370
Demand in units per cost period (on the basis of the above selling price)	200	125	750
Machine hours required per unit of production	15	5	3

It is felt that initially extra plant facilities can be built to operate at the following five different levels of activity viz. 1,800, 2,300, 2,800, 3,300 and 3,800 machines hours per cost period. The fixed overhead costs for a cost period relevant to these five different levels of activity are estimated at ₹15,000, ₹20,000, ₹26,000, ₹33,000 and ₹39,000 respectively.

You are required to advise, with supporting figures, the product or products to be manufactured and in what quantities at each of the five contemplated levels of activity that would seem most desirable to be pursued for maximisation of profits.

Solution

Something More Ltd.

Statement showing the production of R, Q and P in order of priority determined on the basis of contribution per machine hour, to maximise the profit at various levels of activity

Product Levels of Activity (Machine Hours)	P		Q		R		Total Contribution	Fixed Cost	Net Profit
	(Max. demand = 200 units Machine hours for max. demand = 3,000 hours)		(Max. demand = 125 units Machine hours For max. demand = 625 hours)		(Max. demand = 750 units Machine hours For max demand = 2,250 hours)				
	Units	Contribution	Units	Contribution	Units	Contribution			
	(₹)	(₹)	(₹)	(₹)	(₹)	(₹)	(₹)	(₹)	
1,800	–	–	–	–	600	54,000	54,000	15,000	39,000
2,300	–	–	10	1,000	750	67,500	68,500	20,000	48,500
2,800	–	–	110	11,000	750	67,500	78,500	26,000	52,500
3,300	28*	4,200	125	12,500	750	67,500	84,200	33,000	51,200
3,800	61*	9,150	125	12,500	750	67,500	89,150	39,000	50,150

* 28 and 61 units of product P consumes 420 and 915 machine hours respectively whereas actually 425 and 925 machine hours are available. As incomplete units can be sold only in the next period after they are completed, for these computations only complete units have been considered.

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The most desirable level of activity to be pursued is at 2,800 machine hours to produce and sell 750 units of R and 110 units of Q. At this activity level profit is maximum, i.e. ₹52,500.

Working note

Computation of contribution per unit of product and per machine hour

	Products		
	P (₹)	Q (₹)	R (₹)
Selling price: (A)	350	420	370
<i>Less : Variable costs</i>			
Direct materials	100	120	90
Direct labour	50	70	90
Variable overheads	50	130	100
Total variable costs: (B)	200	320	280
Contribution per unit: (A–B)	150	100	90
Machine hours required per unit	15	5	3
Contribution per machine hour	10	20	30

For maximizing profits, the products giving the maximum contribution per machine hour should be concentrated upon as machine hours available are the foremost constraint.

Hence the order of priority for producing the product should be R, Q, and P.

2.4.4 Optimising Investment Plan: The investment decisions, also termed as capital budgeting decisions involve current outlays in return for a stream of benefits in future year. When multiple alternatives of investment opportunities having similar risks are available, we can use incremental cost and revenue approach to find out the optimum investment plan. In this case we increase the total investment by increment till such time the incremental rate of return falls below the cut off rate given. The cut off rate is defined as the minimum rate of return expected from the investment.

Illustration 19

A company has ₹2,00,000 to invest and it can earn 14% by investing the sum in company deposits. It also has got an opportunity to invest this sum in five projects as under:

	Projects				
	A (₹)	B (₹)	C (₹)	D (₹)	E (₹)
Total investment	20,000	60,000	1,00,000	1,60,000	2,00,000
Annual net profit	1,000	8,400	15,600	24,240	28,640
Rate of return	5%	14%	15.6%	15.15%	14.32%

Find the optimum investment plan.

Solution

The optimum investment plan by using the incremental approach is as under:

	Projects			
	B (₹)	C (₹)	D (₹)	E (₹)
Incremental investment	40,000	40,000	60,000	40,000
Incremental net profit	7,400	7,200	8,640	4,400
Rate of return on incremental investment	18.5%	18%	14.4%	11%

Looking at the figures above, we find that project D is the most profitable one because if we take project E, the rate of return on the incremental investment will fall below the cut off rate of 14% and hence not acceptable. The following table will prove the facts. It may be observed here that the total income is the highest figure if the funds are invested in project D and the balance available in other company deposits at 14%.

	Project				
	A	B	C	D	E
	(₹)	(₹)	(₹)	(₹)	(₹)
Total funds available	2,00,000	2,00,000	2,00,000	2,00,000	2,00,000
Funds invested in project	20,000	60,000	1,00,000	1,60,000	2,00,000
Balance invested in deposits	1,80,000	1,40,000	1,00,000	40,000	—
Income from project	1,000	8,400	15,600	24,240	28,640
Income from deposits @ 14%	25,200	19,600	14,000	5,600	—
Total income	26,200	28,000	29,600	29,840	28,640

2.4.5 Decision making using Cash flow technique: This technique is useful in making decision regarding investment alternatives.

In this technique of decision making only differential cash flows are considered. Cash flow refers to the actual movement of cash in and out of an organisation. When cash is received it is called 'cash inflows' or positive cash flow, and when cash is paid out, it is called 'cash outflows' or negative cash flow. The difference between the two flows is termed as the net cash flow'. This technique of decision making can be applied in those circumstances in which the prime differences can be measured in terms of the future cash flows of the various alternatives under consideration. An alternative which gives most favourable net cash flow is selected. The application of the cash flow technique involves the following steps:

- (i) Compute the future cash inflows and the future cash outflows of each alternative under consideration.
- (ii) Ascertain the overall net cash flow.
- (iii) Select the alternative that has the most favourable net cash flow i.e. the highest net cash flow.

Illustration 20

A firm needs component in an assembly operation. If it wants to do the manufacturing itself, it would need to buy a machine for ₹ 4 lakhs which will last for 4 years with no salvage value. Manufacturing costs in each of the 4 years would be ₹ 6 lakhs, ₹ 7 lakhs, ₹ 8 lakhs, and ₹ 10 lakhs respectively. If the firm had to buy the components from a supplier, the cost would be ₹ 9 lakhs, ₹ 10 lakhs, ₹ 11 lakhs and ₹ 14 lakhs respectively in each of the four years. However, the machine would occupy floor space which would have been used for another machine. This latter machine would be hired at no cost to manufacture an item, the sale of which would produce net cash flows in each of the four years of ₹ 2 lakhs. It is impossible to find room for both the machines and there are no other external effects. The cost of capital is 10% and the present value factor for each of the four years is 0.909, 0.826, 0.751 and 0.683 respectively.

Should the firm make the components or buy from outside?

Solution

Evaluation of Make or Buy proposal
(All figures are in lakhs of rupees)

Year	P.V. factors at 10%	When the component is manufactured		When the component is bought from an outside supplier	
		Cash outflow*	Present value	Cash outflow (Buying cost)	Present value
		(₹)	(₹)	(₹)	(₹)
(a)	(b)	(c)	(d) = (b) × (c)	(e)	(f) = (b) × (e)
0	1.000	4	4.000	—	—
1	0.909	8	7.272	9	8.181
2	0.826	9	7.434	10	8.260
3	0.751	10	7.510	11	8.261
4	0.683	12	8.196	14	9.562
Total			34.412		34.264

* (Capital cost + manufacturing cost + opportunity cost)

$$\begin{aligned}
 \text{Saving in cash outflow} &= \left[\begin{array}{l} \text{Total present value of} \\ \text{cash outflow, when the} \\ \text{component is manufac-} \\ \text{tured internally} \end{array} \right] - \left[\begin{array}{l} \text{Total present value of} \\ \text{cash outflow, when the} \\ \text{component is bought} \\ \text{from outside} \end{array} \right] \\
 &= ₹ 34.412 - ₹ 34.264 \\
 &= ₹ 0.148 \text{ (lakhs)}
 \end{aligned}$$

Conclusion : Since there is a saving of ₹ 0.148 (lakhs) in buying the component from outside, therefore, we should stick to this decision.

Note: The loss of ₹ 2 lakhs cash inflow for each of the four years due to the inability of the firm to operate another machine if it manufactures the component has been treated as an opportunity cost.

2.5 Shut Down & Divestment Decision

Very often it becomes necessary for a firm to temporarily close down the factory due to trade recession with a view to reopening it in the future. In such cases, the decision should be based on the marginal cost analysis. If the products are making a contribution towards fixed expenses or in other words if selling price is above the marginal cost, it is preferable to continue because the losses are minimized. By suspending the manufacture, certain fixed expenses can be avoided and certain extra fixed expenses may be incurred depending up on the nature of the industry, say, for example, extra cost incurred in protecting the machinery. So the decision is based on as to whether the contribution is more than the difference between the fixed expenses incurred in normal operation and the fixed expenses incurred when the plant is shut down. In other words, the shut down point is calculated by using the formula:

$$\text{Shut down point} = (\text{Total fixed cost} - \text{Shut down costs}) \div \text{Contribution per unit}$$

In case of decision rendering closure or shut down we consider the following points:

1. Current profit situation has to be maintained, so by analyzing the proposal of shut down or outsourcing if the current income is reduced then shut down will not be allowed unless the product or factory has reached at the end of its life cycle.
 2. Avoidance of short term loss may cause the loss of brand value in the market as well as loss of efficient employees. So in that case the business may be continued for better profit after the recession period.
 3. In case of outsourcing proposal we can also apply the differential cost concept i.e. saving in cost must be greater than or equal to out-sourcing fees payment. Here saving in cost i.e. cash inflow is computed from the concept of relevant cost i.e. by closing down we are saving variable cost of production, and discretionary fixed cost or shut down cost. This cash inflow further may be classified into two parts:
 1. Saving in variable cost per time period i.e. Cash Inflow (CIF) per annum.
 2. One time cash inflow following shut down i.e. sale of machine, sale of current stock of material etc.
- ∴ Total CIF or saving following shut down = one time CIF + CIF p.a. × life span of the proposal of outsourcing.

If this total is greater than total outsourcing fees then shutdown will take place other production will be continue.

Illustration- 21

<i>Fixed expenses at 50% activity</i>	₹15,000
<i>Fixed expenses when the factory is shut down</i>	₹10,000
<i>Additional expenses in closing down</i>	₹1,000
<i>Production at 50% activity = 5,000 units</i>	
<i>Contribution per unit ₹ 1</i>	

Solution

(₹)

A. If the plant is shut down the sunk costs or fixed expenses	11,000
B. If it is working at 50% activity the fixed expenses	15,000
C. Additional fixed expenses: [(B-A)]	4,000
D. Contribution (5,000 units ₹ 1 p.u.)	5,000

By working at 50% activity the firm is able to recover the additional fixed expenses of ₹ 4,000 and earn an extra contribution of ₹1,000 towards shut down expenses. Hence it is advisable to continue production in the factory instead of closing it down.

Illustration 22

Alfa Engineering Works Ltd. had the following annual budget for the year ending on 30th June

Production capacity	60%	80%
<i>Costs</i>		<i>(₹ in lakhs)</i>
<i>Direct materials</i>	9.60	12.80
<i>Direct Labour</i>	7.20	9.60
<i>Factory expenses</i>	7.56	8.04
<i>Administrative expenses</i>	3.72	3.88
<i>Selling & distribution expenses</i>	4.08	4.32
<i>Total cost</i>	32.16	38.64
<i>Profit</i>	4.86	10.72
<i>Sales</i>	37.02	49.36

Owing to adverse trading conditions, the company has been operating during July/September at 40% capacity, realizing budgeted selling prices.

Owing to acute competition, it has become inevitable to reduce prices by 35% even to maintain the sales at the existing level. The directors are considering whether or not their factory should be closed down until the trade recession has passed. A market research consultant has advised that in about a year's time there is every indication that sales will increase to 75% of normal capacity and that the revenues to be produced for the full year at that volume could be expected to ₹ 40 lakhs

If the directors decide to close down the factory for a year it is estimated that:

- The present fixed costs would be reduced to ₹6 lakhs p.a.
- Closing down costs (redundancy payments, etc.) would amount to ₹2 lakhs.
- Necessary maintenance of plant would cost ₹50,000 p.a.; and
- On re-opening the factory, the cost of overhauling the plant, training and engagement of new personal would amount to ₹80,000.

Prepare a report for the directors, making your recommendations.

Solution

The Directors,
Alfa Engineering Works Ltd.

New Delhi

Date.....

Dear Sir,

As desired, we have analysed the cost implications of the decision of temporary closure of the trade recession. We find that if the factory is run at 40% capacity and with reduced selling prices, the loss likely to be incurred in one full year (the estimated period of recession), would be around ₹7.17 lakhs as detailed below:

	(₹) In lakhs
Direct materials	6.40
Direct labour	4.80
Factory expenses	7.08
Administrative expenses	3.56
Selling & distribution expenses	<u>3.84</u>
	25.68
Loss	<u>(7.17)</u>
Sales $\left(₹ 36.02 \text{ lakhs} \times \frac{40}{60} \times \frac{75}{100} \right)$	<u>18.51</u>

If the factory is closed, the following costs will be incurred:

	(₹) in lakhs
Fixed costs	6.00
Closing down costs	2.00
Maintenance costs	0.50
Cost of overhauling the plant, training and engagement of staff	<u>0.80</u>
	<u>9.30</u>

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It is obvious from the above, that despite the fact that running at 40% capacity would imply a loss of ₹ 7.17 lakhs, it is better not to close down the factory since in that case the loss would be higher.

In our views, even if running the factory entailed a somewhat bigger loss as compared to the loss incurred by closing it down temporarily, it may be better to keep the factory in operation. This is because a closure, even if temporary, results in the loss of regular and old customers, suppliers and skilled personal. This, coupled with a loss of goodwill in the market, may give rise to substantial losses at the time of restarting the factory. We trust that the above analysis would be helpful to you in reaching an appropriate decision in the matter. We shall be glad to be of any further assistance that may be required in this regard.

Yours faithfully
X and Co.
Chartered Accountants.

Working Note:

		Factory Expenses (₹ Lakhs)	Admn. expenses (₹ Lakhs)	Selling expenses (₹ Lakhs)
(i)	Amount at 60%	7.56	3.72	4.08
(ii)	Amount at 80%	8.04	3.88	4.32
(iii)	Change for 20%	0.48	0.16	0.24
(iv)	Amount at 40% (i)-(iii)	7.08	3.56	3.84

Illustration23

Universe Ltd. manufactures 20,000 units of 'X' in a year at its normal production capacity. The unit cost as to variable costs and fixed costs at this level are ₹13 and ₹ 4 respectively.

Due to trade depression, it is expected that only 2,000 units of 'X' can be sold during the next year. The management plans to shut-down the plant. The fixed costs for the next year then is expected to be reduced to ₹ 33,000. Additional costs of plant shut-down are expected at ₹12,000. Should the plant be shut-down? What is the shut-down point?

Solution

Note: The decisions regarding the plant to shut-down and the calculation of shut-down point requires the figure of selling price per unit of the units sold. As the statement of the question fails to indicate the selling price (per unit) therefore one is free to assume it.

Let's assume the selling price per unit be ₹ 20

Statement of cost for taking a decision about shutdown of plant

	Plant is operated (₹)	Plant is shut down (₹)
Variable cost	26,000 (2,000 units × ₹13)	—
Fixed costs	80,000 (20,000 units × ₹ 4)	33,000 (Inescapable cost)
Additional shut down cost	—	<u>12,000</u>
Total cost	<u>1,06,000</u>	<u>45,000</u>
State of loss:		
Sales	40,000 (2,000 units ₹ 20)	-
Less: Total cost (as above)	<u>1,06,000</u>	<u>45,000</u>
Loss	(66,000) (if continued)	(45,000) (if shut-down)

Recommendation: A comparison of loss figures indicated as above points out, that, loss is reduced if the plant is shut-down. In fact by doing so the concern's loss would be reduced by ₹ 21,000 (₹66,000 - ₹ 45,000).

Calculation of shut down point:

$$\begin{aligned} \text{Shut-down point} &= \frac{\text{₹}80,000 - \text{₹}45,000}{\text{₹}20 - \text{₹}13} \\ &= 5,000 \text{ units} \end{aligned}$$

Illustration 24

A paint manufacturing company manufactures 2,00,000 per annum medium-sized tins of "Spray Lac Paints" when working at normal capacity. It incurs the following costs of manufacturing per unit :

	(₹)
Direct material	7.80
Direct labour	2.10
Variable overhead	2.50
Fixed overhead	4.00
Product cost (per unit)	<u>16.40</u>

Each unit (tin) of the product is sold for ₹ 21 with variable selling and administrative expenses of 60 paise per tin.

During the next quarter only 10,000 units can be produced and sold. Management plans to shut down the plant estimating that the fixed manufacturing cost can be reduced to ₹ 74,000 for the quarter.

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When the plant is operating, the fixed overheads are incurred at a uniform rate throughout the year. Additional costs of plant shut-down for the quarter are estimated at ₹ 14,000.

You are required:

- To express your opinion, along with the calculations, as to whether the plant should be shut down during the quarter, and
- To calculate the shut down point for quarter in units of products (i.e., in terms of number of tins).

Solution

(a) Working note:

Contribution per tin:

$$\begin{aligned} & \text{Selling price} - \text{Variable cost of the product} \\ &= ₹ 21 - ₹ (7.80 + 2.10 + 2.50 + 0.60) \\ &= ₹ 8 \text{ per tin} \end{aligned}$$

Calculation of loss, if plant is operated

Total contribution on 10,000 tins @ ₹ 8 each	(₹) 80,000
Less: Total fixed cost for three months	
$(2,00,000 \times ₹ 4) \times \frac{3}{12}$	2,00,000
Expected loss on operation	<u>(1,20,000)</u>

Calculation of loss (shut down costs) if plant is shut down

Unavoidable fixed cost	(₹) 74,000
Additional cost of shut-down	14,000
Total loss on shut down	<u>(88,000)</u>

It is clear from the above, that if plant is operated, loss would be ₹ 1,20,000 which exceeds the loss by ₹ 32,000 (₹ 1,20,000 – ₹ 88,000) when the plant is shut-down. Therefore, the management should shut-down the plant during the quarter.

(b) Calculation of shut-down point

Avoidable fixed cost for the period (or fixed cost which will not be incurred if the plant is shut down) :

$$\begin{aligned} &= \text{Total fixed cost for the period} - (\text{Unavoidable fixed costs} + \text{Additional shut down costs}) \\ &= ₹ 2,00,000 - (₹ 74,000 + ₹ 14,000) \\ &= ₹ 2,00,000 - ₹ 88,000 \\ &= ₹ 1,12,000 \end{aligned}$$

$$\begin{aligned} \text{Shut-down point} &= \frac{\text{Avoidable fixed cost}}{\text{Contribution per unit}} \\ &= \frac{\text{₹ } 1,12,000}{\text{₹ } 8} = 14,000 \text{ tins} \end{aligned}$$

or

$$\begin{aligned} \text{Shut-down point} &= \frac{\text{Total fixed cost} - \text{Shut down costs}}{\text{Contribution per unit}} \\ &= \frac{\text{₹ } 2,00,000 - \text{₹ } 88,000}{\text{₹ } 8} = 14,000 \text{ tins} \end{aligned}$$

Other considerations in shut down decisions:

Cost is not the only criterion for deciding in favour of shut down. Non-cost factors should also be taken into consideration. Few non-cost factors are:

1. Interest of the workers – If the workers are discharged it may become difficult to get skilled workers later, on re-opening of the factory. Also shut down may create problem for the workers which may far exceed the cost benefits of the shut down.
2. Once the firm is closed down competitors may establish their products and thus it may be difficult to introduce the product in the market again.
3. The plant may become obsolete or depreciate at a larger rate when not in operation. Thus, heavy capital expenditure may have to be incurred on re-opening.

Divestment Strategy

Divestment involves a strategy of selling off or shedding business operations to divert the resources, so released, for other purposes. Selling off a business segment or product division is one of the frequent forms of divestment strategy. It may also include selling off or giving up the control over a subsidiary where by the wholly owned subsidiaries may be floated as independently quoted companies.

Reasons for Divestment

1. In case of a firm having an opportunity to get more profitable product or segment but has resource constraint, it may selling off its unprofitable or less profitable division and utilise the recourse so released. Cost Benefit Analysis & Capital Budgeting Method is the useful tool for analysing this type of situation.
2. In case of purchase of new business, it may be found that some of the part of the acquired business is not up to the mark. In such type of situation disposal of the unwanted part of the business is more desirable than hold it.
3. In case where any business segment or product or subsidiary is pull down the profit of the whole organisation, it is better to cut down of that operation of the product or business segment or subsidiary.

4. If managing of the organisation is very constrained, it is good to dispose off the unwanted and undesirable activity of the organisation, which involves large management skill. So that it can concentrated on the core activities of the organisation.
5. In the situation where the firm suffering from loss, selling off or divestment policy is one suitable option to exit in the current position and to go for turnaround strategy.

2.6 Other Decision Makings

Illustration 25

An item of finished goods inventory that cost ₹200 per unit to make is facing the danger of becoming obsolete. There are two following alternative ways of disposing it of:

Sell the stock to P for ₹200; or to Q for ₹216. Q's place is twice as far away as that of P though due to favourable transport conditions the delivery time will be the same. The cost accountant has prescribed the following cost estimates for delivery:

P - Petrol and oil ₹10, wages ₹12, share of licence, insurance and depreciation (based on mileage) ₹14.

Q - Petrol and oil ₹20, wages ₹12, share of licence, insurance and depreciation ₹28.

You are required to recommend whether the stock should be sold to P or Q.

Solution

	P (₹)	Q (₹)
Cash inflow (Sales)	200	216
Cash outflow (Petrol, oil and wages)	22	32
Net cash flow	178	184

Since the most favourable net cash flow occurs in the case of sale to Q, hence it is recommended that the item be sold to Q.

Notes: 1. In the above analysis ₹14 and ₹28 the share of licence, insurance and depreciation have not been included because there is no actual cash outflow in respect of these costs. Otherwise also these costs are not going to affect the cashflow whether sale is made to P or Q or even to neither of them.

2. It may be noted that the net cashflow does not measure the profits of the projects. It only indicates which project is more profitable.

Note: Students should note that the discounted cash flow technique has been discussed in detail in the book of Strategic Financial Management. Students should refer to the aforesaid book to refresh their knowledge.

Illustration 26

The Z company owns and operates a chain of 25 stores. Budgeted data for the Garden stores are as follows

	(₹)
Annual sales	4,25,000
Annual cost of goods sold and other operating expenses	3,82,000
Annual building ownership costs (not included above)	20,000

The company can lease the building to a large flower shop for ₹ 4,000 per month. Decide whether to continue operations of this store or to lease using:

- (i) The total project (or comparative statement) approach.
- (ii) The incremental (or relevant cost) approach.
- (iii) The opportunity cost approach.

Solution

(i) Comparative statement showing the profitability of two alternatives

	Continue operation (₹)	Lease the building (₹)
Annual sales	4,25,000	48,000 (@₹4,000 p.m.)
Less: Cost of goods sold (excluding ownership costs)	3,82,000	—
Building ownership costs	20,000	20,000
Net income	23,000	28,000

Net income is ₹ 28,000 if the building is leased out and thus leasing is a profitable proposition.

(ii) Incremental or relevant cost approach

Building ownership costs are not relevant as there is no change in these costs under both the alternatives. Therefore, the correct approach will be to consider the incremental cash inflows from the continuing operation.

	(₹)
Net cash flow from continuing the operation (₹ 4,25,000 – ₹ 3,82,000)	43,000
Less: Income from leasing	<u>48,000</u>
Incremental loss from continuing operations	<u>5,000</u>

Therefore, company should not continue the operation

(iii) The opportunity cost approach

	(₹)
Total sale revenue	4,25,000
Less: Cost of goods sold	(3,82,000)
Opportunity cost of leasing	<u>(48,000)</u>
Loss due to continuing operation	<u>5,000</u>

Therefore, the company should lease out the building.

Illustration 27

Carcare Corporation has just today paid for and installed a special machine for polishing cars at one of its prestigious outlets. It is the first day of company's fiscal year. The machine costs ₹ 20,000. Its annual operating costs total ₹ 15,000 exclusive of depreciation. The machine will have a four year useful life and a zero terminal disposal value.

After the machine has been used for one day, a machine salesman walks in. He offers a different machine that promises to do the same job at a yearly operating cost of ₹ 9,000, exclusive of depreciation. The new machine will cost ₹ 24,000 in cash, duly installed. The "old" machine is unique and can be sold outright for only ₹ 10,000 minus ₹ 2,000 removal cost. The new machine, like the old one, will have a four-year useful life and zero terminal disposal value.

Sales, all in cash, will be ₹ 1,50,000 annually and other cash costs will be ₹ 1,10,000 annually, regardless of this decision.

For simplicity, ignore income taxes, interest and present value considerations.

Required :

- Prepare a statement of cash receipts and disbursements for each of the four years under both alternatives. What is the cumulative difference in cash flows for the four years taken together ?
- Prepare Income Statements for each of the four years under both alternatives. Assume straight-line depreciation. What is the cumulative difference in operating income for the four years taken together ?
- What are the irrelevant items in your presentations in requirements (a) and (b) ? Why are they irrelevant ?
- Suppose the cost of the "old" machine was ₹ 10,00,000 rather than ₹ 20,000. Nevertheless, the old machine can be sold outright for only ₹ 10,000 minus ₹ 2,000 removal cost. Would the net differences in requirements (a) and (b) change ? Explain.
- "To avoid a loss, we should keep the old machine." What is the role of book value in decisions about replacement of machines ?

Solution

- Statement of Cash Receipts, Disbursements and cumulative difference in Cash flows for four years taken together under both alternatives.

(₹ in thousands)

Alternatives	Keep old machine			Buy new machine			
	Year 1	2nd, 3 rd & 4 th year each	All 4 years	Year 1	2nd, 3 rd & 4 th year each	All 4 years	Cumulative difference in cash flows for four years taken together
<i>Receipts :</i>							
Sales revenue	150	150	600	150	150	600	

Sales of old equipment	—	—	—	8	—	8	
Total receipts : (A)	150	150	600	158	150	608	
<i>Disbursements :</i>							
Annual operating cost	15	15	60	9	9	36	
Other cash costs	110	110	440	110	110	440	
Purchase cost of "old" machine	20	—	20	20	—	20	
Purchase of "new" machine	—	—	—	24	—	24	
Total disbursements : (B)	145	125	520	163	119	520	
Net cash in-flows : (A) – (B)	5	25	80	(5)	31	88	08

(b) Statement of income for each of the four years and cumulative difference in operating income

(₹ in thousands)

Alternatives	Keep old machine		Buy new machine			Cumulative difference in operating income
	1 st , 2 nd 3 rd & 4 th year each (₹)	All 4 years (₹)	Year 1 (₹)	2 nd , 3 rd & 4 th year each (₹)	All 4 years (₹)	
<i>Income :</i>						
Sales revenue	150	600	150	150	600	
Total revenue : (A)	150	600	150	150	600	
<i>Costs :</i>						
Annual operating cost	15	60	9	9	36	
Other cash costs	110	440	110	110	440	
Depreciation	5	20	6	6	24	
(Refer to working note 1)						
Loss on the disposal of old machine	—	—	12	—	12	
(Refer to working note 2)						
Total costs : (B)	130	520	137	125	512	
Operating income : (A) – (B)	20	80	13	25	88	08

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- (c) The purchase cost of old machine ₹ 20,000; the sales revenue ₹ 1,50,000 and other cash costs of ₹ 1,10,000 are irrelevant items for the presentation in requirements (a) and (b) above. These items are irrelevant because their amount are common to both the alternatives.
- (d) The net difference in requirements under (a) and (b) will not change if the cost of 'old' machine becomes ₹ 10,00,000 instead of ₹ 20,000. This is so because the cost of old machine is common for both the alternatives.
- (e) In the decision about the replacement of machine the book value of the machine is irrelevant because it is a past (historical) cost. All past costs are down the drain. Nothing can change what has already happened. As apparent from (a) and (b) above; we can completely ignore the cost of old machine i.e. ₹ 20,000 and still have a correct analysis.

Working Notes :

1. *Depreciation (under straight line method):*

		Old machine	New machine
(i)	Cost of machine (₹)	20,000	24,000
(ii)	Terminal disposal value (₹)	Zero	Zero
(iii)	Useful life	4	4
	Depreciation $\left[\frac{(i) - (ii)}{(iii)} \right]$ ₹	5,000	6,000

2. *Loss on the disposal of old machine :*

	(₹)	(₹)
Purchase price of old machine		20,000
Disposal value	10,000	
Less: Removal cost	2,000	8,000
Loss		12,000

2.7 Introduction to Marginal Costing

According to CIMA, Marginal costing is the system in which variable costs are charged to cost units and fixed costs of the period are written off in full against the aggregate contribution.

Marginal costing is not a distinct method of costing like job costing, process costing, operating costing, etc. but a special technique used for managerial decision making. Marginal costing is used to provide a basis for the interpretation of cost data to measure the profitability of different products, processes and cost centre in the course of decision making. It can, therefore, be used in conjunction with the different methods of costing such as job costing, process costing, etc., or even with other technique such as standard costing or budgetary control.

In marginal costing, cost ascertainment is made on the basis of the nature of cost. It gives consideration to behaviour of costs. In other words, the technique has developed from a

particular concept and expression of the nature and behaviour of costs and their effect upon the profitability of an undertaking.

Marginal Costing (and Absorption costing) is covered in CA-Integrated Proficiency Competence Course (IPCC). Here an overview has been included to explain extension of Marginal Costing i.e. C-V-P Analysis.

2.8 Introduction of Cost-Volume-Profit (CVP) Analysis

Cost-Volume-Profit Analysis (as the name suggests) is the analysis of three variable viz., cost, volume and profit. Such an analysis explores the relationship existing amongst costs, revenue, activity levels and the resulting profit. It aims at measuring variations of cost with volume. In the profit planning of a business, cost-volume-profit (C-V-P) relationship is the most significant factor.

Features of CVP Analysis:

- ❖ It is a technique for studying the relationship between cost volume and profit.
- ❖ Profit of an undertaking depends upon a large number of factors. But the most important of these factors are the cost of manufacture, volume of sales and selling price of products.
- ❖ In words of Herman C. Heiser, "the most significant single factor in profit planning of the average business is the relationship between volume of business, cost and profits".
- ❖ The CVP relationship is an important tool used for profit planning of a business.

Some important marginal cost concepts are as follows

1. Profit Statement under Marginal Costing

Statement of Profit	(₹)	(₹)
Revenue/Sales		xxx
Less: <u>Variable cost of production</u>		
Material	xx	
Labour	xx	
Direct Expenses	xx	
Variable overheads	xx	
	xx	
Add: Opening Stock of Finished goods (at MC)	xx	
Less: Closing Stock of Finished goods (at MC)	xx	
Variable cost of goods sold	xxx	
Add: Variable Selling overhead	xx	
Variable cost of sales		xx
Contribution		xx
Less: All types of Fixed cost		xx
(Committed, Discretionary costs)		xx

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2. Sales - Variable Cost = Contribution = Fixed Cost ± Profit/ (loss)
3. Profit Volume (P/V) Ratio or Contribution to Sales (C/S) Ratio also known as contribution margin ratio
 - = $\text{Contribution} \div \text{Sales}$
 - = $\text{Contribution per unit} \div \text{Selling price per unit}$
 - = $\text{Change in Contribution} \div \text{Change in Sales}$
4. Breakeven Point (BEP): Point where there is no profit or no loss.
at BEP, Contribution = Fixed Cost
Thus, Break Even Sales (in sales value) = $\text{Fixed Cost} \div \text{P/V ratio}$
5. Margin of safety = Sales – BEP sales
 - = $\text{Contribution} / \text{P/V ratio} - \text{Fixed cost} / \text{P/V ratio}$
 - = Profit / P/V ratio
6. Profit = (Sales × P/V ratio) – Fixed Cost
 - = (Margin of Safety Sales) × P/V ratio
7. BEP - Calculation in different scenario :
 - (i) Without limiting factor (non- attributable to a single product)
BEP in units = $\text{Fixed cost} \div \text{Average contribution per unit.}$
(when sales mix in units are given)
BEP in value = $\text{Fixed cost} \div \text{composite P/ V Ratio}$
(when sales mix in rupee are given)
where Composite P/V Ratio = $(\text{Total Contribution} \div \text{Total Sales})$
= $\sum[\text{Sales Mix} \times \text{P/ V Ratio}]$
 - (ii) With limiting factor (attributable to a single product)
Find contribution per limiting factor & give rank. Find total contribution from the product ranked as 1st. Calculate the amount of fixed cost still to be recovered. Whether it can be recovered by 2nd rank product or not?
 - (iii) For perishable products apply the same concept in case of opening stock with the identified variable cost.
8.
 - a. BEP in case of process costing is expressed in terms of total raw material input
 - b. In capital budgeting, BEP is that sales volume where discounted cash inflow = discounted cash outflow.
 - c. Potential BE : On the basis of sales out of current period production only.
 - d. Multiple BE : Different BE due to change in sales price, variable costs & fixed costs for different production level.

- e. Cash BEP = Cash fixed cost ÷ contribution p.u. So do not consider the sunk cost.
- f. BEP for decision making purpose: Accept that proposal where BEP is lowest provided the profit cannot be calculated.

2.9 Important Factors in Marginal Costing Decisions

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

- (i) Whether the product or production line in question makes a contribution.
- (ii) Where a choice is to be made between two courses of action, the additional fixed overhead, if any, should be taken into account.
- (iii) The continuity of demand after expansion or renovation or installation of the sophisticated machine and its impact on the selling price should also be considered. For example, if the selling price goes down when the supply increases the possible drop in profit should be taken into account.
- (iv) Cost is not the only criterion for decision making. Non-cost factors like the necessity to retain the experienced employees, etc. should also be considered.

2.10 Pricing Decisions under Special Circumstances

If goods were sold in the normal circumstances under normal business conditions, the price would cover the total cost plus a margin of profit. Selling prices are not always determined by the cost of production. They may be determined by market conditions but in the long run they tend to become equal to the cost of production of marginal firm. Therefore, a business cannot continue to sell below the total cost for a long period. Occasionally, a firm may have to sell below the total cost.

The problem of pricing can be summarised under three heads:

- (i) Pricing in periods of recession,
- (ii) Differential selling prices and
- (iii) Acceptance of an offer and submission of a tender.

2.10.1 Pricing in periods of recession : In periods of recession, a firm may sell its articles at a price *less than the total cost but above the marginal cost* for a limited period.

The advantages of this practice are:

- (i) The firm can continue to produce and use the services of skilled employees who are well trained and will be difficult to re-employ later if discharged.
- (ii) Plant and machinery can be prevented from deterioration through idleness.
- (iii) The business would be ready to take advantage of improved business conditions later.
- (iv) This avoids the competition of securing the business of the firm.

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One thing to remember here is that a situation like this should not lead to a drastic price cutting and the orders accepted should not cover a long period extending over the production facilities of a period when business conditions improve.

It may also be justifiable to sell the product at a price below marginal cost for a limited period provided the following conditions prevail:

- (i) Where materials are of perishable nature.
- (ii) Where stocks have been accumulated in large quantities and the market prices have fallen. This will save the carrying cost of stocks.
- (iii) Is it essential to reduce the prices to such an extent in order to popularise a new product?
- (iv) Where such reduction enables the firm to boost the sales of other products having larger profit margin.

2.10.2 Differential selling prices: Use of differential selling price which is above the marginal cost but below the total cost is resorted to in an order to absorb surplus capacity. There are two ways of doing this:

- (i) The firm producing a branded article may use the surplus capacity to produce the same article to be sold above marginal cost in a different market.

Dumping of goods in the export market is an example of this type of pricing.

The articles sold in the home market will recover all fixed expenses. Since price reduction in the home market is injurious to the normal sales, it is not resorted to. Any reduction in the selling prices in the export market will not affect the price prevailing in the home market.

- (ii) The firm may produce and sell a branded article, say product A, which covers the entire fixed overheads and use the surplus capacity to produce another product B, which may be sold at a price above its marginal cost. The overall profitability will thus increase. The manufacture of product B, however, should be confined to surplus capacity and it should not have the possibility of becoming a major product at the low price at which it is sold. If it becomes so there will be a reduction in profit as illustrated below:

Example

	<i>Condition 1</i>		<i>Condition 2</i>	
	<i>Product A</i>	<i>Product B</i>	<i>Product A</i>	<i>Product B</i>
Capacity	90%	10%	60%	40%
	(₹)	(₹)	(₹)	(₹)
Sales	9,000	2,000	6,000	8,000
Marginal cost	6,000	1,800	4,000	7,200
Gross margin	3,000	200	2,000	800

Fixed expenses	2,000	—	2,000	—
Profit	1,000	200	—	800
Total profit	1,200		800	

Surplus capacity is assumed to be 10% in the above example.

2.11 Acceptance of an offer and submission of a tender

◆ **Acceptance of an offer:** When a firm having surplus capacity receives an offer from a special or export market, a decision as to whether to accept or not to accept the offer can be taken after the analysis of the *incremental cost and incremental revenue*.

Illustration 28

Capacity	Unit cost (₹)	Unit selling price (₹)
6,000	80	100
7,000	75	97
8,000	74	95
9,000	72	
10,000	71	

The firm is operating at 8,000 units capacity and has received an order for 2,000 units from an export market at a price of ₹ 70 per unit. Advise the firm as to whether the export order should be accepted or not.

Solution

Apparently, the unit cost at 9,000 and 10,000 units capacity is ₹ 72 and ₹ 71 respectively and since the export order is at ₹ 70 per unit, the order is not profitable. But this is a wrong approach. Let us tabulate the figures again and see the result.

Capacity	Unit cost (₹)	Total cost (₹)	Incremental cost (₹)	Unit price (₹)	Total sales value (₹)	Incremental revenue (₹)
6,000	80	4,80,000		100	6,00,000	
7,000	75	5,25,000	45,000	97	6,79,000	79,000
8,000	74	5,92,000	67,000	95	7,60,000	81,000
9,000	72	6,48,000	56,000			
10,000	71	7,10,000	62,000			

At 8,000 level of output the total sales revenue is ₹ 7,60,000 and the total cost is ₹ 5,92,000 leaving a profit of ₹ 1,68,000. The fact that this level of output leaves a profit means that the

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fixed expenses have been recovered already. Hence we have to take only the incremental cost for further levels of output. For an additional sales of 2,000 units the incremental cost is ₹ 7,10,000 – ₹ 5,92,000 = ₹ 1,18,000. The cost per unit, therefore, is $\frac{₹ 1,18,000}{2,000 \text{ units}} = ₹ 59$ for

which the price quoted is ₹ 70 per unit. The offer is, therefore, acceptable.

◆ **Submission of Tenders:** For submitting tenders also the incremental cost and incremental revenue approach is useful. Considering the above example, if the firm operates at 8,000 level of output, and quotations are to be given, any price quotation above the unit incremental cost of ₹ 59 would be profitable.

Illustration 29

All Play and Nowork Ltd. are specialists in the manufacture of sports goods. They manufacture croquet mallets but purchase the wooden balls, iron arches and stakes required to complete a croquet set.

Mallets consist of a head and handle. Handles use 1.5 board feet per handle at ₹ 40 per board foot. Spoilage loss is negligible for the manufacture of handles.

Heads frequently split and create considerable scrap. A head requires 0.20 board feet of high quality lumber costing ₹ 70 per board foot. Spoilage normally works out to 20% of the completed heads. 4% of the spoiled heads can be salvaged and sold as scrap at ₹ 10 per spoiled head.

In the department machining and assembling the mallets, 12 men work 8 hours per day for 25 days in a month. Each worker can machine and assemble 15 mallets per uninterrupted 50 minutes time frame. In each 8 hours working day, 15 minutes are allowed for coffee-break, 8 minutes on an average for training and 9 minutes for supervisory instructions. Besides 10% of each day is booked as idle time to cover checking in and checking out changing operations, getting materials and other miscellaneous matters. Workers are paid at a comprehensive rate of ₹ 6 per hour.

The department is geared to produce 40,000 mallets per month and the monthly expenses of the department are as under:

	(₹)
<i>Finishing and painting of the mallets</i>	50,800
<i>Lubricating oil for cutting machines</i>	300
<i>Depreciation for cutting machine</i>	700
<i>Repairs and maintenance</i>	100
<i>Power to run the machines</i>	200
<i>Plant Manager's salary</i>	2,700
<i>Other overheads allocated to the department</i>	1,20,000

As the mallets are machined and assembled in lots of 500, prepare a total cost sheet for one lot and advise the management on the selling price to be fixed per mallet in order to ensure a minimum 20% margin on the selling price.

Solution

All Play and Nowork Ltd.
Cost Sheet of one lot of 500 Croquet Mallets

	(₹)	(₹)	(₹)
Direct material:			
Handles (1.5 feet × 500 units × ₹ 40)		30,000	
Heads (1.20 × 500 × 0.20 × ₹ 70) (Refer to working note 1)	8,400		
Less: Scrap recovery (4% × 100 × ₹ 10)	40	8,360	38,360
Direct labour:			
$\left(\frac{8 \text{ hrs} \times ₹ 6}{120} \times 500\right)$ (Refer to working note 2)			200
Prime cost			<u>38,560</u>
Factory & other overheads:			
Variable			
Finishing & painting $\left(\frac{₹ 50,800}{40,000} \times 500\right)$ (Refer to working note 3)			635
Fixed $\left(\frac{₹ 1,24,000}{36,000} \times 500\right)$ (Refer to working note 4)			1,722
Total cost			40,917
Price quotation:			
Cost per mallet $\left(\frac{₹ 40,917}{500 \text{ units}}\right)$			81.834
Add: Profit 25% on cost (20% margin on selling price means 25% on cost)			20.458
Selling price			102.29

Working notes:

- Since 20% of completed heads are spoiled, output of 1 unit requires input of $1 + 0.20 = 1.20$ units; so, total heads processed: $1.20 \times 500 = 600$, of which spoiled heads are 100.

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2.	Total time in a day: 8 × 60	480 minutes	
	Less : Idle time	48 minutes	
	Coffee break	15 minutes	
	Instructions	9 minutes	
	Training	<u>8 minutes</u>	<u>80 minutes</u>
	Productive time per day:		<u>400 minutes</u>

Therefore, mallets to be produced per man per day: $\left(\frac{400}{50} \times 15\right) = 120$ units.

Since mallets are produced at the rate of 120 mallets per man day, so total monthly production will be: 120 units × 12 men × 25 days = 36,000 mallets.

3. Finishing and painting overheads are assumed to be variable for the production of 40,000 mallets.
4. All the other expenses are fixed and are to be absorbed by 36,000 mallets of monthly production.

Illustration 30

A Company can produce and sell at its maximum capacity 20,000 units of a product. The sales price per unit is ₹ 100. The present sale is 15,000 units. To produce over 20,000 units and up to another 10,000 units some balancing equipments are to be installed at a cost of ₹ 10 lakhs and the same will have a life span of 10 years.

The current cost structure is as under:

<i>Direct material</i>	<i>30% of sale value</i>
<i>Direct labour</i>	<i>20% of sale value</i>
<i>Variable overheads</i>	<i>₹ 20 per unit</i>
<i>Profit</i>	<i>₹ 15 per unit</i>

The present cost is estimated to go up due to price escalation as under:

- 10% in Direct material from present level of 30%*
- 25% in Direct labour from present level of 20%*
- ₹ 50,000 in Fixed overheads per year.*

There is a concrete proposal from a party to take 10,000 units additionally over the present level of output on a long-term basis at a unit price of ₹ 90. Apart from the investment of ₹ 10 lakhs, as shown above, the fixed overheads will increase by ₹ 50,000 due to additional Administrative expenses.

The Company is in a dilemma as to whether to accept the order for 10,000 units or to use the present unused capacity of 5,000 units for which there will be additional selling expenditure of ₹ 50,000.

Ignore financing charges and give your recommendation.

Solution

Working Note :

Fixed overheads :	(₹)
Present sale value: (A) (15,000 units × ₹ 100)	15,00,000
Direct materials (30% of sale value)	4,50,000
Direct labour (20% of sale value)	3,00,000
Variable overheads (₹ 20 per unit)	3,00,000
Total variable costs: (B)	10,50,000
Contribution: (C) : (A) – (B)	4,50,000
Profit : (D) (15,000 units × ₹ 15)	2,25,000
Fixed overheads: (C) – (D) (current level)	2,25,000
Add: Additional fixed overheads due to price escalation	50,000
Total fixed overheads	2,75,000

Statement of profitability for various alternatives

Alternatives	I	II	III	IV
	<i>Rejecting the proposal for the purchase of 10,000 units and continuing with present level of sales only</i>	<i>Rejecting the proposal for the purchase of 10,000 units from a party and attaining the maximum capacity by incurring additional selling expenditure</i>	<i>Accepting the proposal of the party to take 10,000 units @ ₹ 90 per unit by installing a balancing equipment and continuing with pre-sent level of sales</i>	<i>Accepting the proposal of party to take 10,000 units @ ₹ 90 per unit by installing a balancing equipment and attaining sale of maximum available capacity by incurring additional selling expenditure</i>
Sales (units)	15,000	20,000	25,000	30,000
	(₹)	(₹)	(₹)	(₹)
Sales value: (A)	15,00,000	20,00,000	24,00,000	29,00,000
	(15,000 × ₹ 100)	(20,000 × ₹ 100)	(15,000 × ₹ 100 +	(20,000 × ₹ 100 +
			10,000 × ₹ 90)	(10,000 × ₹ 90)

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<i>Variable costs :</i>				
Direct materials (33% of sales value)	4,95,000	6,60,000	8,25,000*	9,90,000*
Direct labour (25% of sale value)	3,75,000	5,00,000	6,25,000*	7,50,000*
Variable overheads (@ ₹ 20 per unit)	3,00,000	4,00,000	5,00,000	6,00,000
Total variable costs : (B)	11,70,000	15,60,000	19,50,000	23,40,000
<i>Fixed costs :</i>				
Fixed overheads (Refer to working note)	2,75,000	2,75,000	2,75,000	2,75,000
Additional selling expenditure	—	50,000	—	50,000
Depreciation for balancing equipment	—	—	1,00,000	1,00,000
Additional adminis- trative expenses	—	—	50,000	50,000
Total fixed costs : (C)	2,75,000	3,25,000	4,25,000	4,75,000
Total costs D : [(B)+ (C)]	14,45,000	18,85,000	23,75,000	28,15,000
Profit : (A)–(D)	55,000	1,15,000	25,000	85,000

* Note : For computing the material and labour cost under alternatives III & IV the notional sale price of ₹ 100 is taken for additional 10,000 units.

Recommendations: Alternative II is the best as it gives maximum profit.

2.12 Quotation for an Export Order

Illustration31

Somesh of Agra presently operates its plant at 80% of the normal capacity to manufacture a product only to meet the demand of Government of Tamil Nadu under a rate contract.

He supplies the product for ₹ 4,00,000 and earns a profit margin of 20% on sales realisations. Direct cost per unit is constant.

The indirect costs as per his budget projections are :

<i>Indirect costs</i>	<i>20,000 units (80% capacity)</i>	<i>22,500 units (90% capacity) (₹)</i>	<i>25,000 units (100% capacity) (₹)</i>
<i>Variable</i>	<i>80,000</i>	<i>90,000</i>	<i>1,00,000</i>
<i>Semi-variable</i>	<i>40,000</i>	<i>42,500</i>	<i>45,000</i>
<i>Fixed</i>	<i>80,000</i>	<i>80,000</i>	<i>80,000</i>

He has received an export order for the product equal to 20% of its present operations. Additional packing charges on this order will be ₹ 1,000.

Arrive at the price to be quoted for the export order to give him a profit margin of 10% on the export price.

Solution

Working Notes :

1. Direct Cost per unit

	₹
Selling price per unit (₹ 4,00,000/20,000 units)	20
Less : Profit margin (20% × ₹ 20/-)	4
Total cost	<u>16</u>
Less: Indirect costs (₹ 2,00,000/20,000 units)	<u>10</u>
Direct cost per unit	<u>6</u>

2. Statement of differential cost for 4,000 units (20% of 20,000 units)

	Present production 20,000 units (₹)	Proposed production 24,000 units (₹)	Differential cost for 4,000 units (₹)
Direct cost @ ₹ 6/- p.u.	1,20,000	1,44,000	24,000
<i>Indirect cost:</i>			
Variable @ ₹4/- p.u.	80,000	96,000	16,000
Semi-variable	40,000	44,000	4,000
Fixed	80,000	81,000	1,000
Total	3,20,000	3,65,000	45,000

Computation for the price to be quoted for the export order of 4,000 units

	(₹)
Differential cost	45,000
<i>(Refer to working note 2)</i>	
Add : Profit	5,000
(10% of export price or 1/9th of cost)	<u> </u>
Price to be quoted	<u>50,000</u>
Export price per unit : ₹ 12.50	
(₹ 50,000/4000 units)	

2.13 Make or Buy Decision

Very often management is faced with the problem as to whether a part should be manufactured or it should be purchased from outside market. Under such circumstances two factors are to be considered:

- whether surplus capacity is available, and
- the marginal cost.

Illustration32

The total cost of a manufactured component is as under:

Prime cost	₹ 15	Fixed overhead	₹ 4
Variable overhead	₹ 7	Total cost	₹ 26

The same part is available in the market at ₹ 23. Should the firm make it or buy it?

Solution

If surplus capacity is available and will remain idle if the component is bought, the out of pocket expenses will be ₹ 23 per unit, ₹ 1 more than the variable (relevant) cost of making component which is ₹ 22 (₹ 15 + ₹ 7). Hence, it is economical to make it. However, if the firm is utilizing or can utilize the capacity in making some other part, which contributes, say ₹ 4 per unit, the effective cost of buying the component will be ₹ 19 (₹ 23 less ₹ 4 contribution from other product). In that case, it would be economical to buy the component at ₹ 23 per unit from outside. The relevant computations for taking decision may be as follows:

	Make (₹)	Per unit cost Buy and leave capacity idle (₹)	Buy and use capacity for other product (₹)
Cost of making/buying	(22)	(23)	(23)
Contribution from other product	—	—	4
Net relevant cost	(22)	(23)	(19)

Illustration33

Perfect Product Ltd. is currently buying a component from a local supplier at ₹ 15 each. The supply is tending to be irregular. Two proposals are under consideration:

- Buy and install a semi-automatic machine for manufacturing this component, which would involve an annual fixed cost of ₹ 9 lakhs and a variable cost of ₹ 6 per manufactured component.
- Buy and install an automatic machine for manufacturing this component, incurring an annual fixed cost of ₹ 15 lakhs and a variable cost of ₹ 5 per manufactured component.

Determine with necessary computations:

- (1) The annual volume required, in each case, to justify a switch over from outside purchase to 'own manufacture'.
- (2) The annual volume required, to justify selection of the automatic machine instead of the semi-automatic machine.
- (3) If the annual requirement of the coming year is expected to be 5,00,000 Nos. and the volume is expected to increase rapidly thereafter, would you recommend the automatic or semi-automatic machine. Justify your recommendation.

Solution(1)

	Proposal 1 Semi-automatic Machine (₹)	Proposal 2 Automatic Machine (₹)
Purchase cost per unit for the component now being bought	15	15
Less : Unit variable cost for 'own manufacture'	<u>6</u>	<u>5</u>
Unit contribution from 'own manufacture'	9	10
Total annual fixed cost to be recouped	9,00,000	15,00,000
Number of units required to fully recover the fixed costs.	1,00,000 Units	1,50,000 Units

These figures show that an annual volume of over 1,00,000 Nos. of the component will justify 'own manufacture' on the semi-automatic machine, instead of purchase from outside.

To justify the installation of the automatic machine, the quantity required is an annual volume of over 1,50,000 Nos.

- (2) Incremental annual fixed cost if automatic machine is chosen: ₹ 6,00,000
 Saving in unit variable cost by choosing the automatic machine: ₹ 1
 Production volume required to recover the additional annual fixed costs through saving in unit variable cost. 6,00,000 Nos.

For annual requirements of over 6,00,000 units of the components, the automatic machine will be more economical as compared to the semi-automatic machine.

- (3) If the annual requirement is 5,00,000 units, the semi-automatic machine is to be preferred, as it would involve a lower total cost per unit of the component, as indicated below :

	Semi-automatic (₹)	Automatic (₹)
Total variable costs: 5,00,000 units @ ₹ 6 and ₹ 5 respectively	30,00,000	25,00,000
Total fixed costs	9,00,000	15,00,000

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Total costs	39,00,000	40,00,000
Total cost per unit	7.80	8.00

However, the annual requirement is expected to increase rapidly beyond 5,00,000 units; as soon as it is 6,00,000 units the semi-automatic machine will become more expensive as compared to the automatic machine. Then the need for installing the automatic machine will arise which may be within a very short period after commissioning the semi-automatic machine. Replacement of the semi-automatic machine by an automatic machine may then become costly, not only because of the loss that may arise on the semi-automatic machine but also by possibly a higher price of the automatic machine. The management may therefore, install an automatic machine immediately.

Illustration 34

Agrocaps Ltd., in manufacturing agricultural machinery, is preparing its annual budget for the coming year. The company has a metal pressing capacity of 20,000 hours, which will be insufficient for manufacture of all requirements of components A, B, C and D.

The company has the following choices:

- (i) *Buy the components entirely from outside suppliers.*
- (ii) *Buy from outside suppliers and/or use a partial second shift.*

The data for the current year are given below:

Standard production cost per unit

Component	A (₹)	B (₹)	C (₹)	D (₹)
<i>Variable cost:</i>				
<i>Direct materials</i>	37	27	25	44
<i>Direct wages</i>	10	8	22	40
<i>Direct expenses</i>	10	20	10	60
<i>Fixed overhead</i>	5	4	11	20
<i>Total production cost p.u.</i>	62	59	68	164
<i>Requirements in units</i>	2,000	3,500	1,500	2,800

Direct expenses relate to the use of the metal presses which cost ₹ 10 per hour, to operate. Fixed overheads are absorbed as a percentage of direct wages.

Supply of all or any part of the total requirement can be obtained at following prices, each delivered to the factory:

Component	(₹)
A	60
B	59
C	52
D	168

Second shift operations would increase direct wages by 25 percent over the normal shift and fixed overhead by ₹ 500 for each 1,000 (or part thereof) second shift hours worked.

You are required to present, with calculations:

- (a) Which component, and in how much quantities should it be manufactured in the 20,000 hours of press time available?
- (b) Whether it would be profitable to make any of the balance of components required on a second shift basis instead of buying them from outside suppliers.

Solution

(a) Working notes:

(i) Press hours required per unit of production

Component	A	B	C	D
Direct expenses per unit	10	20	10	60
No. of press hours per unit, direct expenses per presshour being ₹ 10	1	2	1	6

(ii) Marginal cost of production per unit vs. bought out prices per unit

Component	A	B	C	D
	(₹)	(₹)	(₹)	(₹)
Marginal (variable) costs				
Direct material	37	27	25	44
Direct wages	10	8	22	40
Direct expenses	10	20	10	60
Marginal cost per unit : (A)	57	55	57	144
Bought out price : (B)	60	59	52	168
Excess of bought out price over marginal cost : {(B) – (A)}	3	4	(5)	24
Press hours per unit	1	2	1	6
Excess of bought out price per unit of limiting factor (i.e. press hour)	3	2	(5)	4

The bought-out price for component C is lower by ₹ 5 than the marginal cost of production and so it should be purchased from outside.

In case the remaining components A, B and D are bought, their ranking in terms of loss per unit of limiting factors (press hour) would be D (highest loss per unit), A and B. The capacity available should, therefore, be deployed for making D first and then A and thereafter B.

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Components and their quantities to be manufactured in 20,000 hours of press time available(single shift operation)

	(Hours)
Available capacity for metal pressing	20,000
First, produce D hours required (2,800 units × 6 hours)	<u>16,800</u>
Balance hours available	3,200
Second, produce A hours required (2,000 units × 1 hour)	<u>2,000</u>
Balance hours available	1,200
Third, produce B, for the balance hours available (600 units × 2 hours)	<u>1,200</u>
Balance hours available	<u>Nil</u>

So, in 20,000 hours of press time available, all the requirements of components D and A and only 600 units of component B can be manufactured. The balance requirement of component B i.e. 2,900 (3,500 – 600) units will have to be bought out or manufactured in the second shift.

(b) Since the purchase price of Component C (₹ 52) is lower than the marginal cost of manufacturing (₹ 57) in even single shift, it will not be profitable to make it, hence it should be purchased from outside.

Now it is to be seen whether 2,900 units of B should be produced in the second shift or bought from outside. The comparative position is given below:

Cost of producing 2,900 units of components B in second shift	(₹)
Variable cost per unit on single shift basis	55.00
<i>Add.</i> Increase in direct wages per unit	<u>2.00</u>
Variable cost per unit	<u>57.00</u>
Total variable cost for 2,900 units, (2,900 units × ₹ 57)	1,65,300
<i>Additional fixed cost :</i>	
Hours required for 2,900 units of B (2900 units × 2 hours) = 5,800 hrs.	
Extra fixed cost for 5,800 hours at ₹ 500 for every 1,000 hours (or part thereof)	3,000
Total cost for producing 2,900 units of B in second shift : (A)	1,68,300
Bought outside price for 2,900 units of B will be 2,900 units × ₹59:(B)	1,71,100
Disadvantage in buying: (A – B)	(2,800)

Since the cost of manufacturing balance quantity of component B i.e. 2,900 units in second shift is less by ₹ 2,800, it is profitable to make it on a second shift basis instead of buying it from outside suppliers.

Illustration35

A company manufacturing a highly successful line of cosmetics intends to diversify the product line to achieve fuller utilisation of its plant capacity. As a result of considerable research made, the company has been able to develop a new product called "EMO".

EMO is packed in tubes of 50 gram capacity and is sold to the wholesalers in cartons of 24 tubes at ₹ 240 per carton. Since the company uses its spare capacity for the manufacture of EMO, no additional fixed expenses will be incurred. However the cost accountant has allocated a share of ₹ 4,50,000 per month as fixed expenses to be absorbed by EMO as a fair share of the company's present fixed costs to the new product for costing purposes.

The company estimates the production and sale of EMO at 3,00,000 tubes per month and on this basis the following cost estimates have been developed:

	₹ per carton
Direct materials	108
Direct wages	72
Overheads	54
Total costs	234

After a detailed market survey the company is confident that the production and sales of EMO can be increased to 3,50,000 tubes per month and ultimately to 4,50,000 tubes per month.

The company at present has a capacity for the manufacture of 3,00,000 empty tubes and the cost of the empty tubes if purchased from outside will result in a saving of 20% in material and 10% in direct wages and variable overhead costs of EMO. The price at which the outside firm is willing to supply the empty tubes is ₹ 1.35 per empty tube. If the company desires to manufacture empty tubes in excess of 3,00,000 tubes, a new machine involving an additional fixed overheads of ₹ 30,000 per month will have to be installed.

Required:

- (i) State by showing your workings whether the company should make or buy the empty tubes at each of the three volumes of production of EMO namely, 3,00,000; 3,50,000 and 4,50,000 tubes.
- (ii) At what volume of sales will it be economical for the company to install the additional equipment for the manufacture of empty tubes?
- (iii) Evaluate the profitability on the sale of EMO at each of the aforesaid three levels of output based on your decision and showing the cost of empty tubes as a separate element of cost.

Solution

(i) Working notes :

	(₹)
(1) Overheads for one carton i.e. 24 tubes	54
Therefore, per tube overheads: (₹ 54/24 tubes)	2.25

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Fixed overheads allocated for 3,00,000 tubes: ₹ 4,50,000

Per tube fixed overheads: $\left(\frac{\text{₹ } 4,50,000}{3,00,000 \text{ tubes}} \right) = \text{₹ } 1.50$

Therefore variable overheads, per tube {₹ 2.25 – ₹ 1.50} = ₹ 0.75

	(₹)
(2) Direct wages per carton	72
Therefore, direct wages per tube : (₹ 72/24 tubes)	3
(3) Direct materials per carton	108
Therefore, direct materials per tube : (₹ 108/24 tubes)	4.50
(4) <i>Cost of making one empty tube:</i>	

	Cost per tube of EMO (₹)	% of cost in respect of empty tube	Cost of empty tube (₹)	Cost per tube of EMO without empty tube (₹)
Direct materials	4.50	20	0.90	3.60
Direct wages	3.00	10	0.30	2.70
Variable overheads	0.75	10	0.075	0.675
	8.25		1.275	6.975

Cost of manufacturing / buying of 300,000 empty tubes of EMO

	Empty tube cost (₹)	If empty tubes are made (₹)	If empty tubes are purchased (₹)
Direct materials	0.90	2,70,000	—
Direct wages	0.30	90,000	—
Variable overheads	0.075	22,500	—
Purchase price	1.35	—	4,05,000
Total		3,82,500	4,05,000

Since manufacturing capacity is available for the manufacture of 3,00,000 empty tubes at a cost of ₹ 3,82,500 whereas the total cost of purchase of tubes is higher, i.e., ₹ 4,05,000, the company should manufacture the empty tubes for a production volume of 3,00,000 EMO tubes.

Beyond 3,00,000 empty tubes, the company has to install a new machine involving a total additional fixed overheads of ₹ 30,000. The cost of making and buying the additional tubes 50,000 and 1,50,000 units of empty tubes will be as under :

	Per tube (₹)	Additional empty tubes			
		50,000 tubes		1,50,000 tubes	
		Make (₹)	Buy (₹)	Make (₹)	Buy (₹)
Direct materials	0.90	45,000		1,35,000	—
Direct wages	0.30	15,000		45,000	—
Variable overheads	0.075	3,750		11,250	—
Additional overheads		30,000		30,000	—
Purchase price	1.35	—	67,500	—	2,02,500
Total		93,750	67,500	2,21,250	2,02,500

The above statement shows that the cost of buying additional empty tubes at both the levels is lower than the cost of their manufacture. Therefore, if the company increases production to 3,50,000 tubes of EMO, 3,00,000 tubes should be made in the factory and additional 50,000 tubes should be purchased at ₹ 67,500.

If the company increases production to 4,50,000 tubes of EMO, 3,00,000 empty tubes should be made in the factory and additional 1,50,000 tubes should be purchased at a cost of ₹ 2,02,500.

(ii) Additional fixed overheads to be incurred on a new machine: ₹ 30,000. Savings per unit if empty tubes are made in the factory instead of buying: ₹ 1.35 – ₹ 1.275 = ₹ .075

Minimum additional quantity of empty tubes to be made to recover the additional fixed costs:

$$\frac{\text{₹ } 30,000}{\text{₹ } 0.075} = 4,00,000 \text{ empty tubes}$$

Thus the company should sell 3,00,000 + 4,00,000 = 7,00,000 tubes of EMO per month to warrant justification for the installation of the new machine for the manufacture of empty tubes.

(iii) Evaluation of the profitability on sale of EMO at the three levels

	Per tube (₹)	3,00,000 tubes (₹)	3,50,000 tubes (₹)	4,50,000 tubes (₹)
Sales (₹ 240/24 tubes)	10	30,00,000	35,00,000	45,00,000
Direct materials	3.60	10,80,000	12,60,000	16,20,000
Direct wages	2.70	8,10,000	9,45,000	12,15,000
Variable overheads	0.675	2,02,500	2,36,250	3,03,750
Empty tubes made	1.275	3,82,500	3,82,500	3,82,500
Empty tubes purchased	1.35	—	67,500	2,02,500
Total costs		24,75,000	28,91,250	37,23,750
Profit		5,25,000	6,08,750	7,76,250

Illustration 36

A firm needs a component in an assembly operation. If it wants to do the manufacturing itself, it would need to buy a machine for ₹ 4 lakhs which would last for 4 years with no salvage value. Manufacturing costs in each of the 4 years would be ₹ 6 lakhs, ₹ 7 lakhs, ₹ 8 lakhs and 10 lakhs respectively. If the firm had to buy the component from a supplier the component would cost ₹ 9 lakhs, ₹ 10 lakhs, ₹ 11 lakhs and ₹ 14 lakhs respectively in each of the 4 years. However, the machine would occupy floor space which could have been used for another machine. This latter machine could be hired at no cost to manufacture an item, the sale of which would produce net cash flows in each of the 4 years of ₹ 2 lakhs; it is impossible to find room for both the machines and there are no other external effects. The cost of capital is 10% and PV factor for each of the 4 years is 0.909, 0.826, 0.751 and 0.683 respectively. Should the firm make the component or buy from outside?

Solution**Evaluation of Make or Buy Proposal**

(₹ in lakhs)

Year	Present value factor at 10%	When the Component is manufactured		When the Component is bought	
		Cash outflow	Present value	Cash outflow	Present value
0	1.000	4	4.000	—	—
1	0.909	6 + 2	7.272	9	8.181
2	0.826	7 + 2	7.434	10	8.260
3	0.751	8 + 2	7.510	11	8.261
4	0.683	10 + 2	8.196	14	9.562
			34.412		34.264

Saving in buying: ₹ 34.412 lakhs – ₹ 34.264 lakhs = ₹ 0.148 lakh

Thus it is beneficial to buy the component from outside.

Note: The loss of ₹ 2 lakhs cash inflow for each of the 4 years due to inability of the firm to operate another machine when it manufactures the component is to be treated as an opportunity cost.

2.14 Export Vs Local Sale Decision

When the firm is catering to the needs of the local market and surplus capacity is still available, it may think of utilising the same to meet export orders at price lower than that prevailing in the local market.

This decision is made only when the local sale is earning a profit, i.e., where its fixed expenses have already been recovered by the local sales. In such cases, if the export price is more than the marginal cost, it is preferable to enter the export market.

Any reduction in the price prevailing in the local market to fulfill surplus capacity may have adverse effect on the normal local sales. Dumping in the export market at a lower price will not, however, have any such adverse effect on local sales.

Illustration 37

XLtd., having an installed capacity of 1,00,000 units of a product is currently operating at 70% utilization. At current levels of input prices, the FOB unit costs (after taking credit for applicable export incentives) work out as follows:

Capacity Utilisation	FOB Unit Costs
Per cent	(₹)
70	97
80	92
90	87
100	82

The company has received three foreign offers from different sources as under:

Source A 5,000 units at ₹ 55 per unit FOB

Source B 10,000 units at ₹ 52 per unit FOB

Source C 10,000 units at ₹ 51 per unit FOB

Advise the company as to whether any or all export orders should be accepted or not.

Solution

X Limited
Statement showing Differential Cost at Different Capacity Utilisation Levels
Installed capacity 1,00,000 Units

Capacity utilisation	Production at different levels of capacity utilisation	FOB unit costs	Total costs	Differential costs	Per unit differential costs
Percent	Units	(₹)	(₹)	(₹)	(₹)
70	70,000	97	67,90,000	—	—
80	80,000	92	73,60,000	5,70,000	57
90	90,000	87	78,30,000	4,70,000	47
100	1,00,000	82	82,00,000	3,70,000	37

Statement showing Gain or Loss on Accepting the Various Export Orders

Export Order (Source)	Export Order (Unit)	Capacity Utilisation Per cent	Differential Costs		FOB Price per Unit (₹)	Sales Revenue from the Export (₹)	Gain/ (Loss) (₹)
			Per Unit (₹)	Total (₹)			
A	5,000	75%	5,000 Uts. @ 57	2,85,000	55	2,75,000	(10,000)
B	10,000	85%	5,000 Uts. @ 57 5,000 Uts. @ 47	5,20,000	52	5,20,000	Nil
C	10,000	95%	5,000 Uts. @ 47 5,000 Uts. @ 37	4,20,000	51	5,10,000	90,000
Total	25,000	95%		12,25,000		13,05,000	80,000

It is obvious from the above statement that the company will gain only when all the three export orders are accepted. If the company accepts exports only for one or two of the three sources, it will lose. Therefore, the company should accept all the three export orders.

2.15 Expand or Contract Decision

Whenever a decision is to be taken as to whether the capacity is to be expanded or not, consideration should be given to the following points:

- Additional fixed expenses to be incurred.
- Possible decrease in selling price due to increase in production.
- Whether the demand is sufficient to absorb the increased production.

Based on these considerations, the cost schedule will be worked out. While deciding about the contraction of business, the saving in fixed expenses and the marginal contribution lost will have to be taken into account. If a branch office is to be closed down, and if the branch is giving a marginal contribution sufficient to cover fixed expenses the contraction may lead to a loss as under:

Example

Branch B: Sales	₹ 20,000
P/V ratio	20%
Marginal contribution	₹ 4,000
Fixed expenses of the branch	₹ 3,000

The branch is giving an extra contribution of ₹ 1,000. If it is closed, the fixed expenses saving is ₹ 3,000 whereas the contribution lost is ₹ 4,000. Hence it is not advisable to contract the business by closing down the branch.

Illustration38

Nice and Warm Ltd., manufactures and markets hot plates. During the first five years of operation, the company had experienced a gradual increase in sales volume, and the current annual growth in sales of 5% is expected to continue into the foreseeable future. The plant is now producing at its full capacity of one lakh hot plates.

At the monthly Management Advisory Committee meeting, amongst other things, the plan of action for next year was discussed.

Managing Director proposed two alternatives. First, operations could be continued at full capacity and with the existing facilities an output of one lakh hot plates at a selling price of ₹ 100 per unit could be maintained. Secondly, production and sales could be increased by 5% to take advantage of the rate of expansion in demand for the product. But this could increase cost, as to achieve the output, the company will have to resort to weekend and overtime workings. However, a policy of steady growth was preferable to maintaining status quo.

In view of the company's competitors having a substantial share of the market, the Works Director was of the view that it was not enough for the company to maintain merely the present share of the total market. A larger share of the total market should be obtained. For that, the company should increase the production by 10% through a modest expansion of plant capacity. In order to sell the output of 1,10,000 units, the selling price could be reduced to ₹ 95 per unit.

Thinking on the same lines, the Marketing Director put forth a more radical proposal. The strategy should be to seize the competitive leadership in the market with regard to both price and volume. With this end in view, he suggested that the company should straight away embark on an expensive modernisation programme which will initially increase volume by 20%. The entire output of 1,20,000 hot plates could be easily sold at a price of ₹ 90 per unit.

At this juncture Managing Director expressed concern about the probable behaviour of the company's competitors. They might also expand in order to produce more and sell at lowest prices. Suppose this happened, he wanted also the financial effects of the proposals of the Works Director and the Marketing Director, if in those proposals, the increase in sales were to be only half of that predicted.

As the Cost Accountant of the company you are required to critically evaluate the six alternatives, along with your recommendations and circulate the same to the Directors.

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In this connection you have gathered the following details.,

- (1) If next year's production was maintained at the current year's level variable costs would remain unchanged at ₹ 30 lakhs.
- (2) The weekend and overtime working would increase with the variable and fixed costs. Variable cost would rise to ₹ 55 per unit while fixed costs would increase to ₹30,25,000.
- (3) In the proposal of the Works Director, the ratio of variable costs to sales would continue to be 50% and fixed costs would rise to ₹ 32,25,000.
- (4) In the proposal of the Marketing Director, as a result of increased production efficiency and some savings from purchase of materials, it is estimated that the ratio of variable cost to sales would decrease to 48% and the fixed costs would increase by ₹ 5,16,000.

Your answer should contain:

- (a) A tabular statement of comparative figures pertaining to Total Turnover, Total Contribution, Percentage of Profit to Sales and Break-Even units as regards to each of the six proposals.
- (b) Comment on the relative risks involved.
- (c) Consideration of the short-term and long-term implications of the Managing Director's proposals.
- (d) Comments on the price elasticity of demand for the company's product and your suggestions on the pricing policy and cost structure.
- (e) Comments on financial implications of the expansion schemes.

Solution

- (a) **Tabular Statement of Comparative Figures Pertaining to Total Turnover, Total Contribution, Percentage of Profit to Sales and Break-even Units etc., as regards to each of the Six Proposals.**

	Proposals					
	Managing Director's 1st Proposal	Managing Director's 2nd Proposal	Works Director's 1st Proposal	Works Director's 2nd Proposal (1/2 of expected increase)	Marketing Director's 1st Proposal	Marketing Director's 2nd Proposal (1/2 of expected increase)
	(1)	(2)	(3)	(4)	(5)	(6)
Units sold	1,00,000	1,05,000	1,10,000	1,05,000	1,20,000	1,10,000
Unit selling price (₹)	100	100	95	95	90	90
Total turnover (₹ in lakhs)	100.00	105.00	104.50	99.75	108.00	99.00
Unit contribution (₹)	50	45	47.5	47.5	46.80	46.80

Total contribution (₹ in lakhs)	50	47.25	52.25	49.875	56.16	51.48
Fixed cost (₹ in lakhs)	30	30.25	32.25	32.25	35.16	35.16
Profit (₹ in lakhs)	20	17.00	20.00	17.625	21	16.32
Percentage of profit to sales	20%	16.19%	19.14%	17.67%	19.44%	16.48%
Break-even units	60,000	67,222	67,895	67,895	75,128	75,128
Margin of safety in units	40,000	37,778	42,105	37,105	44,872	34,872

- (b) At the present full capacity level, it is enough to sell 60,000 units to break even. Other proposals raise the break-even point further. In an uncertain market, if in the proposals of Works Director and the Marketing Director, only half the increase is achieved, the margin of safety will be lower than the present 40,000 units. Profit as a percentage of sales is also lower than existing, in all the proposals. All this is a disquieting feature as the risk involved is greater in all the other proposals.
- (c) The company has already reached its full capacity. As a short term measure, the Managing Director's first proposal seems to be all right. From long-term point of view, neither of the proposals can be considered to be satisfactory. Both the proposals of the Managing Director do not provide a lasting solution. Though the second proposal maintains the market share, it results in less profit, both in quantum and percentage. As the capacity has already been reached there is an urgent necessity for the Managing Director to address himself to long range objectives and plans keeping in view the expansion in demand for the company's product.
- (d) It seems that both the Works Director and the Marketing Director have very elementary notions on price. They think that if the volume increases in order to sell the increased volume, price has to be lowered. No serious study seems to have been made on the price elasticity of demand for the company's product. On the other hand, we have been told that there is a steady 5% annual growth in demand, which means that the prices need not be reduced, only more market share has to be obtained. For incremental production, differential pricing in certain special markets has to be resorted to; if this is not possible, the increased production can be sold under a different brand name with a different price (A static cost structure, more or less, has been assumed). To beat competition, a better product has to be put in the market and cost reduction offered through value analysis, etc.
- (e) The expansion scheme envisaged have to be properly tested for profitability by feasibility study reports, etc. Source of financing the expansion has to be determined. The financial implications of share issue or borrowed funds have to be gone through. Long range objectives have to be defined and plans drawn accordingly to achieve them.

2.16 Product Mix Decision

Many times the management has to take a decision whether to produce one product or another instead. Generally decision is made on the basis of *contribution of each product*. Other things *being the same the product which yields the highest contribution is best one to produce*. But, if there is shortage or limited supply of certain other resources which may act as a key factor like for example, the machine hours, then the contribution is linked with such a key factor for taking a decision. For example, in an undertaking the availability of machine capacity is limited and the machine hours required for one unit of the two products are different. In such cases the contribution is to be linked with the machine hour and the product which yields the highest contribution per machine hour is to be preferred for taking decision.

Illustration 39

A firm's operations are at present performed by hand. It has a proposal to install a new machine which can produce at a faster rate. Following information is available. Advise the management about the profitability of mechanisation.

	Hand	Machine
Production in units per hour	1	2
Marginal cost per unit (₹)	18	16
Additional fixed cost per unit (₹)	—	3
Total cost per unit (₹)	18	19
Selling price per unit (₹)	24	24

Solution

Let us analyse the figures as under:

	Hand (₹)	Machine (₹)
Selling price per unit	24	24
Less: Marginal cost per unit (including additional fixed cost)	18	19
Contribution per unit	6	5
Contribution per hour	6	10

If there is a great demand for the products, it is advisable to mechanise because the gross margin per hour is more when machine is used. If however, there is idle capacity and there is an under-absorption of fixed overheads to the extent of ₹ 3 per unit the total cost will be ₹ (19 + 3) = ₹ 22 leaving a contribution of ₹ 2 per unit. The contribution per hour will, therefore, be ₹ 4 which is less than that of obtaining under hand operation. Hence mechanisation will not be advisable under these circumstances.

Illustration 40

An engineering company is engaged in producing four products through operations at welding and pressing departments. Products W_1 and W_2 are produced by welders in the welding department whereas products P_1 and P_2 are produced by press-operators in the pressing department. Due to specific skill requirements, the welders and press-operators can only work in their own department.

The following relevant data are available in respect of the products:

	Products			
	W_1	W_2	P_1	P_2
Hours required per unit	4	4	5	2
Selling price per unit (₹)	48	50	77	69
Direct material cost per unit (₹)	18	22	32	44
Direct labour hourly rate (₹)	4	4	4	4
Variable overhead rate per unit (₹)	2	2	3	3

The company incurs ₹ 50,000 per annum towards fixed costs. The maximum available hours are 20,000 and 16,000 for welding and pressing departments respectively.

The demands keep on fluctuating but the minimum demands which are to be met as per management's decision are 2,000 units of W_1 , 2,500 units of W_2 , 1,800 units of P_1 and 2,200 units of P_2 .

The production manager suggests that the welders and press-operators can be trained to perform both welding and pressing jobs so that excess demand of any of the products can be met. This decision is going to increase the burden of fixed costs by ₹ 5,000 per annum.

Prepare the profitability statement for optimum product-mix and recommend with reasons and appropriate workings whether it is advisable to train the welders and press-operators as suggested by the production manager.

Solution**Optimum Product Mix before Training**

Department Maximum Hours Product	Welding 20,000 hours		Pressing 16,000 hours	
	W_1	W_2	P_1	P_2
Selling price per unit (₹)	48	50	77	69
Less: Variable cost				
Material (₹)	18	22	32	44
Labour (₹)	16	16	20	8

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Variable overhead (₹)	2	2	3	3
Total variable cost (₹)	36	40	55	55
Contribution per unit : (A)	12	10	22	14
Labour hours per unit : (B)	4	4	5	2
Contribution per hour (₹) (A)/(B)	3	2.5	4.4	7
<i>Ranking</i>	<i>/</i>	<i>//</i>	<i>//</i>	<i>/</i>
Minimum production (units)	2,000	2,500	1,800	2,200
Labour hours needed	8,000	10,000	9,000	4,400
Labour hours used foreach department	8,000 + 10,000 = 18,000		9,000 + 4,400 = 13,400	
Balance hours available	20,000 – 18,000 = 2,000		16,000–13,400= 2,600	
Product to be produced	W ₁		P ₂	
Units to be produced	2,000/4 = 500		2,600/2 = 1,300	
	W ₁	W ₂	P ₁	P ₂
Hence, product-mix(units)	2,000 + 500	2,500	1,800	2,200+1,300 = 3,500
	= 2,500			

Profitability Statement before Training

Product	Product-mix units	Hours		Contribution	
		Per unit	Total	Per hour (₹)	Total
W ₁	2,500	4	10,000	3.00	30,000
W ₂	2,500	4	10,000	2.50	25,000
			20,000		55,000
P ₁	1,800	5	9,000	4.40	39,600
P ₂	3,500	2	7,000	7.00	49,000
			16,000		88,600
	Total		36,000		1,43,600
			Less: Fixed costs		50,000
			Net profit		93,600

Optimum Product-Mix after Training

After training, the capacity will be taken as a whole at 36,000 labour hours because of interchangeability of available labour force. The ranking will be done on the basis of contribution per hour among all the four products, since a workman is trained to work in any of the departments.

Production	W ₁	W ₂	P ₁	P ₂
Maximum hours	36,000 hours as a whole			
Hours needed for minimum production	8,000	10,000	9,000	4,400
	(Total hours = 31,400 hours)			
Balance hours	(36,000 – 31,400 hours = 4,600 hours)			
Product priority (Ranking)	III	IV	II	I
Product in balance hours P ₂ (I rank):				4,600 ÷ 2 = 2,300 units
Product-mix (units)	2,000	2,500	1,800	2,200 + 2,300 = 4,500

Profitability Statement after Training

Product	Product-mix units	Hours		Contribution	
		Per unit	Total	Per hour	Amount
				(₹)	(₹)
W ₁	2,000	4	8,000	3.00	24,000
W ₂	2,500	4	10,000	2.50	25,000
P ₁	1,800	5	9,000	4.40	39,600
P ₂	4,500	2	9,000	7.00	63,000
			36,000		1,51,600
				Less: Fixed costs	55,000
				Net profit	96,600

Recommendation:

Since the net profit after training will be more by ₹ 3,000 (₹ 96,600 – ₹ 93,600), it is advisable to train the welders and press operators as suggested by the production manager.

Illustration 41

Veejay Ltd. makes and sell two products, 'Vee' and 'Jay'. The budgeted selling price of 'Vee' is ₹ 1,800 and that of 'Jay' is ₹ 2,160. Variable costs associated with producing and selling the 'Vee' are ₹ 900 and with 'Jay' ₹ 1,800. Annual fixed production and selling costs of Veejay Ltd. are ₹ 88,000.

The company has two production/sales option. The 'Vee' and 'Jay' can be sold either in the ratio of two 'Vees' to three 'Jays' or in the ratio of one 'Vee' to two 'Jays'.

What will be the optimal mix and why ?

Solution

Selection of best optimal mix

	Products	
	'Vee'	'Jay'
	(₹)	(₹)
Budgeted selling price p.u.	1,800	2,160
Less : Variable cost p.u.	900	1,800
Contribution p.u.	900	360

Option-I

(I) *Production/Sales option : (2 units of 'Vee' and 3 units of 'Jays')*

Total contribution under 1st option

$$= (2 \text{ units} \times ₹ 900 + 3 \text{ units} \times ₹ 360)$$

$$= ₹ 1,800 + ₹ 1,080 = ₹ 2,880$$

$$\text{Break-even point} = \frac{\text{Annual fixed production \& selling costs}}{\text{Total contribution under 1st option}}$$

$$= \frac{₹ 88,000}{₹ 2,880} = 30.56 \text{ (sets of 5 units)}$$

	Products		Total
	'Vee'	'Jay'	
Break-even point (units)	30.56 × 2 units = 61.12 units = 61 (units approx.)	30.56 × 3 units = 91.68 units = 92 (units approx.)	
Break-even sales (₹)	= 1,09,800 (61 units × ₹ 1,800)	= 1,98,720 (92 units × ₹ 2,160)	3,08,520

Option-II

(II) *Production/Sales option : (1 unit of 'Vee' and 2 units of 'Jays')*

Total contribution under 1st option

$$= (1 \text{ unit} \times ₹ 900 + 2 \text{ units} \times ₹ 360)$$

$$= ₹ 900 + ₹ 720 = ₹ 1,620$$

$$\text{Break-even point} = \frac{\text{Annual fixed production \& selling costs}}{\text{Total contribution under 1st option}}$$

$$= \frac{\text{₹ } 88,000}{\text{₹ } 2,880} = 54.32 \text{ (sets of 3 units)}$$

	Products		Total
	'Vee'	'Jay'	
Break-even points (units)	54.32 × 1 unit = 54 (units approx.)	54.32 × 2 units = 109 (units approx.)	
Break-even sales (₹)	= 97,200 (54 units × ₹ 1,800)	= 2,35,440 (109 units × ₹ 2,160)	3,32,640

Note:

The given amount of annual fixed production and selling cost is such that it fails to determine the exact figure of break-even point under two given sales options. The approximations made in the above solutions under option- I, at break-even level over recovery of ₹ 20; whereas under option- II of the solution there is an under recovery of fixed cost to the extent of ₹ 160.

Decision & reasoning:

Option I is preferred over option II, as it results in a lower level of sales to reach break-even (because of higher average contribution per unit sold). The average contribution per unit (under option I) is ₹ 576 (₹ 2,880/5 units) and (under option II) it is ₹ 540 (₹ 1,620/3 units). Option I contains a higher percentage (40% as against 33 1/3%) of more profitable products.

Illustration 42

ZED Ltd. manufactures two products P and Q and sells them at ₹ 215 and ₹ 320 per unit respectively. The variable costs per unit are as under.

	Product-P (₹)	Product-Q (₹)
<i>Raw materials :</i>		
<i>Material-X</i>	22.00	28.00
<i>Material-Y</i>	8.00	32.00
<i>Direct wages (₹6 per labour hour) :</i>		
<i>Department-A</i>	36.00	54.00
<i>Department-B</i>	18.00	36.00
<i>Department-C</i>	54.00	—
<i>Department-D</i>	—	72.00
<i>Variable overheads</i>	23.00	14.30

The company procures raw materials against import licence. The company operates at single shift a day of 8 hours for 300 days in a year. The numbers of workmen engaged are 30, 16, 18 and 24 in departments A, B, C and D respectively. Neither the workers are subject to transfer from one department to another nor any new recruitment is possible at present. Fixed costs are ₹ 12,000 per month.

2.92 Advanced Management Accounting

You are required to find out the following:

- The product-mix to yield maximum profit
- The most profitable product if only one product is to be manufactured. Whether the answer will differ if licence to import raw materials is released only for ₹ 1,80,000.

Solution

Working Notes :

1. Computation of total labour hours available

Departments (a)	No. of workmen (b)	Days (c)	Hrs./day (d)	Total hours (e) = (b) × (c) × (d)
A	30	300	8	72,000
B	16	300	8	38,400
C	18	300	8	43,200
D	24	300	8	57,600

2. Computation of hours required per unit of each product

Departments	Product P			Product Q		
	Wages (₹)	Wages/hr. (₹)	Hrs.	Wages (₹)	Wage/hr. (₹)	Hrs
	(a)	(b)	(c) = (a)/(b)	(d)	(e)	(f) = (d)/(e)
A	36	6	6	54	6	9
B	18	6	3	36	6	6
C	54	6	9	–	–	–
D	–	–	–	72	6	12
	Total hours per unit :		18			27

3. Statement showing maximum output permissible

Department s	Hours available	Product P		Product Q	
		Hrs. required/ Unit	Maximum output in Units	Hrs. required/ Unit	Maximum output in Units
	(a)	(b)	(c) = (a)/(b)	(d)	(e) = (a)/(d)
A	72,000	6	12,000	9	8,000
B	38,400	3	12,800	6	6,400
C	43,200	9	4,800*	–	–
D	57,600	–		12	4,800*
	Total hours p.u.	18		27	

* This shows that either 4,800 units of product P or Q can be obtained by utilising the available hours in the four departments.

4. Product wise Contribution per hour

	Product P (₹)	Product Q (₹)
<i>Selling price p.u.</i> (A)	215	320
Total raw material cost p.u. (₹ 22 + ₹ 8)	30	
(₹ 28 + ₹ 32)		60
Total wages per unit (₹ 36 + ₹ 18 + ₹ 54)	108	
(₹ 54 + ₹ 36 + ₹ 72)		162
Variable overheads p.u.	23	14.30
<i>Total variable cost p.u.</i> (B)	161	236.30
Contribution p.u. [(A) – (B)]	54	83.70
Labour hours p.u.	18	27
Contribution per labour hour	3 (₹ 54/18 hrs.)	3.10 (₹ 83.70/27 hrs.)

- (a) Though the contribution per labour hour of Product Q is better but there is a constraint viz., the numbers of workers in each department can neither be interchanged nor newly recruited, hence due to this, following alternatives would arise which may help in deciding about the product mix to yield maximum profit.

Alternative I : Producing 4,800 units of Product Q and utilising the remaining available hours of labour for making units of Product P.

Alternative II : Producing 4,800 units of Product P and utilising the remaining available hours of labour for making units of Product Q.

Statement of Product mix under alternative I

Departments	Available hours	Hours required for 4,800 units of Q	Remaining hours	Hrs./Unit of Product P	Units of Product
	(a)	(b)	(c) = (a) – (b)	(d)	(e) = (c)/(d)
A	72,000	43,200	28,800	6	4,800
B	38,400	28,800	9,600	3	3,200
C	43,200	–	43,200	9	4,800
D	57,600	57,600	Nil	–	–

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The above table shows that out of the available hours under alternative I; 4,800 units of Product Q and 3,200 units of Product P can be made.

Statement of Product mix under alternative II

Departments	Available hours	Hours required for 4,800 units of P	Remaining hours	Hrs./Unit of Product Q	Units of Product
	(a)	(b)	(c) = (a)–(b)	(d)	(e) = (c)/(d)
A	72,000	28,800	43,200	9	4,800
B	38,400	14,400	24,000	6	4,000
C	43,200	43,200	–	–	–
D	57,600	–	57,600	12	4,800

The above table shows that out of the available hours under alternative II; 4,800 units of Product P and 4,000 units of Product Q can be made.

Profit Statement under above alternatives

Products	First alternative			Second alternative		
	Units	Contribution p.u. (₹)	Amount (₹)	Units	Contribution p.u. (₹)	Amount (₹)
P	3,200	54.00	1,72,800	4,800	54.00	2,59,200
Q	4,800	83.70	4,01,760	4,000	83.70	3,34,800
Total Contribution:			5,74,560			5,94,000
Less : Fixed cost p.a.			1,44,000			1,44,000
Profit			4,30,560			4,50,000

Second alternative is the most profitable product mix.

(b) Statement of most profitable product if only one product is to be manufactured

Products	P	Q
Contribution per unit (₹) : A	54.00	83.70
Maximum possible output (in units) : (B)	4,800	4,800
Total Contribution : (A) × (B)	2,59,200	4,01,760

Product Q is to be preferred

Statement of most profitable product if only one product is to be manufactured and licence to import the raw material is only for materials worth ₹ 1,80,000

Products	P	Q
Raw material required p.u. (₹)	30	60
Permissible output in units out of imported material of ₹ 1,80,000	6,000	3,000
Maximum output possible in the available hours	4,800	4,800
Output possible keeping in view the availability of imported material and labour hours (Units)	4,800	3,000
Contribution per unit (₹)	54	83.70
Total Contribution (₹)	2,59,200	2,51,100
	(4,800 units × ₹ 54)	(3,000 units × ₹ 83.70)

Product P is to be preferred (i.e. answer differs) because of import licence restriction, which is only available for purchasing material worth only ₹ 1,80,000.

Illustration 43

The relevant data of X Ltd. for its three products A, B and C are as under:

	A	B	C
Direct material (₹/Unit)	260	300	250
Direct labour (₹/Unit)	130	270	260
Variable overheads (₹/Unit)	110	230	180
Selling price (₹/Unit)	860	1,040	930
Machine Hours required (Per Unit)	12	6	3

The estimated fixed overheads at four different levels of 3,600; 6,000; 8,400; and 10,800 machine hours are ₹ 1,00,000; ₹ 1,50,000; ₹ 2,20,000 and ₹ 3,00,000 respectively. The maximum demand of A, B and C in a cost period are 500; 300 and 1,800 units respectively.

You are required to find out (i) the most profitable product-mix at each level and (ii) the level of activity where the profit would be maximum.

Solution

Working Note :

Ranking of three products A, B and C

Products	A	B	C
Selling price (p.u.) (₹)	860	1,040	930

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Less : Variable cost p.u. (₹)	500	800	690
Contribution p.u. (R.s)	360	240	240
Machine hrs. required p.u.	12	6	3
Contribution per machine hour (₹)	30 (₹ 360/12. hrs)	40 (₹ 240/6 hrs.)	80 (₹ 240/3 hrs.)
Ranking	III	II	I
Maximum demand in units	500	300*	1,800

- (i) Statement of the most profitable product mix at each level of machine hours
(Refer to working note)

Product (mix)	Machine hours			
	3,600	6,000	8,400	10,800
C	1,200units (3,600 hrs/ 3 hrsp.u.)	1,800units (5,400 hrs/ 3 hrsp.u.)	1,800units	1,800units
B	–	100units (600 hrs/6 hrsp.u.)	300units (1800 hrs/6 hrsp.u.)	300units
A	–	–	100units (1,200 hrs/ 12 hrsp.u.)	300units (3,600 hrs/ 12 hrsp.u.)

- (ii) Statement of level of activity where the profit would be maximum
[Refer to the answer of part (i)]

Level of activity (Machine hours)	Products						Total Contribution (₹)	Fixed Cost (₹)	Net Profit (₹)
	C units	Contribution* (₹)	B units	Contribution* (₹)	A units	Contribution* (₹)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7) = (2) + (4) + (6)	(8)	(7)–(8)
3,600	1,200	2,88,000 (1200 × ₹ 240)	–	–	–	–	2,88,000	1,00,000	1,88,000
6,000	1,800	4,32,000 (1,800 × ₹ 240)	100	24,000 (100 × ₹ 240)	–	–	4,56,000	1,50,000	3,06,000
8,400	1,800	4,32,000	300	72,000	100	36,000	5,40,000	2,20,000	3,20,000

10,800	1,800	4,32,000	300	(300 × ₹ 240)	300	(100 × ₹ 360)	6,12,000	3,00,000	3,12,000
						(300 × ₹ 360)			

Recommendation :

- * At 8,400 machine hour level of capacity the company would earn maximum profit i.e. ₹ 3,20,000
- * Refer to working note.

2.17 Price-Mix Decision

When a firm can produce two or more products from the same production facilities and the demand of each product is affected by the change in their prices, the management may have to choose price mix which will give the maximum profit, particularly when the production capacity is limited.

In such a situation, the firm should compute all the possible combinations and select a price-mix which yields the maximum profitability.

Illustration44

Sellaway Ltd. manufactures and markets 2 products A and B, the demand in the market of which fluctuates with the prices quoted. As a result of the deliberations of its recent Sales Conference the following data were agreed upon as a working basis:

Product	A			B		
	Selling price per unit (₹)	32	30	28	22	20
Expected demand per month (Nos.)	900	1,000	1,500	1,600	2,000	3,000

8 labour hours are required to produce product A and 4 labour hours to produce product B and the maximum capacity of the factory is restricted to 20,000 labour hours per month.

The cost structure per unit of production is as under:

Product	A	B
	(₹)	(₹)
Direct material	4	3
Direct labour	6	5
Variable overheads	10	6
	20	14

Fixed overheads are ₹ 32,400 per quarter.

You are required to compute the possible combinations and arrive at a proper price mix for maximum profitability.

Solution.

Workings :

Product	A			B		
	Selling price per unit (₹)	32	30	28	22	20
Expected demand per month (Nos.)	900	1,000	1,500	1,600	2,000	3,000
Total labour hours required	7,200	8,000	12,000	6,400	8,000	12,000
Variable cost per unit (₹)	20	20	20	14	14	14
Contribution per unit (₹)	12	10	8	8	6	4
Contribution per hour (₹)	1.5	1.25	1	2	1.5	1
Total contribution (₹)	10,800	10,000	12,000	12,800	12,000	12,000

Possible combinations

Products		Contribution ₹	Labour Hrs. Reqd.
A	B		
32	22	23,600	13,600
32	20	22,800	15,200
32	18	22,800	19,200
30	22	22,800	14,400
30	20	22,000	16,000
30	18	22,000	20,000
28	22	24,800	18,400
28	20	24,000	20,000
28	18	24,000	24,000

Recommendation:

The above computations show that the maximum contribution of ₹ 24,800 is possible at 18,400 labour hours. Therefore, profitable *price mix* is A ₹ 28 and B ₹ 22.

Summary

- For the purpose of decision making and control, costs are distinguished on the basis of their relevance to the different type of decisions.
- **Relevant Costs:** These are the estimated future costs that are different under alternative courses of action for a specific problem and hence are appropriate to a specific management decision.
- **Conditions to be satisfied for relevant costs :-**

- ✓ **Occur in the Future**-every decision deals with selecting a course of action based on its expected future results.
- ✓ **Differ among the alternative courses of action**- costs and revenues that do not differ will not matter and will have no bearing on the decision being made.

- **Differential cost:** Difference in total cost that will arise from the selection of one alternative instead of another.
- **Opportunity Cost:** Value of the next best alternative.
- **Sunk Cost:** Cost which do not change under given circumstance and do not play any role in decision making process.
- **Out of Pocket Costs :** Portion of costs which involves payments to outsiders i.e., it gives rise to cash expenditure as opposed to other costs such as depreciation, which do not involve any cash expenditure.
- The investment decisions involve current outlays in return for a stream of benefits in future year.

- **Shut Down or Continue Decision**

A firm to temporarily close down the factory due to trade recession with a view to reopening it in the future. In such cases, the decision should be based on the marginal cost analysis.

$$\text{Shut down point} = \frac{\text{Total fixed cost} - \text{Shut down costs}}{\text{Contribution per unit}}$$

- The cut off rate is defined as the minimum rate of return expected from the investment.
- Cost-Volume-Profit analysis explores the relationship existing amongst costs, volume and profit.
- **Pricing Decisions under Special Circumstances**

If goods were sold in the normal circumstances under normal business conditions, the price would cover the total cost plus a margin of profit.

The problem of pricing can be summarised under three heads:

- ✓ Pricing in periods of recession,
- ✓ Differential selling prices, and
- ✓ Acceptance of an offer and submission of a tender.

Pricing in periods of recession: Sell its articles at a price *less than the total cost but above the marginal cost* for a limited period.

Differential selling prices: Which is above, the marginal cost but below the total cost is resorted to in order to absorb surplus capacity.

- **Make or Buy Decision**

Very often management is faced with the problem as to whether a part should be manufactured or it should be purchased from outside market. Under such circumstances two factors are to be considered:

- ✓ Whether surplus capacity is available, and
- ✓ The marginal cost.

- **Export vs Local Sale Decision**

When the firm is catering to the needs of the local market and surplus capacity is still available, it may think of utilising the same to meet export orders at price lower than that prevailing in the local market.

- **Price-Mix Decision**

When a firm can produce two or more products from the same production facilities and the demand of each product is affected by the change in their prices, the management may have to choose price mix which will give the maximum profit, particularly when the production capacity is limited.